InaSAFE help 4.4.0

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2. Overview

2.1. Disclaimer

InaSAFE has been jointly developed by the Indonesian Government-BNPB, the Australian Government, the World Bank-GFDRR and independent contributors. These agencies and the individual software developers of InaSAFE take no responsibility for the correctness of outputs from InaSAFE or decisions derived as a consequence.

2.2. Limitations and License

- InaSAFE is not a hazard modelling tool.
- InaSAFE is a Free and Open Source Software (FOSS) project, published under the GPL V3 license. As such you may freely download, share and (if you like) modify the software.
- InaSAFE carries out all processing in-memory. Your ability to use a set of hazard, exposure and aggregation data with InaSAFE will depend on the resources (RAM, Hard Disk space) available on your computer. If you run into memory errors, try doing the analysis in several smaller parts.

3. Glossary of terms

3.1. Basic concepts

Term	Description

Analysis	An **analysis** from the point of view of using InaSAFE is the process whereby a hazard layer, an exposure layer and an optional aggregation layer are used to determine the potential impact of the hazard data on the exposure. The analysis results are grouped by region (as defined in the aggregation layer). In InaSAFE the analysis process commences with a preparation phase where each input layer is pre-processed to ensure that it is in a consistent state. The hazard and aggregation are reprojected to the same coordinate reference system of the exposure dataset. Any data that is not within the selected aggregation areas is removed. Note that any modifications made are done on copies of the original data - the original data are not modified in any way. Any continuous datasets are reclassified into classfied (also sometimes referred to as categorical) datasets. The aggregation layer and the hazard are combined using a GIS union operation and then each exposure within these areas is counted to arrive at a total number, length or area of exposure features per aggregation area. These processes are defined in more detail below. After the primary GIS processing has been carried out, one or more post-processors are applied to the resulting datasets in order to compute statistics like the breakdown of buildings or the area of each land use type in the affected areas. The final part of the analysis process is report generation whereby InaSAFE generates various tables and cartographic products to represent the result summaries. InaSAFE will also create a number of spatial and non-spatial products which you can use to generate your own reports - for example by importing the data into a spreadsheet and further analysing it there.
Hazard	A **hazard** represents a natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. For example; flood, earthquake, tsunami and volcano are all examples of hazards. UNISDR (2009) Terminology on disaster risk reduction.
Generic Hazard	A generic hazard is any dataset where the areas within the data set have been classified as either **low**, **medium**, or **high** hazard level. Use generic hazard in cases where InaSAFE does not have an existing hazard concept for the data you are using.
Exposure	**Exposure** represents people, property, systems, or other elements present in hazard zones that are subject to potential losses in the event of a flood, earthquake, volcano etc. UNISDR (2009) Terminology on disaster risk reduction.
Affected	An exposure element (e.g. people, roads, buildings, land cover) that experiences a hazard (e.g. tsunami, flood, earthquake) and endures consequences (e.g. damage, evacuation, displacement, death) due to that hazard. UNISDR (2015)Proposed Updated Terminology on Disaster Risk Reduction: A Technical Review
Exposed People	People who are present in hazard zones and are thereby subject to potential losses. In InaSAFE, people who are exposed are those people who are within the extent of the hazard. UNISDR (2009)Terminology on Disaster
Affected People	People who are affected by a hazardous event. People can be affected directly or indirectly. Affected people may experience short-term or long-term consequences to their lives, livelihoods or health and in the economic, physical, social, cultural and environmental assets. In InaSAFE, people who are killed during the event are also considered affected. UNISDR (2015)Proposed Updated Terminology on Disaster Risk Reduction: A Technical Review

Directly Affected People	People who have suffered injury, illness or other health effects who were evacuated, displaced,relocated; or have suffered direct damage to their livelihoods, economic, physical, social,cultural and environmental assets. In InaSAFE, people who are missing or dead may be considered as directly affected. UNISDR (2015)Proposed Updated Terminology on Disaster Risk Reduction: A Technical Review
Indirectly Affected People	People who have suffered consequences, other than or in addition to direct effects, over time due to disruption or changes in economy, critical infrastructures, basic services, commerce,work or social, health and psychological consequences. In InaSAFE, people who are indirectly affected are not included in minimum needs reports. UNISDR (2015)Proposed Updated Terminology on Disaster Risk Reduction: A Technical Review
Displaced People	Displaced people are people who, for different reasons and circumstances because of risk or disaster, have to leave their place of residence. In InaSAFE, demographic and minimum needs reports are based on displaced / evacuated people. UNISDR (2015)Proposed Updated Terminology on Disaster Risk Reduction: A Technical Review
Displacement Rate	The population displacement ratio for a given hazard class.
Evacuated People	Evacuated people are people who, for different reasons and circumstances because of risk conditions or disaster, move temporarily to safer places before, during or after the occurrence of a hazardous event. Evacuation can occur from places of residence, workplaces, schools and hospitals to other places. Evacuation is usually a planned and organised mobilisation of persons, animals and goods for eventual return. In InaSAFE, demographic and minimum needs reports are based on displaced / evacuated people. UNISDR (2015)Proposed Updated Terminology on Disaster Risk Reduction: A Technical Review
Relocated People	Relocated people are people who, for different reasons or circumstances because of risk or disaster, have moved permanently from their places of residence to new sites. UNISDR (2015)Proposed Updated Terminology on Disaster Risk Reduction: A Technical Review
Injured People	People suffering from a new or exacerbated physical or psychological harm, trauma or an illness as a result of a hazardous event. UNISDR (2015)Proposed Updated Terminology on Disaster Risk Reduction: A Technical Review
Killed People	People who lost their lives as a consequence of a hazardous event. UNISDR (2015)Proposed Updated Terminology on Disaster Risk Reduction: A Technical Review

3.2. Gender

Term	Description	
Female	Relating to the characteristics of women. Oxford Dictionary.	

Male	Relating to the characteristics of men. Oxford Dictionary.	

3.3. Demographics

Term	Description	
People	Human beings in general or considered collectively. Oxford Dictionary.	
Infant	A very young child or baby aged between 0 and 4 years. Oxford Dictionary. World Population Dashboard. ICPD Goals and Demographic Indicators 2016.	
Child	A young person aged between 5 and 14 years, usually below the age of puberty. Oxford Dictionary. World Population Dashboard. ICPD Goals and Demographic Indicators 2016.	
Youth	A person aged between 0 and 14 years. World Population Dashboard. ICPD Goals and Demographic Indicators 2016.	
Adult	Person aged between 15 and 64 years, usually of working age. World Population Dashboard. ICPD Goals and Demographic Indicators 2016.	
Elderly	Persons aged 65 years and over. World Population Dashboard. ICPD Goals and Demographic Indicators 2016.	

3.4. Vulnerability

Term	Description	
Disabled	A person having a physical or mental condition that limits their movements, senses, or activities. Oxford Dictionary. World Report on Disability.	
Under 5	Persons aged under 5 years World Population Dashboard. ICPD Goals and Demographic Indicators 2016.	
Over 60	Persons aged 60 years and over World Population Aging 2013	

Child Bearing Age	The span of ages (usually 15–49) at which individuals are capable of becoming parents. The phrase can be applied to men and women but most frequently refers to women. UNFPA One Voice
Pregnant	A female having a child developing in the uterus. Oxford Dictionary. 
Lactating	A female producing milk to feed a baby. Oxford Dictionary. 

3.5. Minimum needs

Term	Description
Rice	Grains of rice used as food. Oxford Dictionary. 
Drinking Water	Water pure enough for drinking. Oxford Dictionary. 
Clean Water	Water suitable for washing and other purposes but not suitable for drinking. 
Family Kit	Relief supplies such as clothing to support families. BNPB Perka 7/2008
Hygiene Pack	Relief supplies to promote practices conducive to maintaining health and preventing disease. Oxford Dictionary.
Toilet	A room, building or cubicle with facilities to collect and dispose of human waste. Oxford Dictionary.

3.6. Data representation

Term	Description
Thresholds	A range defined with a minimum and maximum value. In InaSAFE we exclude the minimum value but include the maximum value. In mathematical expression: minimum value < x <= maximum value. It is used for doing classification of continuous data.
Value Maps	A conceptual mapping between one set of unique values and another set of unique values. Each unique value represents a particular class. It is used to express terms or concepts from one classification system in another classification system and only applies to non-continuous data. For example a value map can be used to express local names for entities (e.g.street type: "alley") into generic concepts (e.g.street type: "residential").

Rounding Methodology	Note that report rows containing totals are calculated from the entire analysis area totals and then rounded, whereas the subtotal rows are calculated from the aggregation areas and then rounded. Using this approach we avoid adding already rounded numbers and in so doing compounding the rounding.

3.7. Productivity

Term	Description
Productivity Rate	The weight of a crop from land cover can produce per area unit. The unit is in hundred kilograms /hectare.
Productivity	The number of crop in hundred kilograms unit that can be produced in a land cover area.
Production Cost Rate	The amount of money that is needed to build a crop land cover per area unit. The default unit is currency per area unit (e.g. IDR/hectare, USD/hectare).
Production Cost	The amount of money that is needed to build a crop land cover area. The unit is a currency unit (e.g. IDR, USD, Euro).
Production Value Rate	The price of a crop per area unit. The default unit is currency per area unit. (e.g. IDR/hectare, USD/hectare).
Production Value	The price of a crop in a land cover area. The unit is a currency unit (e.g. IDR, USD, Euro).

4. Core functionality and tools

4.1. The InaSAFE Dock

InaSAFE is free software that produces realistic natural hazard impact scenarios for better planning, preparedness and response activities. It provides a simple but rigourous way to combine data from scientists, local governments and communities to provide insights into the likely impacts of future disaster events.

The InaSAFE 'dock panel' helps you to run hazard impact analysis within the QGIS environment. It helps you create your hazard impact analysis question and shows the results of this analysis. If you are a new user, you may also consider using the 'Impact Function Centric Wizard' to run the analysis. This wizard will guide you through the process of running an InaSAFE assessment, with interactive step by step instructions. You can launch the wizard by clicking on this icon in the toolbar: 

You can drag and drop the dock panel to reposition it on the screen. For example, dragging the panel towards the right margin of the QGIS application will dock it to the right side of the screen.

There are three main areas to the dock panel:

- the **questions** area
- the **results** area
- the **buttons** area

You can get help at any time in InaSAFE by clicking on the help buttons provided on each dock and dialog.

4.1.1. The questions area

The intention of InaSAFE is to make it easy to perform your impact analysis. We start the analysis in the questions area. This area contains three drop down menus. You create your question by using these drop down menus to select the hazard and exposure data you wish to perform the analysis on. All questions follow this form: *In the event of a [hazard], how many [exposure] might be [impacted]?*

For example: "If there is a flood, how many buildings might be flooded?"

InaSAFE can be used to answer such questions for hazards such as flood, tsunami, volcanic ash fall and earthquake and exposures such as population, roads, structures, land cover etc.

The first step in answering these questions is to load layers that represent either hazard scenarios or exposure data into QGIS. A hazard, for example, may be represented as a raster layer in QGIS where each pixel in the raster represents the flood depth following an inundation event. An exposure layer could be represented, for example, as vector polygon data representing building outlines, or a raster outline where each pixel represents the number of people thought to be living in that cell.

InaSAFE will combine these two layers in a mathematical model. The results of this model will show what the effect of the hazard will be on the exposed infrastructure or people. The plugin relies on simple keyword metadata associated with each layer to determine what kind of information the layer represents. You can define these keywords by selecting a layer and then clicking the InaSAFE Keywords Wizard icon on the toolbar:  The wizard will guide you through the process of defining the keywords for that layer.

Aggregation is the process whereby we group the analysis results by district so that you can see how many people, roads or buildings were affected in each area. This will help you to understand where the most critical needs are. Aggregation is optional in InaSAFE - if you do not use aggregation, the entire analysis area will be used for the data summaries. Typically aggregation layers in InaSAFE have the name of the district or reporting area as attributes. It is also possible to use extended attributes to indicate the ratio of men and women; youth, adults and elderly living in each area. Where these are provided and the exposure layer is population, InaSAFE will provide a demographic breakdown per aggregation area indicating how many men, women, etc. were probably affected in that area.

4.1.2. The results area

After running an analysis, the question area is hidden to maximise the amount of space allocated to the results area. You can re-open the question area at any time by pressing the 'show question form' button.

The results area is used to display various useful feedback items to the user. Once an impact scenario has been run, a summary table will be shown.

If you select an impact layer (i.e. a layer that was produced using an InaSAFE Impact Function), in the QGIS layers list, this summary will also be displayed in the results area. When you select a hazard or exposure layer in the QGIS layers list, the keywords for that layer will be shown in the results area, making it easy to understand what metadata exists for that layer.

The results area is also used to display status information. For example, during the analysis process, the status area will display notes about each step in the analysis process. The 'Run' button will be activated when both a valid hazard and valid exposure layer have been added in QGIS.

Finally, the results area is also used to display any error messages so that you can see what went wrong and why. You may need to scroll down to view the message completely to see all of the error message details.

After running the impact scenario calculation, the question is automatically hidden to make the results area as large as possible. If you want to see what the question used in the analysis was, click on the 'Show question form' button at the top of the results area.

If you want to hide the question area again to have more space to display the results, click on the layer you just calculated with InaSAFE in the Layers list of QGIS to make it active.

4.1.3. The buttons area

The buttons area contains four buttons:

- **Help** – click on this if you need context help, such as the document you are reading right now!
- **About** – click on this to see short credits for the InaSAFE project.
- **Print** ... – click on this if you wish to create a pdf of your impact scenario project or generate a report to open in composer for further tuning. An impact layer must be active before the 'Print' button will be enabled.
- **Run** – this button is enabled when the combination of hazard and exposure selected in the questions area's drop down menus will allow you to run a scenario.

4.1.4. Data conversions

When running a scenario, the data being used needs to be processed into a state where it is acceptable for use by InaSAFE. In particular it should be noted that:

- Remote datasets will be copied locally before processing.
- All datasets will be clipped to the behaviours defined in the analysis extents dialog if you do not use an aggregation layer. 
- You can visualise the area that will be used for the analysis by enabling the "Toggle Scenario Outlines" tool. When this tool is enabled, a line (green by default) will be drawn around the outermost boundary of the analysis area. 
- When you have selected an aggregation layer the analysis area will be the outline of the aggregation layer. If you select one or more polygons in the aggregation layer (by using the QGIS feature selection tools), the analysis boundary will be reduced to just the outline of these selected polygons. If the "Toggle Scenario Outlines" tool is enabled, the preview of the effective analysis area will be updated to reflect the selected features.
- All clipped datasets will be converted (reprojected) to the Coordinate Reference System of the exposure layer before analysis.

4.1.5. Generating impact reports

When the impact analysis has completed you may want to generate a report. Usually the 'Print...' button will be enabled immediately after analysis. Selecting an InaSAFE impact layer in QGIS Layers panel will also enable it.

To start report generation you need to click on the Print button in the buttons area. This will open the Impact report dialog which has three main areas.

- **InaSAFE reports** – There are four checkboxes available which are representing the type of report component that will be generated.
- **Map reports** – Here you can select desired template for your report. All templates bundled with InaSAFE are available here, plus templates from user-defined template directory (see Options for information how to set templates directory) and from qgis setting directory (/Users/ismailsunni/.qgis2//inasafe). It is also possible to select custom template from any location: just activate radiobutton under combobox and provide path to template using the "..." button.
- **Buttons area** – In this area you will find buttons to open the report as a PDF or in the QGIS print composer. You can also get help by clicking on the help button or using the close button to close the print dialog.

There are four options on which template would you use to generate a map report.

- **InaSAFE default templates** – The map report will be generated using InaSAFE default landscape and portrait map templates. Override template will not be used.
- **Override template** – The map report will be generated using override template found from qgis setting directory. InaSAFE default map templates will not be printed.
- **Template from search directory** – The map report will be generated using selected template on template dropdown selector.

InaSAFE default map templates will not be printed and override template will not be used.

- **Template from file system** – The map report will be generated using selected template on file system. InaSAFE default map templates will not be printed and override template will not be used.

4.2. InaSAFE Reports

To start report generation you need to click on the Print button in the buttons area. This will open the Impact report dialog which has three main areas.

- **InaSAFE reports** – There are four checkboxes available which are representing the type of report component that will be generated.
- **Map reports** – Here you can select desired template for your report. All templates bundled with InaSAFE are available here, plus templates from user-defined template directory (see Options for information how to set templates directory) and from qgis setting directory (/Users/ismailsunni/.qgis2//inasafe). It is also possible to select custom template from any location: just activate radiobutton under combobox and provide path to template using the "..." button.
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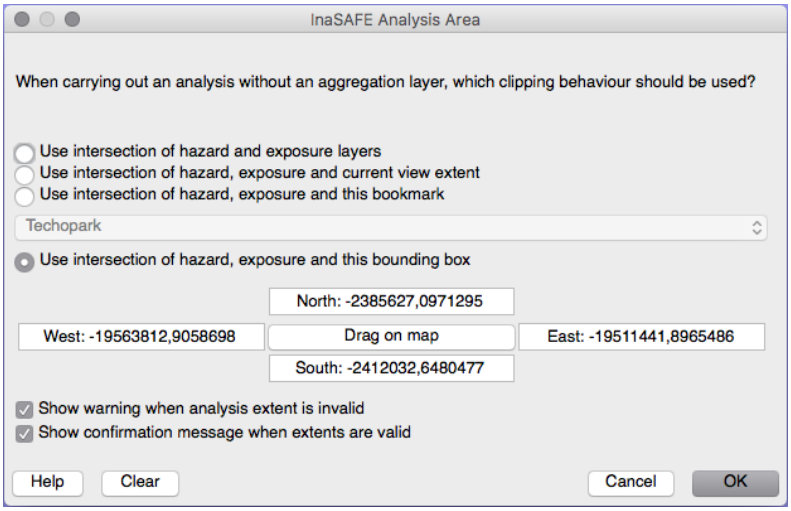
- **Template from search directory** – The map report will be generated using selected template on template dropdown selector. InaSAFE default map templates will not be printed and override template will not be used.
- **Template from file system** – The map report will be generated using selected template on file system. InaSAFE default map templates will not be printed and override template will not be used.

4.3. Managing analysis extents with the extents selector



This tool allows you to specify which geographical region should be used for your analysis. If you want to check what area will be included in your analysis, enable the 'Toggle scenario outlines' tool on the InaSAFE toolbar:


Your user defined extent will be shown on the map as a rectangle. There are a number of different modes that can be used which are described below:

4.3.1. Use intersection of hazard and exposure layers

The largest area that can be analysed is the intersection of the hazard and exposure layers you have added. To choose this option, click 'Use intersection of hazard and exposure layers'.

Sometimes it is more useful to analyse a smaller area. This could be to reduce processing time (smaller areas with process faster) or because information is only needed in a certain area (e.g. if a district only wants information for their district, not for the entire city). If you want to analyse a smaller area, there are a few different ways to do this.

4.3.2. Use intersection of hazard, exposure and current view extent

If you wish to conduct the analysis on the area currently shown in the window, you can set the analysis area to 'Use intersection of hazard, exposure and current view extent'. If the extents of the datasets are smaller than the view extent, the analysis area will be reduced to the extents of the datasets.

4.3.3. Use intersection of hazard, exposure and this bookmark

You can also use one of your QGIS bookmarks to set the analysis area. **This option will be greyed out if you have no bookmarks.**

To create a bookmark, zoom to the area you want to create a bookmark for. When you are happy with the extent, click the 'New bookmark' button in the QGIS toolbar.

The drop down menu in the InaSAFE Analysis Area window should now be activated. When you choose a bookmark from the drop down menu it will zoom to the analysis area selected by the bookmark.

4.3.4. Use intersection of hazard, exposure and this bounding box

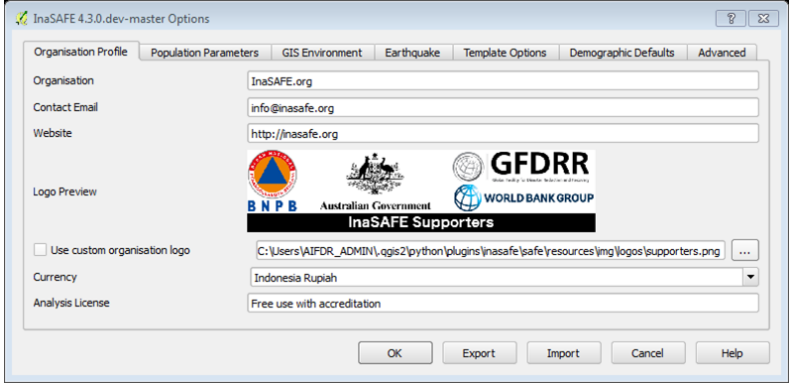
You can also choose the analysis area interactively by clicking 'Use intersection of hazard, exposure and this bounding box'. This will allow you to click 'Drag on map' which will temporarily hide this window and allow you to drag a rectangle on the map. After you have finished dragging the rectangle, this window will reappear with values in the North, South, East and West boxes. If the extents of the datasets are smaller than the user defined analysis area, the analysis area will be reduced to the extents of the datasets.

Alternatively, you can enter the coordinates directly into the N/S/E/W boxes once the 'Use intersection of hazard, exposure and this bounding box' option is selected (using the same coordinate reference system, or CRS, as the map is currently set).

4.4. InaSAFE Options

The InaSAFE options dialog is used to control various aspects of the InaSAFE analysis and reporting environment. Here are brief descriptions of all the options available, grouped by the tab page on which they occur.

4.4.1. Organisation Profile tab



The Organisation Profile tab provides several general settings:

- **Organisation** – Use this option to specify the name of your organisation.
- **Contact email** – Use this option to specify the contact person's email address to use in the generated metadata document.
- **Website** – Use this option to set the website address to be used in the generated metadata document.
- **Use custom organisation logo** – By default, InaSAFE will add the supporters logo to each map template. The supporters logo is also used at tbe bottom of the dock panel if the 'show organisation logo in dock' option is enabled. You can use this option to replace the organisation logo with that of your own organisation. The logo will be rescaled automatically to fill the space provided.
- **Currency** – InaSAFE will use the selected currency for the analysis.
- **Analysis license** – Use this to set the usage and redistribution license for the generated impact layer.

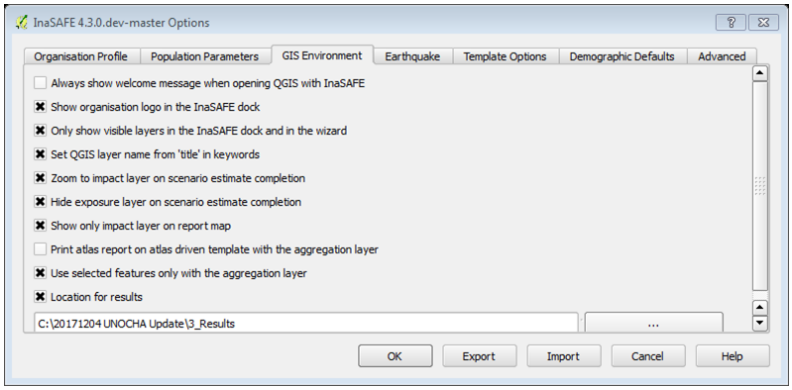
4.4.2. Population Parameters tab

In this tab you can define some parameters that will be used by InaSAFE in the analysis of exposed populations. You have the option to change the parameters for whether the exposed population is considered to be affected by each hazard type and class, and the displacement rate that will be used for affected people.

- **Affected** – When this option is checked, people exposed to the hazard class will be included in the count of affected people.
- **Displacement Rate** – The displacement rate is used to estimate the number of people displaced for each hazard class. People must be affected before they can be displaced.

Please refer to the InaSAFE manual for concept definitions and more information on the source of the hazard classifications and default settings. We really encourage you to consider these parameters carefully and to choose appropriate values for your local situation based on past events and expert knowledge.

4.4.3. GIS Environment tab



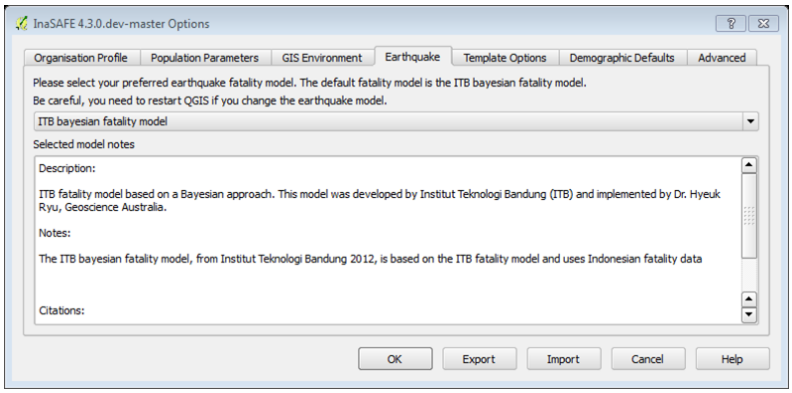
The GIS Environment tab provides several general settings:

- **Always show welcome message when opening QGIS with InaSAFE** – When this option is enabled, the welcome message will be

enabled when opening QGIS with InaSAFE. By default the Welcome message will be displayed.

- **Show organisation logo in InaSAFE dock** – When this option is enabled, a logo will be displayed at the bottom of the InaSAFE dock widget. By default the logo used is the InaSAFE supporters logo, but you can alter this by setting the 'Use custom organisation logo' option in the template options tab (see below).
- **Show only visible layers in the InaSAFE dock** – When this option is enabled layers that are not visible in the QGIS layers panel will not be shown in the hazard, exposure and aggregation combo boxes in the dock area.
- **Set QGIS layer name from title in keywords** – If this option is enabled, the InaSAFE keywords title attribute will be used for the layer name in the QGIS Layers list when adding a layer.
- **Zoom to impact layer on scenario estimate completion** – When this option is enabled, the map view extents will be updated to match the extents of the generated impact layer once the analysis completes.
- **Hide exposure on scenario estimate completion** – Use this option if you prefer to not show the exposure layer as an underlay behind the generated impact layer.
- **Show only impact layer on report map** When this option is enabled, the map report created after an analysis completes will not show any other layers in your current project except for the impact layer.
- **Print atlas report on atlas driven template with the aggregation layer** When this option is enabled, InaSAFE will generate an atlas report based on aggregation area if the template has atlas generation flag enabled.
- **Use selected features only with the aggregation layer** If enabled, running an analysis with some features of the aggregation layer selected will constrain the analysis to only those selected aggregation areas, all others will be ignored.
- **Location for results** – By default, InaSAFE will write impact layer and intermediate outputs to the system temporary directory. On some operating systems, these temporary files will be deleted on each reboot. If you wish to, you can specify an alternative directory to use for storing these temporary files.

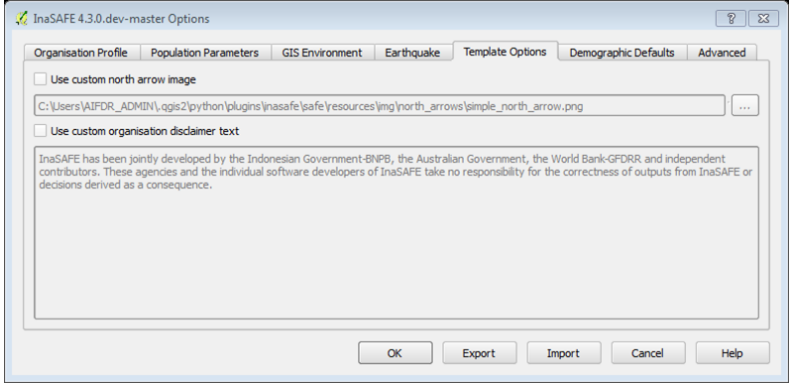
4.4.4. Earthquake tab



In this tab you can select which earthquake fatality model to use when estimating earthquake impact on population. This option is global – it will affect all subsequent earthquake analyses carried out in InaSAFE.

When selecting an earthquake analysis model, its details will be shown below in the text box area.

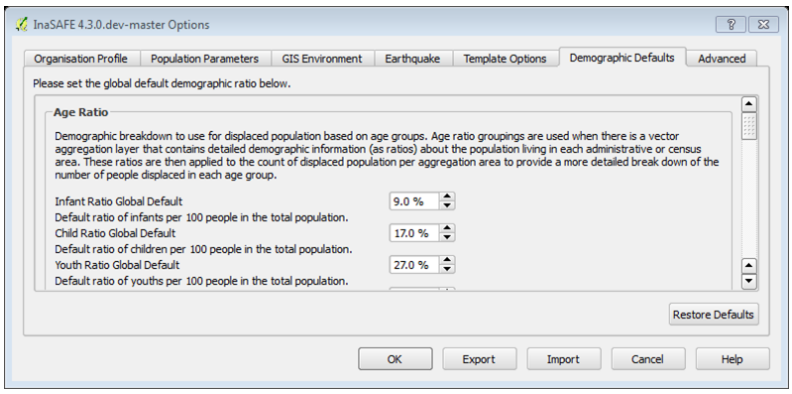
4.4.5. Template Options tab



This tab has options relating to the generation of map composer templates and how reports will be printed:.

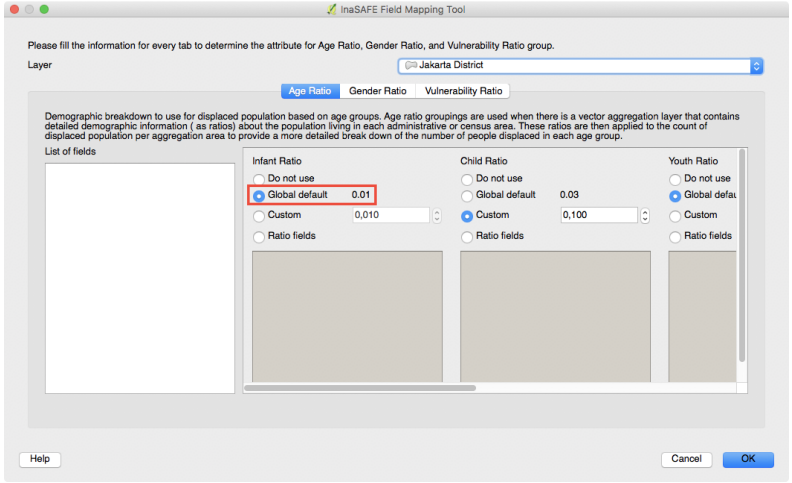
- **Use custom north arrow image** – InaSAFE provides a basic north arrow which is placed on generated map compositions and rendered PDF reports. You can replace this north arrow with one of your own choosing using this option.
- **Use custom disclaimer text** – By default, InaSAFE will display a disclaimer on reports advising readers of the report to exercise caution when interpreting the outputs presented. You can override this text using this option, though we do advise that you include a similar statement of caution in your overridden text.

4.4.6. Demographic Defaults tab

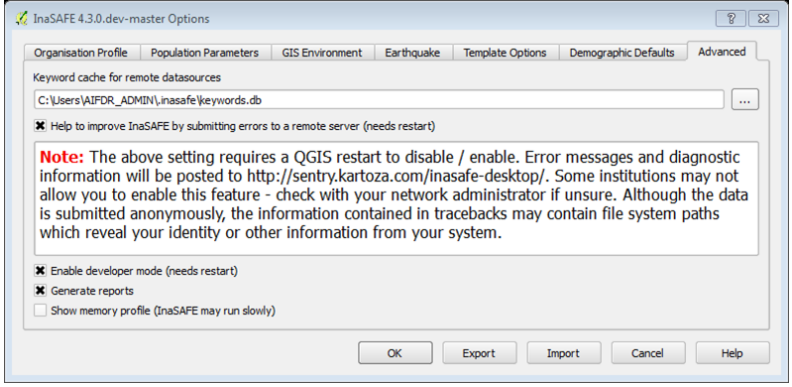


In this tab you will find options for setting the default ratios for demographic groups. There is more detailed help on demographic groups within the main help page for InaSAFE in the Field Mapping Tool section. Essentially default ratios for demographic groups determine what proportion of the population are within each population group (e.g. infants versus children etc.). The options defined in this tab are used in cases where you choose to use the global default ratios while configuring the keywords for an aggregation layer as shown below.

Note that the contents of this tab may changed depending on what groups have been defined for demographic breakdowns.



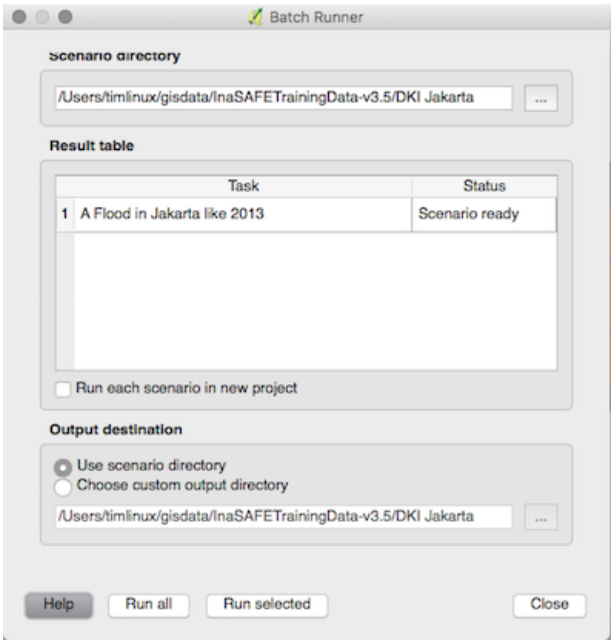
4.4.7. Advanced tab



This tab contains options intended for advanced users only:

- **Keyword cache for remote databases** – When InaSAFE is used with remote layers (for example a database layer or a WFS layer), it is not possible to store the keywords for the layer with the layer itself. To accommodate for these types of layers, InaSAFE writes the keywords to a small file based database (using sqlite) and then retrieves them based on unique connection details used for that layer. You can specify a custom path to be used for storing the keywords database using this option.
- **Help to improve InaSAFE by submitting errors to a remote server** – With this option enabled, InaSAFE will post any errors that occur to an online server for analysis by our development team. This option is disabled by default as some may consider some of the data submitted (IP Address, logged in user name) to be sensitive.
- **Enable developer mode** – When this option is enabled, right clicking on the webview widget in the dock will allow you to debug the generated HTML. In addition, if the metadata.txt for the running InaSAFE is set to 'alpha', an additional icon will be added to the toolbar to add test layers to the QGIS project.
- **Generate reports** – When this option is enabled, InaSAFE will generate reports.
- **Show memory profile** – When this option is enabled, InaSAFE will display the memory profile when it runs.

4.5. The Batch Runner



With this tool you can set up numerous scenarios and run them all in one go. A typical use case may be where you define a number of e.g. flood impact scenarios all using a standard data set e.g. flood.shp. As new flood data becomes available you replace flood.shp and rerun the scenarios using the batch runner. Using this approach you can quickly produce regional contingency plans as your understanding of hazards changes. When you run the batch of scenarios, pdf reports are generated automatically and all placed in a single common directory making it easy for you to browse and disseminate the reports produced.

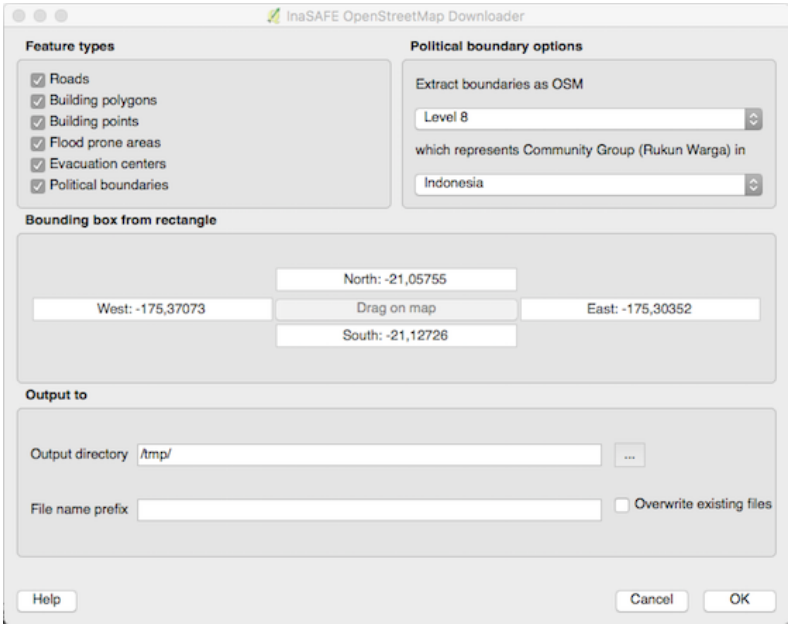
When the batch process completes, it will also produce a summary report like this:

InaSAFE Batch Report File
P: gempa bumi Sumatran fault (Mw7.8)
P: gempa di Yogya tahun 2006
P: banjir jakarta 2007
P: Tsunami di Maumere (Mw 8.1)
P: gempa Mw6.5 Palu-Koro Fault
P: gunung merapi meletus

Total passed: 6
Total failed: 0
Total tasks: 6

Before running the Batch Runner you might want to use the 'save scenario' tool to first save some scenarios on which you can let the batch runner do its work. This tool lets you run saved scenarios in one go. It lets you select scenarios or let run all scenarios in one go.

4.6. The OpenStreetmap Downloader



This tool will fetch building ('structure') or road ('highway') data from the OpenStreetMap project for you. The downloaded data will have InaSAFE keywords defined and a default QGIS style applied. To use this tool effectively:

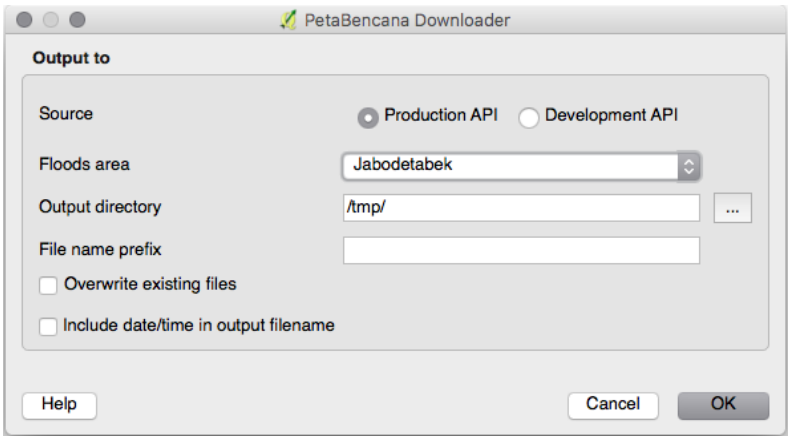
- Your current extent, when opening this window, will be used to determine the area for which you want data to be retrieved. You can interactively select the area by using the 'select on map' button - which will temporarily hide this window and allow you to drag a rectangle on the map. After you have finished dragging the rectangle, this window will reappear.
- Check the output directory is correct. Note that the saved dataset will be named after the type of data being downloaded e.g. roads.shp or buildings.shp (and associated files).
- By default simple file names will be used (e.g. roads.shp, buildings.shp). If you wish you can specify a prefix to add in front of this default name. For example using a prefix of 'padang-' will cause the downloaded files to be saved as 'padang-roads.shp' and 'padang-buildings.shp'. Note that the only allowed prefix characters are A-Z, a-z, 0-9 and the characters '-' and '_'. You can leave this blank if you prefer.

- If a dataset already exists in the output directory it will be overwritten.
- This tool requires a working internet connection and fetching buildings or roads will consume your bandwidth.
- Downloaded data is copyright OpenStreetMap contributors (click for more info).

When the **Political boundaries** box in the Feature types menu is ticked, the Political boundary options panel will be enabled. The panel lets you select which admin level you wish to download. The admin levels are country specific. When you select an admin level, the local name for that admin level will be shown. You can change which country is used for the admin level description using the country drop down menu. The country will be automatically set to coincide with the view extent if a matching country can be found.

Note: We have only provide presets for a subset of the available countries. If you want to know what the levels are for your country, please check on the following web page: List of OSM Admin Boundary definitions

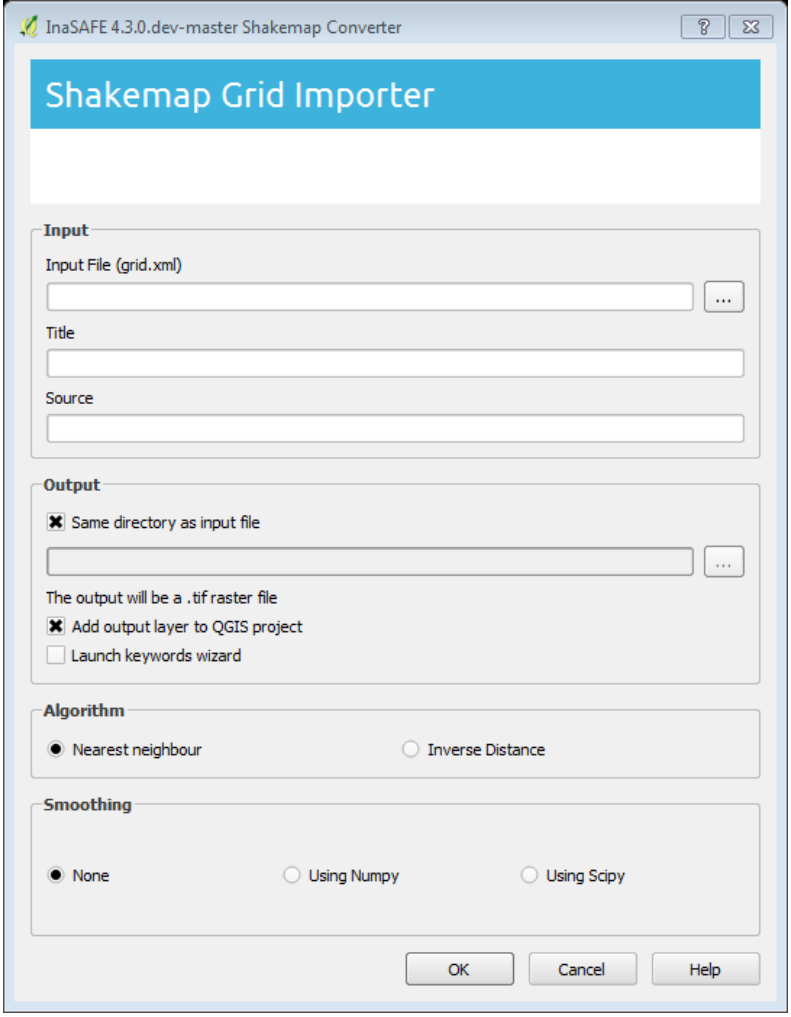
4.7. The PetaBencana Downloader



This tool will fetch current flood data for Jakarta from PetaBencana.id

- Check the output directory is correct. Note that the saved dataset will be called jakarta_flood.shp (and associated files).
- If you wish you can specify a prefix to add in front of this default name. For example using a prefix of 'foo-' will cause the downloaded files to be saved as e.g. 'foo-rw-jakarta-flood.shp'. Note that the only allowed prefix characters are A-Z, a-z, 0-9 and the characters '-' and '_'. You can leave this blank if you prefer.
- If a dataset already exists in the output directory it will be overwritten if the "overwrite existing files" checkbox is ticked.
- If the "include date/time in output filename" option is ticked, the filename will be prefixed with a time stamp e.g. 'foo-22-Mar-2015-08-01-2015-rw-jakarta-flood.shp' where the date timestamp is in the form DD-MMM-YYYY.
- This tool requires a working internet connection and fetching data will consume your bandwidth.
- Downloaded data is copyright the PetaBencana contributors (click for more info).

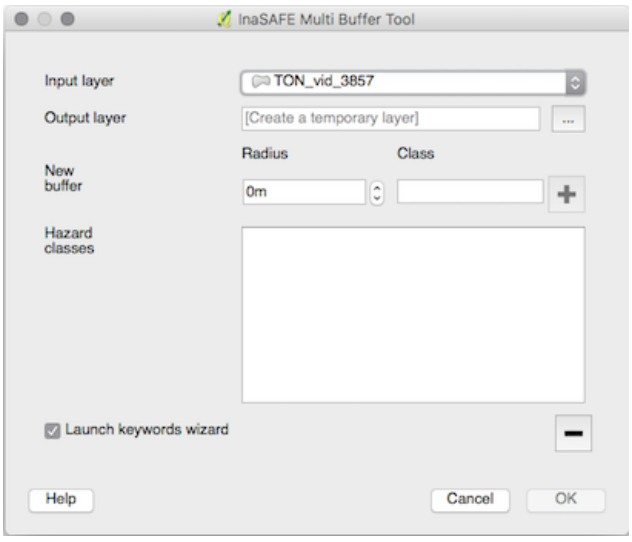
4.8. The Shakemap Converter



This tool will convert an earthquake 'shakemap' that is in grid xml format into a GeoTIFF file. The imported file can be used in InaSAFE as an input for impact functions that require an earthquake layer. To use this tool effectively:

- Select a grid.xml for the input layer.
- Choose where to write the output layer to.
- Choose the interpolation algorithm that should be used when converting the xml grid to a raster. If unsure keep the default.
- If you want to obtain shake data you can get download it free from the USGS shakemap site: http://earthquake.usgs.gov/earthquakes/shakemap/list.php?y=2013

4.9. The Multi Buffer Tool

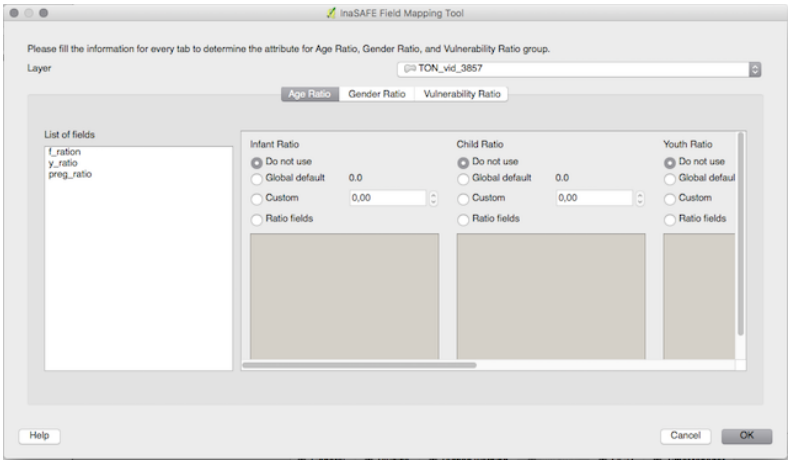


This tool will generate a polygon layer by multi-buffering the input layer. To use this tool effectively:

- Load a point or line layer in QGIS. Typically, the layer will represent hazard source such as volcano and river.

- Choose where to save the output layer to.
- Create one or more entries in the classes list, and define the appropriate distances for each buffer. You should give each buffer distance a corresponding name e.g. "high", "medium", "low". Click the add (+) button to record your entries.
- To remove the classification, select the classification you want to remove, then click the remove (-) button.
- Check the "launch keywords wizard" checkbox to launch the keywords creation wizard after the buffering is complete. If you want assign keywords later, uncheck the "launch keywords wizard" checkbox.
- A new layer will be added to QGIS after the buffering is complete. The layer will contain new buffer polygon(s) and the class name will be stored as an attribute of each polygon. If you check the launch keywords wizard checkbox, the keywords creation wizard will launch right after the buffering process has completed. You can assign the keywords to the output layer.

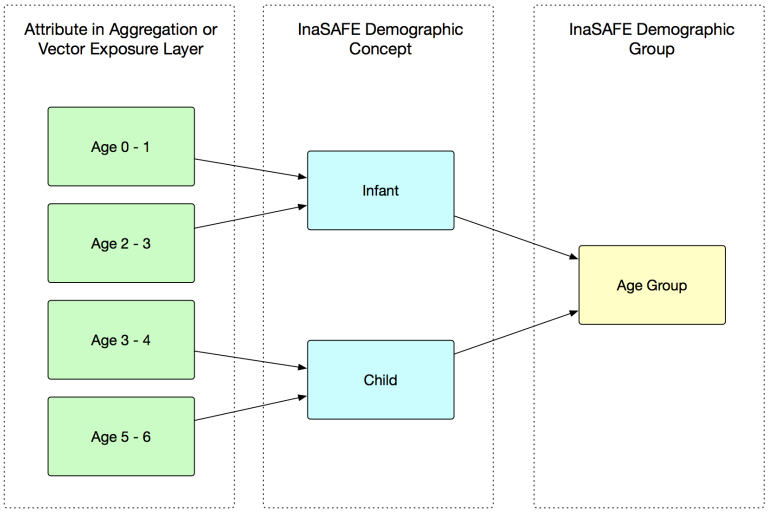
4.10. The Field Mapping Tool



This tool allows you to define field mappings to use for demographic breakdowns of your analysis results. You can activate the tool on the InaSAFE toolbar: 

Field mapping describes the process of matching one or more fields in an attribute table to a concept in InaSAFE. The field mappings tool InaSAFE allows you to match concepts such as "elderly", "disabled people", "pregnant" and so on to their counterpart fields in either an aggregation layer or an exposure population vector layer.

Note: It is not possible to use this tool with raster population exposure data, but ratios defined in aggregation layers will be used when raster exposure population data is used.



The illustration above shows the principle behind InaSAFE's demographic breakdown reporting system. The idea here is to support the production of a detailed demographic breakdown when carrying out an analysis with a population exposure vector dataset. So for example instead of simply

reporting on the total number of people exposed to a hazard, we want to break down the affected population into distinct demographic groups. In InaSAFE by default we consider three groups:

- **Gender:** The gender group reports on gender specific demographics including things like the number of women of child bearing age, number of pregnant women, number of lactating women and so on.
- **Age:** The age group reports on age specific demographics including things like the number of infants, children, young adults, adults elderly people and so on.
- **Vulnerable people:** The vulnerable people group reports on specific demographics relating to vulnerability including things like the number of infants, elderly people, disabled people and so on.

In the diagram above, you can see that we have an "age" group (column on the right) which, for purposes of illustration, has two age classes: "infant" and "child" (center column). These age classes are defined in InaSAFE metadata and there are actually five classes in a default installation. In the left hand column you can see a number of columns listed from the attribute table. In this example our population data contains columns for different age ranges (0–1, 1–2, 2–4, 4–6). The field mapping tool can be used in order to combine the data in the "0 - 1" and "1 - 2" columns into a new column called "infant". In the next section of this document we enumerate the different groups and concepts that InaSAFE supports when generating demographic breakdowns.

When the tool is used, it will write additional data to the exposure or aggregation layer keywords so that your preferred concept mappings will be used when reports are generated after the analysis is carried out. You should note the following special characteristics of the field mapping tool when used for aggregation datasets versus when used for vector population exposure datasets:

Aggregation datasets: For aggregation datasets, the field mapping tool uses global defaults (see the InaSAFE Options Dialog documentation for more details) or dataset level defaults to determine which ratios should be used to calculate concept values. For example, in the age group the aggregation dataset may specify that infants should by calculated as a ratio of 0.1% of the total population. Note that for aggregation datasets you can only use ratios, not counts.

Vector population exposure datasets: For exposure datasets, ratios are not supported, only counts. The field mappings carried out here will be used to generate new columns during a pre-processing step before the actual analysis is carried out.

The interplay between default ratios, aggregation layer provided ratios and population exposure layers is illustrated in the table below.

Aggregation	Raster	Vector, no counts	Vector with counts	Notes
No aggregation	Use global default ratio	Use global default ratio	Use count to determine ratio	
Aggregation, ratio not set	Use global default ratio	Do nothing	Use count to determine ratio	
Aggregation, ratio value set	Use aggregation layer ratio	Use aggregation layer ratio	Use count to determine ratio	
Aggregation, ratio field mapping set	Use aggregation layer ratio	Use aggregation layer ratio	Use count to determine ratio	

4.10.1. Exposure Groups

The following demographic groups apply only to vector population exposure layers:

4.10.1.1. Age Count

Demographic breakdown to use for displaced population based on age groups. Age count groupings are used when there is a vector population dataset that contains detailed demographic information (as counts) about the population living in each administrative or census area.

4.10.1.2. Notes:

4.10.1.2.1. General notes:

- Infant: A very young child or baby aged between 0 and 4 years.
- Child: A young person aged between 5 and 14 years, usually below the age of puberty.
- Youth: A person aged between 0 and 14 years.
- Adult: Person aged between 15 and 64 years, usually of working age.
- Elderly: Persons aged 65 years and over.

Fields:

Name	Field Name	Type	Length	Precision
Infant Count	infant	Whole number, Decimal number	0	
The number of infant people for each feature. "Infant" is defined as: A very young child or baby aged between 0 and 4 years. In cases where population data is available, InaSAFE will calculate the number of infants per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The infant count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) counts or ratios in the input analysis data.				
Child Count	child	Whole number, Decimal number	0	
The number of child people for each feature. "Child" is defined as: A young person aged between 5 and 14 years, usually below the age of puberty. In cases where population data is available, InaSAFE will calculate the number of child per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The child count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) counts or ratios in the input analysis data.				
Youth Count	youth	Whole number, Decimal number	0	
The number of young people for each feature. "Youth" is defined as: A person aged between 0 and 14 years. This definition may not align well with the definition of youth in the humanitarian sector. It should be noted that this concept overlaps with the concepts of infant and child in InaSAFE. In cases where population data is available, InaSAFE will calculate the number of youths per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The youth count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) counts or ratios in the input analysis data.				
Adult Count	adult	Whole number, Decimal number	0	
The number of adults for each feature. "Adult" is defined as: Person aged between 15 and 64 years, usually of working age. In cases where population data is available, InaSAFE will calculate the number of adults per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The adult count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) counts or ratios in the input analysis data.				
Elderly Count	elderly	Whole number, Decimal number	0	
The number of elderly people for each feature. "Elderly" is defined as: Persons aged 65 years and over. In cases where population data is available, InaSAFE will calculate the number of adults per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The elderly count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) counts or ratios in the input analysis data.				

4.10.1.3. Gender Count

Demographic breakdown produced for displaced population based on gender groups (female, pregnant, etc.). These demographic concepts provide a detailed break down of the number of people displaced in each

age group.

4.10.1.4. Notes:

4.10.1.4.1. General notes:

- Male: Relating to the characteristics of men.
- Female: Relating to the characteristics of women.

Fields:

Name	Field Name	Type	Length	Precision
Male Count	male	Whole number, Decimal number	0	
The number of males for each feature. "Male" is defined as: Relating to the characteristics of men. In cases where population data is available, InaSAFE will calculate the number of males per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The male count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) counts or ratios in the input analysis data.				
Female Count	female	Whole number, Decimal number	0	
The number of females for each feature. "Female" is defined as: Relating to the characteristics of women. In cases where population data is available, InaSAFE will calculate the number of females per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The female count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) counts or ratios in the input analysis data.				

4.10.1.5. Age Vulnerability Count

Demographic breakdown to use for displaced population based on age. Vulnerability count groupings are used when there is a vector exposure layer that contains detailed demographic information (as counts) about the population living in each area. These counts are then used to calculate the ratio of vulnerable population sectors for each aggregation area. These are then used to produce a detailed break down of the number of displaced people in each age profile. Vulnerable segments of the population can include criteria like the number of infants, the number of elderly, the number of disabled people, and so on.

4.10.1.6. Notes:

4.10.1.6.1. General notes:

- Under 5: Persons aged under 5 years
- Over 60: Persons aged 60 years and over

Fields:

Name	Field Name	Type	Length	Precision
Under 5 Count	under_5	Whole number, Decimal number	0	
The number of under 5 years old for each feature. "Under 5" is defined as: Persons aged under 5 years In cases where population data is available, InaSAFE will calculate the number of people under 5 years old per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The under 5 years count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) ratios in the input analysis data.				
Over 60 Count	over_60	Whole number, Decimal number	0	
The number of over 60 years old for each feature. "Over 60" is defined as: Persons aged 60 years and over In cases where population data is available, InaSAFE will calculate the number of people over 60 years old per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The over 60 years count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) ratios in the input analysis data.				

4.10.1.7. Gender Vulnerability Count

Demographic breakdown to use for displaced population based on gender. Vulnerability count groupings are used when there is a vector exposure layer that contains detailed demographic information (as counts) about the population living in each area. These counts are then used to calculate the ratio of vulnerable population sectors for each aggregation area. These are then used to produce a detailed break down of the number of displaced people in each gender profile. Vulnerable segments of the population can include criteria like the number of infants, the number of pregnant women, lactating women and so on.

4.10.1.8. Notes:

4.10.1.8.1. General notes:

- Child bearing age: The span of ages (usually 15–49) at which individuals are capable of becoming parents. The phrase can be applied to men and women but most frequently refers to women.
- Pregnant: A female having a child developing in the uterus.
- Lactating: A female producing milk to feed a baby.

Fields:

Name	Field Name	Type	Length	Precision
Child Bearing Age Count	child_bearing_age	Whole number, Decimal number	0	
The number of child bearing age for each feature. "Child Bearing Age" is defined as: The span of ages (usually 15–49) at which individuals are capable of becoming parents. The phrase can be applied to men and women but most frequently refers to women. In cases where population data is available, InaSAFE will calculate the number of child bearing age per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The child bearing age count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) ratios in the input analysis data.				
Pregnant Women Count	pregnant	Whole number, Decimal number	0	
The number of pregnant women for each feature. "Pregnant" is defined as: A female having a child developing in the uterus. In cases where population data is available, InaSAFE will calculate the number of pregnant women per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The pregnant women count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) ratios in the input analysis data.				
Lactating Count	lactating	Whole number, Decimal number	0	
The number of lactating women for each feature. "Lactating" is defined as: A female producing milk to feed a baby. In cases where population data is available, InaSAFE will calculate the number of lactating women per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The lactating count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) ratios in the input analysis data.				

4.10.1.9. Disabled Vulnerability Count

Demographic breakdown to use for displaced population based on displacement vulnerability. Disabled count groupings are used when there is a vector exposure layer that contains detailed demographic information (as counts) about the population living in each area. These counts are then used to calculate the ratio of disabled people to the total population for each aggregation area. These are then used to produce a detailed break down of the number of displaced people in each area.

4.10.1.10. Notes:

4.10.1.10.1. General notes:

- Disabled: A person having a physical or mental condition that limits their movements, senses, or activities.

Fields:

Name	Field Name	Type	Length	Precision

Disabled Count	disabled	Whole number, Decimal number	0

The proportion of disabled people for each feature. "Disabled" is defined as: A person having a physical or mental condition that limits their movements, senses, or activities. In cases where population data is available, InaSAFE will calculate the number of disabled people per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The disabled count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) ratios in the input analysis data.

4.10.2. Aggregation Groups

The following demographic groups apply only to aggregation layers:

4.10.2.1. Age Ratio

Demographic breakdown to use for displaced population based on age groups. Age ratio groupings are used when there is a vector aggregation layer that contains detailed demographic information (as ratios) about the population living in each administrative or census area. These ratios are then applied to the count of displaced population per aggregation area to provide a more detailed break down of the number of people displaced in each age group.

4.10.2.2. Notes:

4.10.2.2.1. General notes:

- Infant: A very young child or baby aged between 0 and 4 years.
- Child: A young person aged between 5 and 14 years, usually below the age of puberty.
- Youth: A person aged between 0 and 14 years.
- Adult: Person aged between 15 and 64 years, usually of working age.
- Elderly: Persons aged 65 years and over.

Fields:

Name	Field Name	Type	Length	Precision
Infant Ratio	infant_ratio	Decimal number	2	

The proportion of infant people for each feature. "Infant" is defined as: A very young child or baby aged between 0 and 4 years. In cases where population data is available, InaSAFE will calculate the number of infants per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The infant count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) ratios in the input analysis data.

Child Ratio	child_ratio	Decimal number	2

The proportion of child people for each feature. "Child" is defined as: A young person aged between 5 and 14 years, usually below the age of puberty. In cases where population data is available, InaSAFE will calculate the number of child per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The child count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) ratios in the input analysis data.

Youth Ratio	youth_ratio	Decimal number	2

The proportion of young people for each feature. "Youth" is defined as: A person aged between 0 and 14 years. In cases where population data is available, InaSAFE will calculate the number of youths per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The youth count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) ratios in the input analysis data.

Adult Ratio	adult_ratio	Decimal number	2

The proportion of adults for each feature. "Adult" is defined as: Person aged between 15 and 64 years, usually of working age. In cases where population data is available, InaSAFE will calculate the number of adults per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The adult count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) ratios in the input analysis data.

Elderly Ratio	elderly_ratio	Decimal number	2

The proportion of elderly people for each feature. "Elderly" is defined as: Persons aged 65 years and over. In cases where population data is available, InaSAFE will calculate the number of adults per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The elderly count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) ratios in the input analysis data.

4.10.2.3. Gender Ratio

Demographic breakdown to use for displaced population based on gender. Gender ratio groupings are used when there is a vector aggregation layer that contains detailed demographic information (as ratios) about the population living in each administrative or census area. These ratios are then applied to the count of displaced population per aggregation area to provide a more detailed break down of the number of people displaced in each gender profile. Gender specific info can include criteria like the number of females, the number of females of child bearing age, and so on.

4.10.2.4. Notes:

4.10.2.4.1. General notes:

- Male: Relating to the characteristics of men.
- Female: Relating to the characteristics of women.

Fields:

Name	Field Name	Type	Length	Precision
Male Ratio	male_ratio	Decimal number	2	

The proportion of male for each feature. "Male" is defined as: Relating to the characteristics of men. In cases where population data is available, InaSAFE will calculate the number of males per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The male count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) ratios in the input analysis data.

Female Ratio	female_ratio	Decimal number	2

The proportion of females for each feature. "Female" is defined as: Relating to the characteristics of women. In cases where population data is available, InaSAFE will calculate the number of females per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The female count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) ratios in the input analysis data.

4.10.2.5. Age Vulnerability Ratio

Demographic breakdown to use for displaced population based on age. Vulnerability ratio groupings are used when there is a vector aggregation layer that contains detailed demographic information (as ratios) about the population living in each administrative or census area. These ratios are then applied to the count of displaced population per aggregation area to provide a more detailed break down of the number of people displaced in each age profile. Vulnerable segments of the population can include criteria like the number of infants, the number of elderly, the number of disabled people, and so on.

4.10.2.6. Notes:

4.10.2.6.1. General notes:

- Under 5: Persons aged under 5 years
- Over 60: Persons aged 60 years and over

Fields:

Name	Field Name	Type	Length	Precision
Under 5 Years Ratio	under_5_ratio	Decimal number	2	

The proportion of under 5 years old for each feature. "Under 5" is defined as: Persons aged under 5 years In cases where population data is available, InaSAFE will calculate the number of people under 5 years old per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The under 5 years count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) ratios in the input analysis data.			
Over 60 Years Ratio	over_60_ratio	Decimal number	2
The proportion of over 60 years old for each feature. "Over 60" is defined as: Persons aged 60 years and over In cases where population data is available, InaSAFE will calculate the number of people over 60 years old per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The over 60 years count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) ratios in the input analysis data.			

4.10.2.7. Gender Vulnerability Ratio

Demographic breakdown to use for displaced population based on gender. Vulnerability ratio groupings are used when there is a vector aggregation layer that contains detailed demographic information (as ratios) about the population living in each administrative or census area. These ratios are then applied to the count of displaced population per aggregation area to provide a more detailed break down of the number of people displaced in each gender profile. Vulnerable segments of the population can include criteria like the number of infants, the number of elderly, the number of disabled people, and so on.

4.10.2.8. Notes:

4.10.2.8.1. General notes:

- Child bearing age: The span of ages (usually 15-49) at which individuals are capable of becoming parents. The phrase can be applied to men and women but most frequently refers to women.
- Pregnant: A female having a child developing in the uterus.
- Lactating: A female producing milk to feed a baby.

Fields:

Name	Field Name	Type	Length	Precision
Child Bearing Age Ratio	child_bearing_age_ratio	Decimal number	2	
The proportion of child bearing age for each feature. "Child Bearing Age" is defined as: The span of ages (usually 15-49) at which individuals are capable of becoming parents. The phrase can be applied to men and women but most frequently refers to women. In cases where population data is available, InaSAFE will calculate the number of child bearing age per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The child bearing age count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) ratios in the input analysis data.				
Pregnant Ratio	pregnant_ratio	Decimal number	2	
The proportion of pregnant women for each feature. "Pregnant or Lactating" is defined as: A female having a child developing in the uterus. In cases where population data is available, InaSAFE will calculate the number of pregnant women per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The pregnant count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) ratios in the input analysis data.				
Lactating Ratio	lactating_ratio	Decimal number	2	
The proportion of lactating women for each feature. "Lactating" is defined as: A female producing milk to feed a baby. In cases where population data is available, InaSAFE will calculate the number of lactating people per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The lactating count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) ratios in the input analysis data.				

4.10.2.9. Disability Vulnerability Ratio

Demographic breakdown to use for displaced population based on disability vulnerability. Disability vulnerability ratio groupings are used when there is a vector aggregation layer that contains detailed demographic information (as ratios) about the disabled population living in each administrative or census area. These ratios are then applied to the count of displaced population per aggregation area to provide a more detailed break down of the number of disabled people displaced in each area.

4.10.2.10. Notes:

4.10.2.10.1. General notes:

- Disabled: A person having a physical or mental condition that limits their movements, senses, or activities.

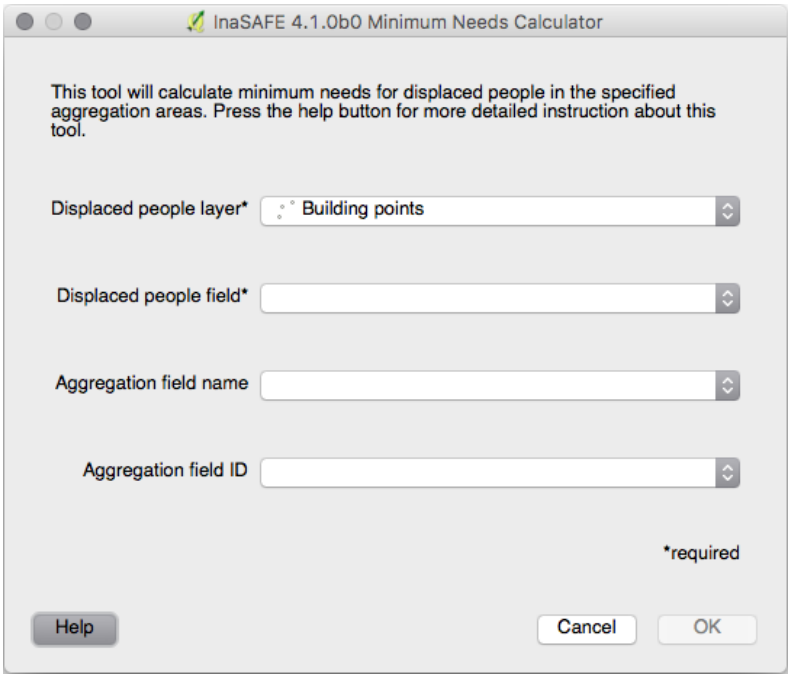
Fields:

Name	Field Name	Type	Length	Precision
Disabled Ratio	disabled_ratio	Decimal number	2	

The proportion of disabled people for each feature. "Disabled" is defined as: A person having a physical or mental condition that limits their movements, senses, or activities. In cases where population data is available, InaSAFE will calculate the number of disabled people per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The disabled count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) ratios in the input analysis data.

4.11. Minimum Needs

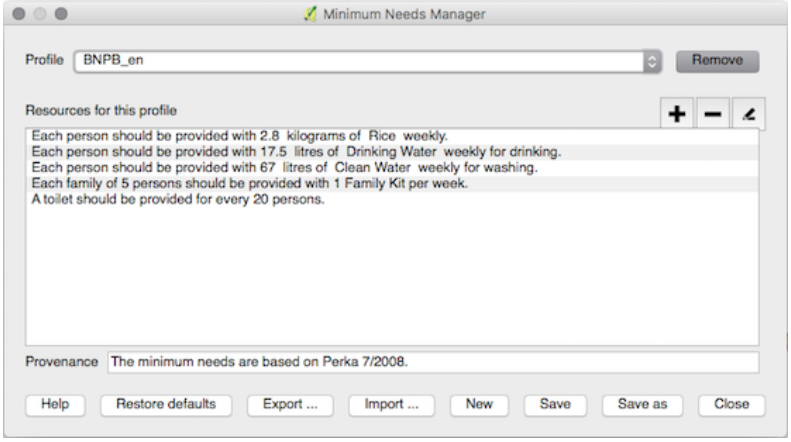
4.11.1. The minimum needs tool



This tool will calculated minimum needs for evacuated people. To use this tool effectively:

- Load a point or polygon layer in QGIS. Typically the layer will represent administrative districts where people have gone to an evacuation center.
- Ensure that the layer has an INTEGER attribute for the number of displaced people associated with each feature.
- Use the pick lists to select the layer and the population field and then press 'OK'.
- A new layer will be added to QGIS after the calculation is complete. The layer will contain the minimum needs per district / administrative boundary.

4.11.2. The minimum needs manager



During and after a disaster, providing for the basic human minimum needs of food, water, hygiene and shelter is an important element of your contingency plan. InaSAFE has a customisable minimum needs system that allows you to define country or region specific requirements for compiling a needs report where the exposure layer represents population.

By default InaSAFE uses minimum needs defined for Indonesia - and ships with additional profiles for the Philippines and Tanzania. You can customise these or add your own region-specific profiles too.

Minimum needs are grouped into regional or linguistic 'profiles'. The default profile is 'BNPB_en' - the english profile for the national disaster agency in Indonesia. You will see that this profile defines requirements for displaced persons in terms of Rice, Drinking Water, Clean Water (for bathing etc.), Family Kits (with personal hygiene items) and provision of toilets.

Each item in the profile can be customised or removed. For example selecting the first item in the list and then clicking on the 'pencil' icon will show the details of how it was defined. If you scroll up and down in the panel you will see that for each item, you can set a name, description, units (in singular, plural and abbreviated forms), specify maxima and minima for the quantity of item allowed, a default and a frequency. You would use the maxima and minima to ensure that disaster managers never allocate amounts that will not be sufficient for human livelihood, and also that will not overtax the logistics operation for those providing humanitarian relief.

The final item in the item configuration is the 'readable sentence' which bears special discussion. Using a simple system of tokens you can construct a sentence that will be used in the generated needs report.

4.11.3. Minimum needs profiles

A profile is a collection of resources that define the minimum needs for a particular country or region. Typically a profile should be based on a regional, national or international standard. The actual definition of which resources are needed in a given profile is dependent on the local conditions and customs for the area where the contingency plan is being devised.

For example in the middle east, rice is a staple food whereas in South Africa, maize meal is a staple food and thus the contingency planning should take these localised needs into account.

4.11.4. Minimum needs resources

Each item in a minimum needs profile is a resource. Each resource is described as a simple natural language sentence e.g.:

Each person should be provided with 2.8 kilograms of Rice weekly.

By clicking on a resource entry in the profile window, and then clicking the black pencil icon you will be able to edit the resource using the resource editor. Alternatively you can create a new resource for a profile by clicking on the black + icon in the profile manager. You can also remove any resource from a profile using the - icon in the profile manager.

4.11.5. Resource Editor

When switching to edit or add resource mode, the minimum needs manager will be updated to show the resource editor. Each resource is described in terms of:

- **resource name** – e.g. Rice
- **a description of the resource** – e.g. Basic food
- **unit in which the resource is provided** – e.g. kilogram
- **pluralised form of the units** – e.g. kilograms
- **abbreviation for the unit** – e.g. kg
- **the default allocation for the resource** – e.g. 2.8. This number can be overridden on a per-analysis basis
- **minimum allowed which is used to prevent allocating** – e.g. no drinking water to displaced persons
- **maximum allowed which is used to set a sensible upper limit for the resource**
- **a readable sentence which is used to compile the sentence describing the resource in reports.**

These parameters are probably all fairly self explanatory, but the readable sentence probably needs further detail. The sentence is compiled using a simple keyword token replacement system. The following tokens can be used:

- {{ Default }}
- {{ Unit }}
- {{ Units }}
- {{ Unit abbreviation }}
- {{ Resource name }}
- {{ Frequency }}
- {{ Minimum allowed }}
- {{ Maximum allowed }}

When the token is placed in the sentence it will be replaced with the actual value at report generation time. This contrived example shows a tokenised sentence that includes all possible keywords:

A displaced person should be provided with {{ Default }} {{ Unit }}/{{ Units }}/{{ Unit abbreviation }} of {{ Resource name }}. Though no less than {{ Minimum allowed }} and no more than {{ Maximum allowed }}. This should be provided {{ Frequency }}.

Would generate a human readable sentence like this:

A displaced person should be provided with 2.8 kilogram/kilograms/kg of rice. Though no less than 0 and no more than 100. This should be provided daily.

Once you have populated the resource elements, click the Save resource button to return to the profile view. You will see the new resource added in the profile's resource list.

4.11.6. Managing profiles

In addition to the profiles that come as standard with InaSAFE, you can create new ones, either from scratch, or based on an existing one (which you can then modify).

Use the New button to create new profile. When prompted, give your profile a name e.g. 'JakartaProfile'.

Note: The profile must be saved in your home directory under .qgis2/minimum_needs in order for InaSAFE to successfully detect it.

An alternative way to create a new profile is to use the Save as to clone an existing profile. The clone profile can then be edited according to your specific needs.

4.11.7. Active profile

It is important to note, that which ever profile you select in the Profile pick list, will be considered active and will be used as the basis for all minimum needs analysis. You need to restart QGIS before the changed profile become active.

5. Analysis steps

5.1. Analysis internal process

An **analysis** from the point of view of using InaSAFE is the process whereby a hazard layer, an exposure layer and an optional aggregation layer are used to determine the potential impact of the hazard data on the exposure. The analysis results are grouped by region (as defined in the aggregation layer).

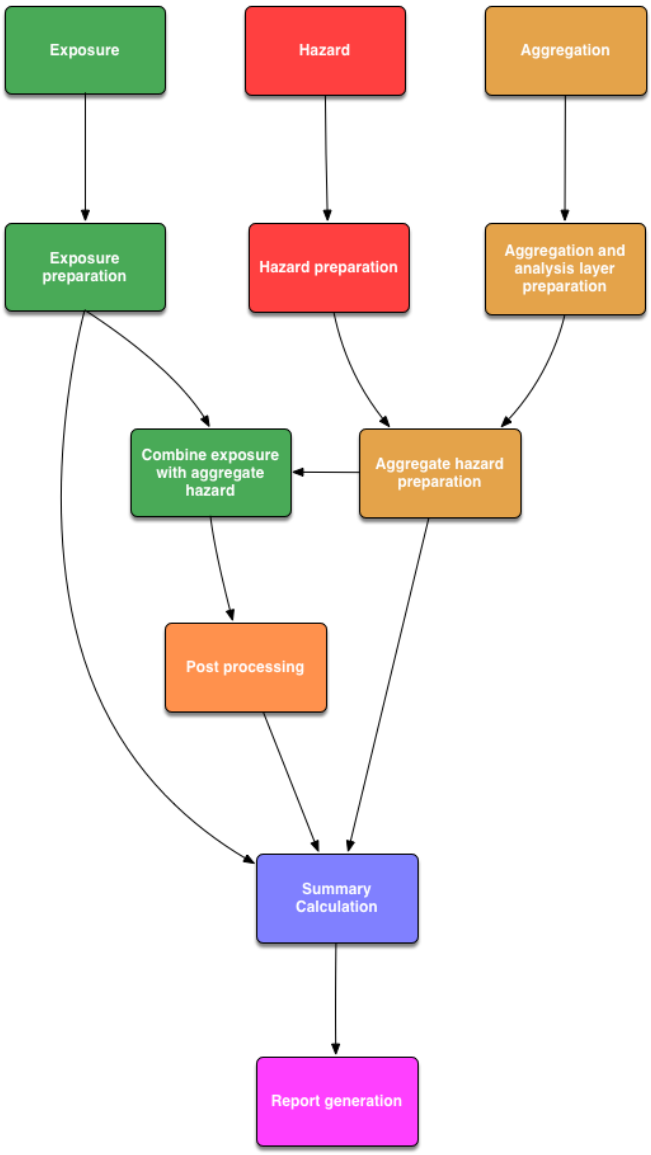
In InaSAFE the analysis process commences with a preparation phase where each input layer is pre-processed to ensure that it is in a consistent state. The hazard and aggregation are reprojected to the same coordinate reference system of the exposure dataset. Any data that is not within the selected aggregation areas is removed. Note that any modifications made are done on copies of the original data - the original data are not modified in any way.

Any continuous datasets are reclassified into classfied (also sometimes referred to as categorical) datasets.

The aggregation layer and the hazard are combined using a GIS union operation and then each exposure within these areas is counted to arrive at a total number, length or area of exposure features per aggregation area. These processes are defined in more detail below. After the primary GIS processing has been carried out, one or more post-processors are applied to the resulting datasets in order to compute statistics like the breakdown of buildings or the area of each land use type in the affected areas.

The final part of the analysis process is report generation whereby InaSAFE generates various tables and cartographic products to represent the result summaries. InaSAFE will also create a number of spatial and non-spatial products which you can use to generate your own reports - for example by importing the data into a spreadsheet and further analysing it there.

Simplified overview of the InaSAFE analysis workflow



5.2. Progress reporting steps

5.2.1. Analysis initialisation

In this phase we clear the impact function state and work logs.

5.2.2. Data store creation

In this phase we create a data store. The data store is a folder or GeoPackage containing all of the working data used for and produced by this analysis.

5.2.3. Pre processing

During this step we check if we can create some side products based on your inputs.

5.2.4. Hazard preparation

During the hazard preparation phase of the analysis, we convert the hazard data to a classified vector layer if it is not already in this format.

5.2.5. Exposure preparation

During the exposure preparation phase of the analysis, we convert the exposure data to a usable format for the analysis.

5.2.6. Aggregation preparation

During this step we prepare the aggregation data, extracting only the selected polygons from the aggregation layer, and reprojecting to aggregation data to the exposure layer's coordinate reference system.

5.2.7. Aggregate hazard preparation

In this step we union the hazard data and the aggregation data then remove any of the resulting polygons that do not intersect the aggregation areas. Each resulting polygon stores the id and class of the hazard and the id and name from the aggregation area.

5.2.8. Combine aggregate hazard and exposure

In this step we combine the aggregate hazard and exposure layers to produce an intermediate impact layer where each exposure feature has been assigned an aggregation id and name, hazard id and class and a column indicating whether the exposed feature is affected or not.

5.2.9. Post processing

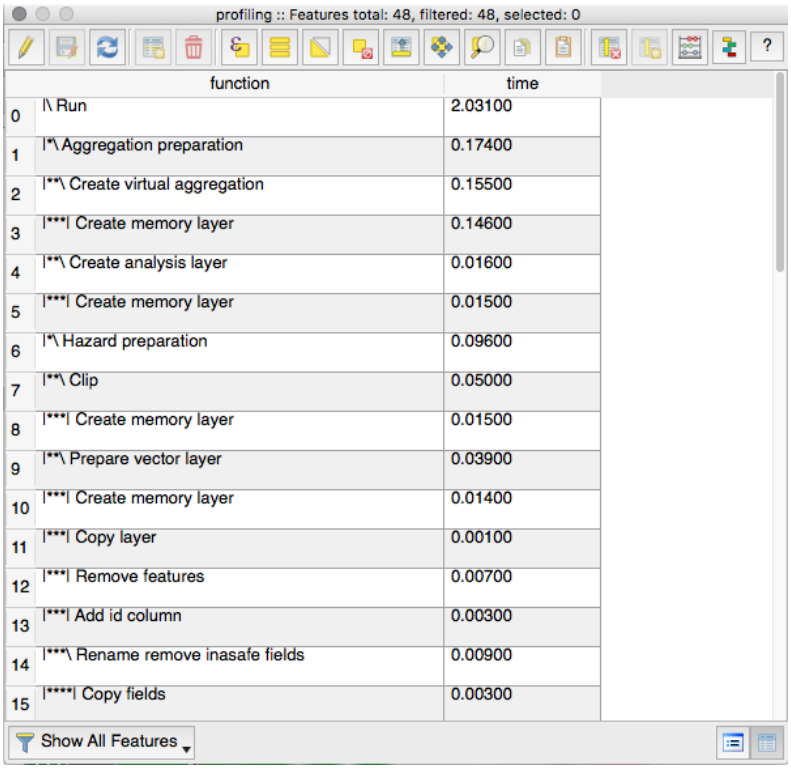
During this step we analyse each exposure feature to determine additional vulnerability attributes such as gender breakdown age breakdown, minimum needs and so on. This additional information is written into the impact layers.

5.2.10. Summary calculation

At the end of the analysis we summarise the analysis results by aggregate hazard areas, aggregation areas and the total analysis area.

5.2.11. Profiling

At the end of the analysis we extract profiling data so that we can provide a detailed work log and also help you to identify any bottlenecks in the processing flow.



	function	time
0	I\ Run	2.03100
1	I*\ Aggregation preparation	0.17400
2	I**\ Create virtual aggregation	0.15500
3	I***I Create memory layer	0.14600
4	I**\ Create analysis layer	0.01600
5	I***I Create memory layer	0.01500
6	I*\ Hazard preparation	0.09600
7	I**\ Clip	0.05000
8	I***I Create memory layer	0.01500
9	I**\ Prepare vector layer	0.03900
10	I***I Create memory layer	0.01400
11	I***I Copy layer	0.00100
12	I***I Remove features	0.00700
13	I***I Add id column	0.00300
14	I***\ Rename remove inasafe fields	0.00900
15	I****I Copy fields	0.00300

6. Hazard Concepts

6.1. Scenario

This describes the type of hazard scenario that is represented by the layer. There are two possible values for this attribute, single event and multiple event.

6.1.1. Single event

Single event hazard data can be based on either a specific event that has happened in the past, for example a flood like Jakarta 2013, or a possible event, such as the tsunami that results from an earthquake near Bima, that might happen in the future.

6.1.2. Multiple event

Multiple event hazard data can be based on historical observations such as a hazard map of all observed volcanic deposits around a volcano.

This type of hazard data shows those locations that might be impacted by a volcanic eruption in the future. Another example might be a probabilistic hazard model that shows the likelihood of a magnitude 7 earthquake happening in the next 50 years.

6.2. Hazards

A **hazard** represents a natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. For example; flood, earthquake, tsunami and volcano are all examples of hazards.

Citations:

- UNISDR (2009) Terminology on disaster risk reduction.

6.2.1. Flood

A **flood** describes the inundation of land that is normally dry by a large amount of water. For example: A **flood** can occur after heavy rainfall, when a river overflows its banks or when a dam breaks. The effect of a **flood** is for land that is normally dry to become wet.

6.2.1.1. Notes:

6.2.1.1.1. General notes:

- The extent and severity of the mapped scenario or hazard zones may not be consistent with future events.
- The impacts on roads, people, buildings and other exposure elements may differ from the analysis results due to local conditions such as terrain and infrastructure type.
- The analysis extent is limited to the extent of the aggregation layer or analysis extent. Hazard and exposure data outside the analysis extent are not included in the impact layer, impact map or impact reports.

6.2.1.1.2. Notes for continuous datasets:

6.2.1.1.3. Notes for classified datasets:

6.2.1.2. Notes for single events

No single event notes defined.

6.2.1.3. Notes for multi events / scenarios:

No multi-event notes defined.

Actions:

Units:

Name	Plural	Abbreviation	Details
Feet	feet	ft	**Feet** are an imperial unit of measure. There are 12 inches in 1 foot and 3 feet in 1 yard.
Metres	metres	m	**Metres** are a metric unit of measure. There are 100 centimetres in 1 metre.
Generic	generic	generic	A generic unit for value that does not have unit or we do not know about the unit. It also can be used for normalised values.

Fields:

Name	Field Name	Type	Length	Precision
Hazard ID	hazard_id	Whole number	0	

An ID attribute in the hazard layer. A unique identifier for each hazard feature. If you provide this we will persist these identifiers in the output datasets so that you can do a table join back to the original hazard layer if needed.

6.2.1.4. Hazard classifications

A hazard classification is used to define a range of severity thresholds (classes) for a hazard layer. The classification will be used to create zones of data that each present a similar hazard level. During the analysis, each exposure feature will be assessed to determine which hazard class it coincides with, and then a determination will be made as to whether and how the exposure feature is likely to be impacted by the hazard.

6.2.2. Flood wet/dry classes

This is a binary classification for an area. The area is either **wet** (affected by flood water) or **dry** (not affected by flood water). This unit does not describe how **wet** or **dry** an area is.

Classes:

Name	Affected	Fatality rate	Displacement rate	Default values	Default min	Default max
Wet	True	unspecified	1%	wet,1,YES,y,true	1	9999
Water is present above ground height.						
Dry	False	unspecified	0%	dry,0,No,n,false	0	1
No water encountered above ground height.						
Not exposed						

6.2.3. Flood classes

This is a flood classification for an area. The area is broken down into a number of flood classes of increasing severity based on the water depth.

Citations:

- PetaBencana.id

Classes:

Name	Affected	Fatality rate	Displacement rate	Default values	Default min	Default max
High	True	unspecified	5%	high,severe	1.5	9999
Flooding is over 150 centimetres.						
Medium	True	unspecified	3%	medium,moderate	0.7	1.5

Flooding between 71 and 150 centimetres.						
Low	True	unspecified	1%	low,minor	0.1	0.7
Flooding of between 10 and 70 centimetres.						
Use caution	False	unspecified	0%	caution,unknown	0	0.1
An unknown level of flooding - use caution -						
Not exposed						

6.2.4. Generic classes

A generic hazard is any dataset where the areas within the data set have been classified as either **low**, **medium**, or **high** hazard level. Use generic hazard in cases where InaSAFE does not have an existing hazard concept for the data you are using.

Classes:

Name	Affected	Fatality rate	Displacement rate	Default values	Default min	Default max
High	True	unspecified	100%	high	3	4
The area with the highest hazard.						
Medium	True	unspecified	100%	medium	2	3
The area with the medium hazard.						
Low	False	unspecified	0%	low	0	2
The area with the lowest hazard.						
Not exposed						

6.2.5. Tsunami

A **tsunami** describes a large ocean wave or series or waves usually caused by an underwater earthquake or volcano. A **tsunami** at sea may go unnoticed but a **tsunami** wave that strikes land may cause massive destruction and flooding.

6.2.5.1. Notes:

6.2.5.1.1. General notes:

- The extent and severity of the mapped scenario or hazard zones may not be consistent with future events.
- The impacts on roads, people, buildings and other exposure elements may differ from the analysis results due to local conditions such as terrain and infrastructure type.
- The analysis extent is limited to the extent of the aggregation layer or analysis extent. Hazard and exposure data outside the analysis extent are not included in the impact layer, impact map or impact reports.

6.2.5.1.2. Notes for continuous datasets:

6.2.5.1.3. Notes for classified datasets:

6.2.5.2. Notes for single events

- Tsunami hazard scenarios estimate the maximum extent of tsunami waves on land.

6.2.5.3. Notes for multi events / scenarios:

No multi-event notes defined.

Actions:

Units:

Name	Plural	Abbreviation	Details
Feet	feet	ft	**Feet** are an imperial unit of measure. There are 12 inches in 1 foot and 3 feet in 1 yard.
Metres	metres	m	**Metres** are a metric unit of measure. There are 100 centimetres in 1 metre.

Fields:

Name	Field Name	Type	Length	Precision
Hazard ID	hazard_id	Whole number	0	

An ID attribute in the hazard layer. A unique identifier for each hazard feature. If you provide this we will persist these identifiers in the output datasets so that you can do a table join back to the original hazard layer if needed.

6.2.5.4. Hazard classifications

A hazard classification is used to define a range of severity thresholds (classes) for a hazard layer. The classification will be used to create zones of data that each present a similar hazard level. During the analysis, each exposure feature will be assessed to determine which hazard class it coincides with, and then a determination will be made as to whether and how the exposure feature is likely to be impacted by the hazard.

6.2.6. Tsunami classes

Tsunami hazards can be classified into one of four classes for an area. The area is either **dry**, **low**, **medium**, or **high**, for tsunami hazard classification. The following description for these classes is provided by Badan Geologi based on BNPB Perka 2/2012

Citations:

- BNPB Perka 2/2012

Classes:

Name	Affected	Fatality rate	Displacement rate	Default values	Default min	Default max
High	True	unspecified	100%	high	3	9999
The area is potentially hit by a tsunami wave with an inundation depth > 3 m or reach a tsunami intensity scale of VII or more (Papadopoulos and Imamura, 2001). Tsunami wave with 4 m inundation depth cause damage to small vessel, a few ships are drifted inland, severe damage on most wooden houses. Boulders are deposited on shore. If tsunami height reaches 8 m, it will cause severe damage. Dykes, wave breaker, tsunami protection walls and green belts will be washed away.						
Medium	True	unspecified	100%	medium	1	3
Water above 1.1m and less than 3.0m. The area is potentially hit by a tsunami wave with an inundation depth of 1 – 3 m or equal to V–VI tsunami intensity scale (Papadopoulos and Imamura, 2001). Tsunami wave with a 3m inundation depth causes most people frightened and to flee to higher ground. Small vessels drift and collide. Damage occurs to some wooden houses, while most of them are safe.						
Low	False	unspecified	0%	low	0.1	1
Water above ground height and less than 1.0m. The area is potentially hit by a tsunami wave with an inundation depth less than 1 m or similar to tsunami intensity scale of V or less in (Papadopoulos and Imamura, 2001). Tsunami wave of 1m height causes few people to be frightened and flee to higher elevation. Felt by most people on large ship, observed from shore. Small vessels drift and collide and some turn over. Sand is deposited and there is flooding of areas close to the shore.						
Dry	False	unspecified	0%	dry	0	0.1
No water above ground height.						
Not exposed						

6.2.7. Tsunami population classes

Tsunami hazards can be classified into one of three classes for an area. The area is either **low**, **medium**, or **high**, for tsunami hazard classification. The following description for these classes is provided by Badan Geologi based on BNPB Perka 2/2012, and modified for population by Pak Hamza

Citations:

- BNPB Perka 2/2012

Classes:

Name	Affected	Fatality rate	Displacement rate	Default values	Default min	Default max
High	True	unspecified	100%	high	3	9999
The area is potentially hit by a tsunami wave with an inundation depth > 3 m or reach a tsunami intensity scale of VII or more (Papadopoulos and Imamura, 2001). Tsunami wave with 4 m inundation depth cause damage to small vessel, a few ships are drifted inland, severe damage on most wooden houses. Boulders are deposited on shore. If tsunami height reaches 8 m, it will cause severe damage. Dykes, wave breaker, tsunami protection walls and green belts will be washed away.						
Medium	True	unspecified	100%	medium	0.7	3
Water above 0.7m and less than 3.0m. The area is potentially hit by a tsunami wave with an inundation depth of 1 – 3 m or equal to V–VI tsunami intensity scale (Papadopoulos and Imamura, 2001). Tsunami wave with a 3m inundation depth causes most people frightened and to flee to higher ground. Small vessels drift and collide. Damage occurs to some wooden houses, while most of them are safe.						
Low	True	unspecified	0%	low	0.1	0.7
Water above ground height and less than 1.0m. The area is potentially hit by a tsunami wave with an inundation depth less than 1 m or similar to tsunami intensity scale of V or less in (Papadopoulos and Imamura, 2001). Tsunami wave of 1m height causes few people to be frightened and flee to higher elevation. Felt by most people on large ship, observed from shore. Small vessels drift and collide and some turn over. Sand is deposited and there is flooding of areas close to the shore.						
Not exposed						

6.2.8. Tsunami classes ITB

Tsunami hazards can be classified into one of five classes for an area. The area is either **dry**, **low**, **medium**, **high**, or **very high** for tsunami hazard classification. The following description for these classes is provided by Pak Hamza ITB based on Papadopoulos and Imamura, 2001.

Citations:

- Papadopoulos and Imamura, 2001

Classes:

Name	Affected	Fatality rate	Displacement rate	Default values	Default min	Default max
Very high	True	unspecified	100%	very high	8	9999
Water above 8.0m.						
High	True	unspecified	100%	high	3	8
Water above 3.1m and less than 8.0m. The area is potentially hit by a tsunami wave with an inundation depth > 3 m or reach a tsunami intensity scale of VII or even more (Papadopoulos and Imamura, 2001). Tsunami wave with 4 m inundation depth cause damage to small vessel, a few ships are drifted inland, severe damage on most wooden houses. Boulders are deposited on shore. If tsunami height reaches 8 m, it will cause severe damage. Dykes, wave breaker, tsunami protection walls and green belts will be washed away.						

Medium	True	unspecified	100%	medium	1	3
Water above 1.1m and less than 3.0m. The area is potentially hit by a tsunami wave with an inundation depth of 1 - 3 m or equal to V-VI tsunami intensity scale (Papadopoulos and Imamura, 2001). Tsunami wave with a 3m inundation depth causes most people frightened and to flee to higher ground. Small vessels drift and collide. Damage occurs to some wooden houses, while most of them are safe.						
Low	False	unspecified	0%	low	0.1	1
Water above ground height and less than 1.0m. The area is potentially hit by a tsunami wave with an inundation depth less than 1 m or similar to tsunami intensity scale of V or less in (Papadopoulos and Imamura, 2001). Tsunami wave of 1m height causes few people to be frightened and flee to higher elevation. Felt by most people on large ship, observed from shore. Small vessels drift and collide and some turn over. Sand is deposited and there is flooding of areas close to the shore.						
Dry zone	False	unspecified	0%	dry	0	0.1
No water above ground height.						
Not exposed						

6.2.9. Tsunami population classes ITB

Tsunami hazards can be classified into one of five classes for an area. The area is either **dry**, **low**, **medium**, **high**, or **very high** for tsunami hazard classification. The following description for these classes is provided by Pak Hamza ITB based on Papadopoulos and Imamura, 2001.

Citations:

- Papadopoulos and Imamura, 2001

Classes:

Name	Affected	Fatality rate	Displacement rate	Default values	Default min	Default max
Very high	True	unspecified	100%	very high	8	9999
Water above 8.0m.						
High	True	unspecified	100%	high	3	8
Water above 3.1m and less than 8.0m. The area is potentially hit by a tsunami wave with an inundation depth > 3 m or reach a tsunami intensity scale of VII or even more (Papadopoulos and Imamura, 2001). Tsunami wave with 4 m inundation depth cause damage to small vessel, a few ships are drifted inland, severe damage on most wooden houses. Boulders are deposited on shore. If tsunami height reaches 8 m, it will cause severe damage. Dykes, wave breaker, tsunami protection walls and green belts will be washed away.						
Medium	True	unspecified	100%	medium	0.7	3
Water above 1.1m and less than 3.0m. The area is potentially hit by a tsunami wave with an inundation depth of 1 - 3 m or equal to V-VI tsunami intensity scale (Papadopoulos and Imamura, 2001). Tsunami wave with a 3m inundation depth causes most people frightened and to flee to higher ground. Small vessels drift and collide. Damage occurs to some wooden houses, while most of them are safe.						
Low	True	unspecified	0%	low	0.1	0.7
Water above ground height and less than 1.0m. The area is potentially hit by a tsunami wave with an inundation depth less than 1 m or similar to tsunami intensity scale of V or less in (Papadopoulos and Imamura, 2001). Tsunami wave of 1m height causes few people to be frightened and flee to higher elevation. Felt by most people on large ship, observed from shore. Small vessels drift and collide and some turn over. Sand is deposited and there is flooding of areas close to the shore.						
Not exposed						

6.2.10. Earthquake

An **earthquake** describes the sudden violent shaking of the ground that occurs as a result of volcanic activity or movement in the earth's crust.

6.2.10.1. Notes:

6.2.10.1.1. General notes:

- The extent and severity of the mapped scenario or hazard zones may not be consistent with future events.
- The impacts on roads, people, buildings and other exposure elements may differ from the analysis results due to local conditions such as terrain and infrastructure type.
- The analysis extent is limited to the extent of the aggregation layer or analysis extent. Hazard and exposure data outside the analysis extent are not included in the impact layer, impact map or impact reports.

The following earthquake fatality models are available in InaSAFE. Note that you need to set one of these as the active model in InaSAFE Options. The currently active model is: **ITB fatality model**

6.2.10.1.2. ITB bayesian fatality model

ITB fatality model based on a Bayesian approach. This model was developed by Institut Teknologi Bandung (ITB) and implemented by Dr. Hyeuk Ryu, Geoscience Australia.

The ITB bayesian fatality model, from Institut Teknologi Bandung 2012, is based on the ITB fatality model and uses Indonesian fatality data

Citations:

- An Empirical Fatality Model for Indonesia Based on a Bayesian Approach by W. Sengara, M. Suarjana, M.A. Yulman, H. Ghasemi, and H. Ryu. submitted for Journal of the Geological Society.

6.2.10.1.3. ITB fatality model

ITB fatality model is modified from the USGS Pager model. This model was developed by Institut Teknologi Bandung (ITB) and implemented by Dr. Hadi Ghasemi, Geoscience Australia.

Algorithm:

In this study, the same functional form as Allen (2009) is adopted to express fatality rate as a function of intensity (see Eq. 10 in the report). The Matlab built-in function (fminsearch) for Nelder-Mead algorithm was used to estimate the model parameters. The objective function (L2G norm) that is minimised during the optimisation is the same as the one used by Jaiswal et al. (2010).

The coefficients used in the indonesian model are x=0.62275231, y=8.03314466, zeta=2.15

Caveats and limitations:

The current model is the result of the above mentioned workshop and reflects the best available information. However, the current model has a number of issues listed below and is expected to evolve further over time.

1 - The model is based on limited number of observed fatality rates during 4 past fatal events.

2 - The model clearly over-predicts the fatality rates at intensities higher than VIII.

3 - The model only estimates the expected fatality rate for a given intensity level; however the associated uncertainty for the proposed model is not addressed.

4 - There are few known mistakes in developing the current model:

- rounding MMI values to the nearest 0.5,

- Implementing Finite-Fault models of candidate events, and

- consistency between selected GMPEs with those in use by

Note: Because of these caveats, decisions should not be made solely on the information presented here and should always be verified by ground truthing and other reliable information sources.

Citations:

- Indonesian Earthquake Building-Damage and Fatality Models and Post Disaster Survey Guidelines Development, Bali, 27-28 February 2012, 54pp.,
- Allen, T. I., Wald, D. J., Earle, P. S., Marano, K. D., Hotovec, A. J., Lin, K., and Hearne, M., 2009. An Atlas of ShakeMaps and population exposure catalog for earthquake loss modeling, Bull. Earthq. Eng. 7, 701-718. Jaiswal, K., and Wald, D., 2010. An empirical model for global earthquake fatality estimation, Earthq. Spectra 26, 1017-1037.

6.2.10.1.4. Pager fatality model

USGS Pager fatality estimation model. This model was developed by Institut Teknologi Bandung (ITB) and implemented by Dr. Hyeuk Ryu, Geoscience Australia.

The USGS Population Vulnerability Pager fatality model using Indonesian country coefficients.

Citations:

- Jaiswal, K. S., Wald, D. J., and Hearne, M. (2009a). Estimating casualties for large worldwide earthquakes using an empirical approach. U.S. Geological Survey Open-File Report 2009-1136.

6.2.10.1.5. Notes for exposure : Population

- Map shows the estimated displaced population. People are displaced if they experience and survive a shake level of more than V on the MMI scale.
- Exposed population varies by the time (day or night, weekends, holidays etc.). Such variations are not considered in the estimates in the InaSAFE.
- The fatality calculation assumes that no fatalities occur for shake levels of less than or equal to V on the MMI scale.
- Estimated fatality counts are reported as ranges. The following ranges are used: 0 - 100, 100 - 1,000, 1,000 - 10,000, 10,000 - 100,000.
- Earthquake fatalities are due to a number of factors, such as destructive level of ground shaking, tsunami, landsliding and fire. The implemented fatality models only consider the number of fatalities due to the earthquake ground shaking and do not include losses due to the other secondary hazards.
- The fatality models do not estimate number of injuries or displaced people.
- Empirical fatality models provide an estimate of the number of fatalities. There are several sources of uncertainty contributing to the overall uncertainty of any estimate, such as uncertainties in shaking intensity, and population estimates.
- Care should be taken when applying empirical earthquake fatality models for ground-motion estimation methods that are inconsistent with the methods used to calibrate the model.

6.2.10.1.6. Notes for continuous datasets:

6.2.10.1.7. Notes for classified datasets:

6.2.10.2. Notes for single events

No single event notes defined.

6.2.10.3. Notes for multi events / scenarios:

No multi-event notes defined.

Actions:

Units:

Name	Plural	Abbreviation	Details
MMI	MMI	MMI	The **Modified Mercalli Intensity (MMI)** scale describes the intensity of ground shaking from a earthquake based on the effects observed by people at the surface.
Generic	generic	generic	A generic unit for value that does not have unit or we do not know about the unit. It also can be used for normalised values.

Fields:

Name	Field Name	Type	Length	Precision
Hazard ID	hazard_id	Whole number	0	

An ID attribute in the hazard layer. A unique identifier for each hazard feature. If you provide this we will persist these identifiers in the output datasets so that you can do a table join back to the original hazard layer if needed.

6.2.10.4. Hazard classifications

A hazard classification is used to define a range of severity thresholds (classes) for a hazard layer. The classification will be used to create zones of data that each present a similar hazard level. During the analysis, each exposure feature will be assessed to determine which hazard class it coincides with, and then a determination will be made as to whether and how the exposure feature is likely to be impacted by the hazard.

6.2.11. Generic classes

A generic hazard is any dataset where the areas within the data set have been classified as either **low**, **medium**, or **high** hazard level. Use generic hazard in cases where InaSAFE does not have an existing hazard concept for the data you are using.

Classes:

Name	Affected	Fatality rate	Displacement rate	Default values	Default min	Default max
High	True	unspecified	100%	high	3	4
The area with the highest hazard.						
Medium	True	unspecified	100%	medium	2	3
The area with the medium hazard.						
Low	False	unspecified	0%	low	0	2
The area with the lowest hazard.						
Not exposed						

6.2.12. Earthquake MMI scale

This scale, composed of increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It does not have a mathematical basis; instead it is an arbitrary ranking based on observed effects. Note that fatality rates listed here are based on the active earthquake fatality model (currently set to ITB fatality model). Users can select the active earthquake fatality model in InaSAFE Options.

Classes:

Name	Affected	Fatality rate	Displacement rate	Default values	Default min	Default max
X	True	1.565%	100%	extreme	9.5	10.5

	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.					
IX	True	0.373%	100%	violent	8.5	9.5
	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.					
VIII	True	0.089%	100%	severe	7.5	8.5
	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.					
VII	True	0.021%	100%	very strong	6.5	7.5
	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.					
VI	True	0.005%	100%	strong	5.5	6.5
	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.					
V	True	0.001%	0%	moderate	4.5	5.5
	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.					
IV	True	$2.87x10^{-04}$%	0%	light	3.5	4.5
	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.					
III	True	0%	0%	weak	2.5	3.5
	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.					
II	True	0%	0%	None or Null found from the data.	1.5	2.5
	Felt only by a few persons at rest, especially on upper floors of buildings.					
I	False	unspecified	0%	not felt	0.5	1.5
	Not felt except by a very few under especially favorable conditions.					
	Not exposed					

6.2.13. Volcano

A **volcano** describes a mountain which has a vent through which rock fragments, ash, lava, steam and gases can be ejected from below the earth's surface. The type of material ejected depends on the type of **volcano**.

6.2.13.1. Notes:

6.2.13.1.1. General notes:

- The extent and severity of the mapped scenario or hazard zones may not be consistent with future events.
- The impacts on roads, people, buildings and other exposure elements may differ from the analysis results due to local conditions such as terrain and infrastructure type.
- The analysis extent is limited to the extent of the aggregation layer or analysis extent. Hazard and exposure data outside the analysis

extent are not included in the impact layer, impact map or impact reports.

6.2.13.1.2. Notes for continuous datasets:

6.2.13.1.3. Notes for classified datasets:

6.2.13.2. Notes for single events

No single event notes defined.

6.2.13.3. Notes for multi events / scenarios:

No multi-event notes defined.

Actions:

Units:

Name	Plural	Abbreviation	Details

Fields:

Name	Field Name	Type	Length	Precision
Hazard ID	hazard_id	Whole number	0	
An ID attribute in the hazard layer. A unique identifier for each hazard feature. If you provide this we will persist these identifiers in the output datasets so that you can do a table join back to the original hazard layer if needed.				
Hazard Name	hazard_name	Text	0	
A NAME attribute in the hazard layer. This will be carried over to the impact layer if provided. The name can be useful in some cases e.g. where hazard is a known entity such as a volcano, the name can be used to label the place names.				

6.2.13.4. Hazard classifications

A hazard classification is used to define a range of severity thresholds (classes) for a hazard layer. The classification will be used to create zones of data that each present a similar hazard level. During the analysis, each exposure feature will be assessed to determine which hazard class it coincides with, and then a determination will be made as to whether and how the exposure feature is likely to be impacted by the hazard.

6.2.14. Volcano classes

Three classes are supported for volcano vector hazard data: **low**, **medium**, or **high**.

Classes:

Name	Affected	Fatality rate	Displacement rate	Default values	Default min	Default max
High	True	unspecified	100%	Kawasan Rawan Bencana III,high	0	3
The highest hazard class.						
Medium	True	unspecified	100%	Kawasan Rawan Bencana II,medium	3	5
The medium hazard class.						
Low	False	unspecified	0%	Kawasan Rawan Bencana I,low	5	10
The lowest hazard class.						

Not exposed

6.2.15. Generic classes

A generic hazard is any dataset where the areas within the data set have been classified as either **low**, **medium**, or **high** hazard level. Use generic hazard in cases where InaSAFE does not have an existing hazard concept for the data you are using.

Classes:

Name	Affected	Fatality rate	Displacement rate	Default values	Default min	Default max
High	True	unspecified	100%	high	3	4
The area with the highest hazard.						
Medium	True	unspecified	100%	medium	2	3
The area with the medium hazard.						
Low	False	unspecified	0%	low	0	2
The area with the lowest hazard.						
Not exposed						

6.2.16. Volcanic ash

Volcanic ash describes fragments of pulverized rock, minerals and volcanic glass, ejected into the atmosphere during volcanic eruptions.

6.2.16.1. Notes:

6.2.16.1.1. General notes:

- The extent and severity of the mapped scenario or hazard zones may not be consistent with future events.
- The impacts on roads, people, buildings and other exposure elements may differ from the analysis results due to local conditions such as terrain and infrastructure type.
- The analysis extent is limited to the extent of the aggregation layer or analysis extent. Hazard and exposure data outside the analysis extent are not included in the impact layer, impact map or impact reports.

6.2.16.1.2. Notes for continuous datasets:

6.2.16.1.3. Notes for classified datasets:

6.2.16.2. Notes for single events

- Volcanic ash is modelled hazard data estimating the thickness of ash on the ground following a volcanic eruption.

6.2.16.3. Notes for multi events / scenarios:

No multi-event notes defined.

Actions:

- What action can be taken to secure water supplies and protect crops?

6.2.16.3.1. Actions for exposure : Population

- Do you have enough masks for people in the affected area?

Units:

Name	Plural	Abbreviation	Details

Centimetres	centimetres	cm	**Centimetres** are a metric unit of measure. There are 100 centimetres in 1 metre.

Fields:

Name	Field Name	Type	Length	Precision
Hazard ID	hazard_id	Whole number	0	

An ID attribute in the hazard layer. A unique identifier for each hazard feature. If you provide this we will persist these identifiers in the output datasets so that you can do a table join back to the original hazard layer if needed.

6.2.16.4. Hazard classifications

A hazard classification is used to define a range of severity thresholds (classes) for a hazard layer. The classification will be used to create zones of data that each present a similar hazard level. During the analysis, each exposure feature will be assessed to determine which hazard class it coincides with, and then a determination will be made as to whether and how the exposure feature is likely to be impacted by the hazard.

6.2.17. Ash classes

Five classes are supported for volcanic ash hazard data: **very low**, **low**, **medium**, **high** or **very high**.

Classes:

Name	Affected	Fatality rate	Displacement rate	Default values	Default min	Default max
Very high	True	unspecified	100%	very high	10	9999
Dry loading on buildings causing structural collapse.						
High	True	unspecified	100%	high	5	10
Dry loading on buildings causing structural damage but not collapse; wet loading on buildings (i.e. ash loading + heavy rainfall) causing structural collapse.						
Medium	True	unspecified	0%	medium	2	5
Damage to less vulnerable agricultural crops (e.g. tea plantations) and destruction of more vulnerable crops; destruction of critical infrastructure; cosmetic (non-structural) damage to buildings						
Low	True	unspecified	0%	low	0.1	2
Damage to transportation routes (e.g. airports, roads, railways); damage to critical infrastructure (e.g. electricity supply); damage to more vulnerable agricultural crops (e.g. rice fields)						
Very low	True	unspecified	0%	very low	0.01	0.1
Impact on health (respiration), livestock, and contamination of water supply.						
Not exposed						

6.2.18. Generic classes

A generic hazard is any dataset where the areas within the data set have been classified as either **low**, **medium**, or **high** hazard level. Use generic hazard in cases where InaSAFE does not have an existing hazard concept for the data you are using.

Classes:

Name	Affected	Fatality rate	Displacement rate	Default values	Default min	Default max
High	True	unspecified	100%	high	3	4

The area with the highest hazard.						
Medium	True	unspecified	100%	medium	2	3
The area with the medium hazard.						
Low	False	unspecified	0%	low	0	2
The area with the lowest hazard.						
Not exposed						

6.2.19. Cyclone

A **Tropical Cyclone** is a rapidly rotating storm system characterised by a low-pressure centre, a closed low-level atmospheric circulation, strong winds, and a spiral arrangement of thunderstorms that produce heavy rain. It is also referred to as **hurricane** in the Atlantic Ocean or **typhoon** in the North West Pacific Ocean.

6.2.19.1. Notes:

6.2.19.1.1. General notes:

- The analysis performed here only considers the impact of **severe winds** from tropical cyclones. The impact of other associated hazards (storm surge inundation, flood) must be analysed separately.
- The extent and severity of the mapped scenario or hazard zones may not be consistent with future events.
- The impacts on roads, people, buildings and other exposure elements may differ from the analysis results due to local conditions such as terrain and infrastructure type.
- The analysis extent is limited to the extent of the aggregation layer or analysis extent. Hazard and exposure data outside the analysis extent are not included in the impact layer, impact map or impact reports.

6.2.19.1.2. Notes for continuous datasets:

- Continuous data are normally used to represent the gust wind speed of the cyclone, representing the 10-m above ground wind speed.

6.2.19.1.3. Notes for classified datasets:

- Classified cyclone hazard data is not presently supported.

6.2.19.2. Notes for single events

No single event notes defined.

6.2.19.3. Notes for multi events / scenarios:

No multi-event notes defined.

Actions:

Units:

Name	Plural	Abbreviation	Details
mph	mph	mph	**The mile per hour** is a unit of speed, expressing the number of statute miles covered in one hour.
km/h	km/h	km/h	**The kilometre per hour** is a unit of speed, expressing the number of kilometres covered in one hour.
kn	kn	kn	**The knot** is a unit of speed, expressing the number of nautical miles covered in one hour.
m/s	m/s	m/s	**The Metres per second** is a unit of speed, expressing the number of metres covered in one second.

Fields:

Name	Field Name	Type	Length	Precision
Hazard ID	hazard_id	Whole number	0	

An ID attribute in the hazard layer. A unique identifier for each hazard feature. If you provide this we will persist these identifiers in the output datasets so that you can do a table join back to the original hazard layer if needed.

6.2.19.4. Hazard classifications

A hazard classification is used to define a range of severity thresholds (classes) for a hazard layer. The classification will be used to create zones of data that each present a similar hazard level. During the analysis, each exposure feature will be assessed to determine which hazard class it coincides with, and then a determination will be made as to whether and how the exposure feature is likely to be impacted by the hazard.

6.2.20. Cyclone classes (AU - BOM)

Tropical cyclone intensity is classified using five classes according to the Australian Bureau of Meteorology. Tropical Cyclone intensity is defined as the maximum mean wind speed over open flat land or water, averaged over a 10-minute period. This is sometimes referred to as the maximum sustained wind and will be experienced around the eye-wall of the cyclone.

Citations:

- Australian Bureau of Meteorology - Tropical Cyclone Intensity and Impacts
- Tropical cyclone scales - wikpedia

Classes:

Name	Affected	Fatality rate	Displacement rate	Default values	Default min	Default max
Category 5 (severe tropical cyclone)	True	unspecified	100%	cat 5,category 5	∘ kilometres_per_hour : 283 ∘ knots : 153 ∘ metres_per_second : 79 ∘ miles_per_hour : 176	9999
Extremely dangerous with widespread destruction. A Category 5 cyclone's strongest winds are VERY DESTRUCTIVE winds with typical gusts over open flat land of more than 151 kt.						
Category 4 (severe tropical cyclone)	True	unspecified	97%	cat 4,category 4	∘ kilometres_per_hour : 224 ∘ knots : 121 ∘ metres_per_second : 63 ∘ miles_per_hour : 140	∘ kilometres_per_hour : 283 ∘ knots : 153 ∘ metres_per_second : 79 ∘ miles_per_hour : 176
Significant roofing loss and structural damage. Many caravans destroyed and blown away. Dangerous airborne debris . Widespread power failures. A Category 4 cyclone's strongest winds are VERY DESTRUCTIVE winds with typical gusts over open flat land of 122 - 151 kt.						
Category 3 (severe tropical cyclone)	True	unspecified	55%	cat 3,category 3	∘ kilometres_per_hour : 167 ∘ knots : 90 ∘ metres_per_second : 47 ∘ miles_per_hour : 103	∘ kilometres_per_hour : 224 ∘ knots : 121 ∘ metres_per_second : 63 ∘ miles_per_hour : 140

				Some roof and structural damage. Some caravans destroyed. Power failures likely. A Category 3 cyclone's strongest winds are VERY DESTRUCTIVE winds with typical gusts over open flat land of 90 – 121 kt.		
Category 2 (tropical cyclone)	True	unspecified	6%	cat 2,category 2	∘ kilometres_per_hour : 126 ∘ knots : 67 ∘ metres_per_second : 34 ∘ miles_per_hour : 77	∘ kilometres_per_hour : 167 ∘ knots : 90 ∘ metres_per_second : 47 ∘ miles_per_hour : 103
				Minor house damage. Significant damage to signs, trees and caravans. Heavy damage to some crops. Risk of power failure. Small craft may break moorings. A Category 2 cyclone's strongest winds are DESTRUCTIVE winds with typical gusts over open flat land of 68 – 89 kt.		
Category 1 (tropical cyclone)	True	unspecified	0%	cat 1,category 1	∘ kilometres_per_hour : 90 ∘ knots : 49 ∘ metres_per_second : 24 ∘ miles_per_hour : 56	∘ kilometres_per_hour : 126 ∘ knots : 67 ∘ metres_per_second : 34 ∘ miles_per_hour : 77
				Negligible house damage. Damage to some crops, trees and caravans. Craft may drag moorings. A Category 1 cyclone's strongest winds are GALES with typical gusts over open flat land of 49 – 67 kt.		
Tropical Depression	False	unspecified	0%	tropical depression,no,false	0	∘ kilometres_per_hour : 90 ∘ knots : 49 ∘ metres_per_second : 24 ∘ miles_per_hour : 56
				A tropical depression is a tropical disturbance, that has a clearly defined surface circulation, which has maximum sustained winds of less than 34 kt.		
				Not exposed		

6.2.21. Hurricane classes (SSHWS)

The **Saffir–Simpson Hurricane Wind Scale** is a 1 to 5 rating based on a hurricane's sustained wind speed, measured over a 1-minute period. This scale estimates potential property damage. Hurricanes reaching Category 3 and higher are considered major hurricanes because of their potential for significant loss of life and damage. Category 1 and 2 storms are still dangerous, however, and require preventative measures. In the western North Pacific, the term "super typhoon" is used for tropical cyclones with sustained winds exceeding 150 mph.

Citations:

- NOAA - NHC
- Saffir–Simpson scale - wikipedia

Classes:

Name	Affected	Fatality rate	Displacement rate	Default values	Default min	Default max

Category 5 (major hurricane)	True	unspecified	100%	cat 5,category 5	∘ kilometres_per_hour : 337 ∘ knots : 183 ∘ metres_per_second : 94 ∘ miles_per_hour : 210	9999

Catastrophic damage will occur: A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Category 4 (major hurricane)	True	unspecified	99%	cat 4,category 4	∘ kilometres_per_hour : 279 ∘ knots : 151 ∘ metres_per_second : 77 ∘ miles_per_hour : 174	∘ kilometres_per_hour : 337 ∘ knots : 183 ∘ metres_per_second : 94 ∘ miles_per_hour : 210

Catastrophic damage will occur: Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Category 3 (major hurricane)	True	unspecified	90%	cat 3,category 3	∘ kilometres_per_hour : 238 ∘ knots : 128 ∘ metres_per_second : 65 ∘ miles_per_hour : 148	∘ kilometres_per_hour : 279 ∘ knots : 151 ∘ metres_per_second : 77 ∘ miles_per_hour : 174

Devastating damage will occur: Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.

Category 2 (hurricane)	True	unspecified	65%	cat 2,category 2	∘ kilometres_per_hour : 206 ∘ knots : 111 ∘ metres_per_second : 57 ∘ miles_per_hour : 128	∘ kilometres_per_hour : 238 ∘ knots : 128 ∘ metres_per_second : 65 ∘ miles_per_hour : 148

Extremely dangerous winds will cause extensive damage: Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.

Category 1 (hurricane)	True	unspecified	15%	cat 1,category 1	∘ kilometres_per_hour : 160 ∘ knots : 85 ∘ metres_per_second : 44 ∘ miles_per_hour : 99	∘ kilometres_per_hour : 238 ∘ knots : 111 ∘ metres_per_second : 57 ∘ miles_per_hour : 128

Very dangerous winds will produce some damage: Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.

No hurricane	False	unspecified	0%	no,false	0		◦ kilometres_per_hour : 160 ◦ knots : 85 ◦ metres_per_second : 44 ◦ miles_per_hour : 199
Winds less than Category 1 Hurricane							
Not exposed							

6.2.22. Generic classes

A generic hazard is any dataset where the areas within the data set have been classified as either **low**, **medium**, or **high** hazard level. Use generic hazard in cases where InaSAFE does not have an existing hazard concept for the data you are using.

Classes:

Name	Affected	Fatality rate	Displacement rate	Default values	Default min	Default max
High	True	unspecified	100%	high	3	4
The area with the highest hazard.						
Medium	True	unspecified	100%	medium	2	3
The area with the medium hazard.						
Low	False	unspecified	0%	low	0	2
The area with the lowest hazard.						
Not exposed						

6.2.23. Generic Hazard

A **generic hazard** can be used for any type of hazard where the data have been classified or generalised. For example: earthquake, flood, volcano, tsunami, landslide, smoke haze or strong wind. You can use the generic hazard functionality in InaSAFE to carry out an assessment for hazard data that are not explicitly supported yet in InaSAFE.

6.2.23.1. Notes:

6.2.23.1.1. General notes:

- The extent and severity of the mapped scenario or hazard zones may not be consistent with future events.
- The impacts on roads, people, buildings and other exposure elements may differ from the analysis results due to local conditions such as terrain and infrastructure type.
- The analysis extent is limited to the extent of the aggregation layer or analysis extent. Hazard and exposure data outside the analysis extent are not included in the impact layer, impact map or impact reports.

6.2.23.1.2. Notes for continuous datasets:

6.2.23.1.3. Notes for classified datasets:

6.2.23.2. Notes for single events

No single event notes defined.

6.2.23.3. Notes for multi events / scenarios:

No multi-event notes defined.

Actions:

Units:

Name	Plural	Abbreviation	Details

Fields:

Name	Field Name	Type	Length	Precision
Hazard ID	hazard_id	Whole number	0	

An ID attribute in the hazard layer. A unique identifier for each hazard feature. If you provide this we will persist these identifiers in the output datasets so that you can do a table join back to the original hazard layer if needed.

6.2.23.4. Hazard classifications

A hazard classification is used to define a range of severity thresholds (classes) for a hazard layer. The classification will be used to create zones of data that each present a similar hazard level. During the analysis, each exposure feature will be assessed to determine which hazard class it coincides with, and then a determination will be made as to whether and how the exposure feature is likely to be impacted by the hazard.

6.2.24. Generic classes

A generic hazard is any dataset where the areas within the data set have been classified as either **low**, **medium**, or **high** hazard level. Use generic hazard in cases where InaSAFE does not have an existing hazard concept for the data you are using.

Classes:

Name	Affected	Fatality rate	Displacement rate	Default values	Default min	Default max
High	True	unspecified	100%	high	3	4
The area with the highest hazard.						
Medium	True	unspecified	100%	medium	2	3
The area with the medium hazard.						
Low	False	unspecified	0%	low	0	2
The area with the lowest hazard.						
Not exposed						

6.2.25. Dam Break

A **Dam Break** is a catastrophic type of failure characterized by the sudden, rapid, and uncontrolled release of impounded water as a result of structural failures or deficiencies in the dam. **Dam Break** can range from fairly minor to catastrophic, and can possibly harm human life and property downstream from the failure.

6.2.25.1. Notes:

6.2.25.1.1. General notes:

- The extent and severity of the mapped scenario or hazard zones may not be consistent with future events.
- The impacts on roads, people, buildings and other exposure elements may differ from the analysis results due to local conditions such as terrain and infrastructure type.
- The analysis extent is limited to the extent of the aggregation layer or analysis extent. Hazard and exposure data outside the analysis extent are not included in the impact layer, impact map or impact reports.

6.2.25.1.2. Notes for continuous datasets:

6.2.25.1.3. Notes for classified datasets:

6.2.25.2. Notes for single events

No single event notes defined.

6.2.25.3. Notes for multi events / scenarios:

No multi-event notes defined.

Actions:

Units:

Name	Plural	Abbreviation	Details
Feet	feet	ft	**Feet** are an imperial unit of measure. There are 12 inches in 1 foot and 3 feet in 1 yard.
Metres	metres	m	**Metres** are a metric unit of measure. There are 100 centimetres in 1 metre.
Generic	generic	generic	A generic unit for value that does not have unit or we do not know about the unit. It also can be used for normalised values.

Fields:

Name	Field Name	Type	Length	Precision
Hazard ID	hazard_id	Whole number	0	
An ID attribute in the hazard layer. A unique identifier for each hazard feature. If you provide this we will persist these identifiers in the output datasets so that you can do a table join back to the original hazard layer if needed.				

6.2.25.4. Hazard classifications

A hazard classification is used to define a range of severity thresholds (classes) for a hazard layer. The classification will be used to create zones of data that each present a similar hazard level. During the analysis, each exposure feature will be assessed to determine which hazard class it coincides with, and then a determination will be made as to whether and how the exposure feature is likely to be impacted by the hazard.

6.2.26. Inundation classes

This type of classification refers to the division of flood areas based on the range of water levels. This area is divided into 3 areas of inundation including **Inundation 1**, **Inundation 2**, and **Inundation 3**.

Classes:

Name	Affected	Fatality rate	Displacement rate	Default values	Default min	Default max
Inundation Class 3	True	unspecified	1%	Inundation 3	1.5	9999
High water level above ground surface.						
Inundation Class 2	False	unspecified	0%	Inundation 2	0.6	1.5
Medium water level above ground surface.						
Inundation Class 1	False	unspecified	0%	Inundation 1	0	0.6
Low water level above ground surface.						
Not exposed						

6.2.27. Generic classes

A generic hazard is any dataset where the areas within the data set have been classified as either **low**, **medium**, or **high** hazard level. Use generic hazard in cases where InaSAFE does not have an existing hazard concept for the data you are using.

Classes:

Name	Affected	Fatality rate	Displacement rate	Default values	Default min	Default max
High	True	unspecified	100%	high	3	4
The area with the highest hazard.						
Medium	True	unspecified	100%	medium	2	3
The area with the medium hazard.						
Low	False	unspecified	0%	low	0	2
The area with the lowest hazard.						
Not exposed						

7. Exposure Concepts

7.1. Exposure

Exposure represents people, property, systems, or other elements present in hazard zones that are subject to potential losses in the event of a flood, earthquake, volcano etc.

Citations:

- UNISDR (2009) Terminology on disaster risk reduction.

7.1.1. Land cover

The **land cover** exposure data describes features on the surface of the earth that might be exposed to a particular hazard. This might include crops, forest and urban areas.

7.1.1.1. Notes:

7.1.1.1.1. General notes:

- The impacts on roads, people, buildings and other exposure elements may be underestimated if the exposure data are incomplete.
- Areas reported for land cover have been rounded to the nearest 10 hectares if the total is less than 1,000; nearest 100 hectares if more than 1,000 and less than 100,000; and nearest 1000 hectares if more than 100,000.
- Rounding is applied to all land cover areas, which may cause discrepancies between subtotals and totals.
- Note that report rows containing totals are calculated from the entire analysis area totals and then rounded, whereas the subtotal rows are calculated from the aggregation areas and then rounded. Using this approach we avoid adding already rounded numbers and in so doing compounding the rounding.

7.1.1.1.2. Notes for continuous datasets:

7.1.1.1.3. Notes for classified datasets:

Actions:

- What type of crops are planted in the affected fields?
- How long will the activity or function of the land cover be disturbed?
- What proportion of the land cover is damaged?
- What potential losses will result from the land cover damage?
- How much productivity will be lost during this event?

- Which crops were ready for harvest during this event?
- What is the ownership system of the land/crops/field?
- Are the land/crops/field accessible after the event?
- What urgent actions can be taken to normalize the land/crops/field?
- What tools or equipment are needed for early recovery of the land/crops/field?

Fields:

Name	Field Name	Type	Length	Precision
Exposure ID	exposure_id	Whole number	0	
An ID attribute in the exposure layer A unique identifier for each exposure feature. If you provide this we will persist these identifiers in the output datasets so that you can do a table join back to the original exposure layer if needed.				
Productivity Rate	productivity_rate	Whole number, Decimal number	0	
The rate of productivity of crop land cover for each feature / area in hundred kilograms per hectare unit. "Productivity Rate" is defined as: The weight of a crop from land cover can produce per area unit. The unit is in hundred kilograms /hectare.. In case where land cover data is available, InaSAFE will calculate the productivity for each land cover area (exposure feature). The productivity is calculated based on the productivity rate multiplied by the area of the land cover.				
Production Cost Rate	production_cost_rate	Whole number, Decimal number	0	
The rate of production cost of a crop for each feature in currency per hectare unit. "Production Cost Rate" is defined as: The amount of money that is needed to build a crop land cover per area unit. The default unit is currency per area unit (e.g. IDR/hectare, USD/hectare).. In case where land cover data is available, InaSAFE will calculate the production cost for each land cover area (exposure feature). The production cost is calculated based on the production cost rate multiplied by the area of the land cover.				
Production Value Rate	production_value_rate	Whole number, Decimal number	0	
The rate of production value of a crop for each feature in currency per hectare unit. "Production Value Rate" is defined as: The price of a crop per area unit. The default unit is currency per area unit. (e.g. IDR/hectare, USD/hectare).. In case where land cover data is available, InaSAFE will calculate the production value for each land cover area (exposure feature). The production value is calculated based on the production value rate multiplied by the area of the land cover.				

7.1.1.2. Hazard classifications

A hazard classification is used to define a range of severity thresholds (classes) for a hazard layer. The classification will be used to create zones of data that each present a similar hazard level. During the analysis, each exposure feature will be assessed to determine which hazard class it coincides with, and then a determination will be made as to whether and how the exposure feature is likely to be impacted by the hazard.

7.1.2. Generic Landcover Classification

Classification of landcover based on OSM.

Classes:

Name	Default values
Residential	residential,population
	Predominantly houses or apartment buildings.
Industrial	industrial
	Predominantly workshops, factories or warehouses.
Retail	retail
	Predominantly shops.
Wood	wood,forest

	A forested area.
Farm	farm,meadow
	An area of farmland used for tillage and pasture (animals, vegetables, flowers, fruit growing).
Water	water,lake
	Water bodies both natural and man-made.
Other	other
	Any other land use type.

7.1.3. Badan Geologi Landcover Classification

Classification of landcover based on Badan Geologi

Citations:

- Badan Geologi

Classes:

Name	Default values
Settlement	Permukiman dan Tempat Kegiatan,50102
	Settlement
Rice Field	Sawah,50306
	Rice Field
Plantation	Perkebunan / Kebun,50304
	Plantation
Water	Air Danau / Situ,Air Empang,Air Penggaraman,Air Tambak,Air Tawar Sungai,Air Waduk,Perairan Lainnya,50404,50420,50418,50416,50408,50406,50400
	Water bodies
Forest	Hutan Rimba,50202
	Forest
Other	other
	Any other land use type.

7.1.4. Generic Data-driven Classification

Classification based on the content of the exposure dataset.

Classes:

Name	Default values

7.1.5. Population

The **population** describes the people that might be exposed to a particular hazard.

Citations:

- The Sphere Handbook: Humanitarian Charter and Minimum Standards in Humanitarian Response

7.1.5.1. Notes:

7.1.5.1.1. General notes:

- The impacts on roads, people, buildings and other exposure elements may be underestimated if the exposure data are incomplete.
- Exposed population varies by the time (day or night, weekends, holidays etc.). Such variations are not included in the analysis.
- Numbers reported for population counts have been rounded to the nearest 10 people if the total is less than 1,000; nearest 100 people if more than 1,000 and less than 100,000; and nearest 1,000 if more than 100,000.
- Rounding is applied to all population values, which may cause discrepancies between subtotals and totals.
- Note that report rows containing totals are calculated from the entire analysis area totals and then rounded, whereas the subtotal rows are calculated from the aggregation areas and then rounded. Using this approach we avoid adding already rounded numbers and in so doing compounding the rounding.
- If displacement counts are 0, no minimum needs and displaced related postprocessors will be shown.

Citations:

- The Sphere Handbook: Humanitarian Charter and Minimum Standards in Humanitarian Response

7.1.5.1.2. Notes for continuous datasets:

7.1.5.1.3. Notes for classified datasets:

Actions:

- How will warnings be disseminated?
- What are people's likely movements?
- Which group or population is most affected?
- Who are the vulnerable people in the population and why?
- How will we distribute relief items?
- Where can we obtain additional relief items?
- How will we distribute relief items?
- Who are the key people responsible for coordination?
- What are the security factors for relief responders?
- Are there enough victim identification units?
- What are people's likely movements?
- How will we reach displaced people?
- Are there enough covered floor areas available for the displaced people?
- What are the land-use rights for the settlement location?
- What is the ownership of the shelter or settlement location?
- What is the appropriate construction for temporary or transitional household shelter?
- What are the existing environmental risks or vulnerabilities at the shelter location?
- Are there enough clothing, bedding and household items available for the displaced people?
- What are the critical non-food items required by the affected population?
- Are the non-food items available at an active local market?
- What kind of food does the population normally consume?
- Are there any alternative source of food?
- Is there enough food for the displaced people?
- Are there any crops that can be used for consumption?
- Are there large numbers of separated children?
- What water and sanitation practices were the population accustomed to before the emergency?
- What type of outreach system would work for hygiene promotion for this situation?
- What is the current water supply source and who are the present users?
- Are there enough water supply, sanitation and hygiene, items available for displaced people?
- Are water collection points close enough to where people live?
- Are water collection points safe?

- Is the water source contaminated or at risk of contamination?
- Are there alternative sources of water nearby?
- Is there a drainage problem?
- What are the existing health problems?
- What are the potential epidemic diseases?
- Are there any potential disease outbreaks?
- Are there any healthcare sources that are accessible and functioning?

Fields:

Name	Field Name	Type	Length	Precision
Exposure ID	exposure_id	Whole number	0	
An ID attribute in the exposure layer A unique identifier for each exposure feature. If you provide this we will persist these identifiers in the output datasets so that you can do a table join back to the original exposure layer if needed.				
Exposure Name	exposure_name	Text	0	
A NAME attribute in the exposure layer. This will be carried over to the impact layer if provided. The name can be useful in some cases e.g. where exposure is a place, the name can be used to label the place names.				

7.1.5.2. Hazard classifications

A hazard classification is used to define a range of severity thresholds (classes) for a hazard layer. The classification will be used to create zones of data that each present a similar hazard level. During the analysis, each exposure feature will be assessed to determine which hazard class it coincides with, and then a determination will be made as to whether and how the exposure feature is likely to be impacted by the hazard.

7.1.6. Roads

A **road** is defined as a route used by a vehicle or people to travel between two or more points.

7.1.6.1. Notes:

7.1.6.1.1. General notes:

- The impacts on roads, people, buildings and other exposure elements may be underestimated if the exposure data are incomplete.
- Numbers for road lengths have been rounded to the nearest 10 metres if the total is less than 1,000; nearest 100 metres if more than 1,000 and less than 100,000; and nearest 1000 metres if more than 100,000.
- Rounding is applied to all road lengths, which may cause discrepancies between subtotals and totals.
- Note that report rows containing totals are calculated from the entire analysis area totals and then rounded, whereas the subtotal rows are calculated from the aggregation areas and then rounded. Using this approach we avoid adding already rounded numbers and in so doing compounding the rounding.
- Roads marked as not affected may still be unusable due to network isolation. Roads marked as affected may still be usable if they are elevated above the local landscape.
- Roads are closed if they are affected.
- Roads are open if they are not affected.

7.1.6.1.2. Notes for continuous datasets:

7.1.6.1.3. Notes for classified datasets:

Actions:

- Which roads can be used to evacuate people or to distribute logistics?
- What type of vehicles can use the not affected roads?
- What sort of equipment will be needed to reopen roads?

- Where will we get the equipment needed to open roads?
- Which government department is responsible for supplying equipment?

Fields:

Name	Field Name	Type	Length	Precision
Exposure ID	exposure_id	Whole number	0	

An ID attribute in the exposure layer A unique identifier for each exposure feature. If you provide this we will persist these identifiers in the output datasets so that you can do a table join back to the original exposure layer if needed.

7.1.6.2. Hazard classifications

A hazard classification is used to define a range of severity thresholds (classes) for a hazard layer. The classification will be used to create zones of data that each present a similar hazard level. During the analysis, each exposure feature will be assessed to determine which hazard class it coincides with, and then a determination will be made as to whether and how the exposure feature is likely to be impacted by the hazard.

7.1.7. Generic Road Classification

Classification of roads based on OSM.

Classes:

Name	Default values
Motorway	motorway link,motorway,trunk link,trunk
	A road designed for fast moving traffic often with multiple lanes for each direction of traffic.
Primary	primary link,primary road,primary
	A road that provides the main transportation link, often over a long distance travel characteristic and supporting a high average velocity.
Secondary	secondary link,secondary
	A road that provides a transportation link for medium distance travel and medium average velocity.
Local	local,tertiary link,tertiary,tertiary,unclassified
	A road that provides a transportation link for a short distance travel and low average velocity.
Path	cycleway,pedestrian,footway,path,track
	A route for pedestrian and non-motorised transport.
Other	living street,other,residential,road,service
	A road that services residential or local traffic with low average velocity.

7.1.8. Generic Data-driven Classification

Classification based on the content of the exposure dataset.

Classes:

Name	Default values

7.1.9. Places

A **place** is used to indicate that a particular location is known by a particular name.

7.1.9.1. Notes:

7.1.9.1.1. General notes:

- The impacts on roads, people, buildings and other exposure elements may be underestimated if the exposure data are incomplete.
- Where places are represented as a single point, the effect of the hazard over the entire place may differ from the point at which the place is represented on the map.

7.1.9.1.2. Notes for continuous datasets:

7.1.9.1.3. Notes for classified datasets:

Actions:

Fields:

Name	Field Name	Type	Length	Precision
Exposure ID	exposure_id	Whole number	0	
An ID attribute in the exposure layer A unique identifier for each exposure feature. If you provide this we will persist these identifiers in the output datasets so that you can do a table join back to the original exposure layer if needed.				
Exposure Name	exposure_name	Text	0	
A NAME attribute in the exposure layer. This will be carried over to the impact layer if provided. The name can be useful in some cases e.g. where exposure is a place, the name can be used to label the place names.				
Population count	population	Whole number, Decimal number	0	
During the impact analysis, population counts are used to calculate the total number of people, expected number of impacted, displaced people and in some cases fatality counts. Population data are also used to calculate demographic data (e.g. how many women, youths, adults etc. were affected) and minimum needs data (i.e. what quantities of provisions and supplies are needed to support displaced persons.) A count of the population for each feature.				

7.1.9.2. Hazard classifications

A hazard classification is used to define a range of severity thresholds (classes) for a hazard layer. The classification will be used to create zones of data that each present a similar hazard level. During the analysis, each exposure feature will be assessed to determine which hazard class it coincides with, and then a determination will be made as to whether and how the exposure feature is likely to be impacted by the hazard.

7.1.10. Generic Place Classification

Classification of place based on OSM.

Classes:

Name	Default values
City	city
	The largest urban settlements in the territory, normally including the national, state and provincial capitals.
Town	town
	A second tier urban settlement of local importance, often with a population of at least 10,000 people and good range of local facilities including schools, medical facilities etc. and traditionally a market.
Village	village
	A smaller distinct settlement, smaller than a town with few facilities available. People will typically travel to nearby towns to access facilities.
Hamlet	hamlet

	A smaller rural community typically with fewer than 100–200 inhabitants and minimal infrastructure.
Evacuation Centre	evacuation centre,evacuation center,refuge,idp camp
	Evacuation centres provide a place of temporary refuge for people evacuated from homes in the vicinity of a disaster and for people who may be travelling through the affected area but are unable to continue.
Airport	airport
	A complex of runways and buildings for the takeoff, landing, and maintenance of civil aircraft, with facilities for passengers.
Other	other
	Other

7.1.11. Generic Data-driven Classification

Classification based on the content of the exposure dataset.

Classes:

Name	Default values

7.1.12. Structures

A **structure** can be any relatively permanent man made feature such as a building (an enclosed structure with walls and a roof), telecommunications facility or bridge.

7.1.12.1. Notes:

7.1.12.1.1. General notes:

- The impacts on roads, people, buildings and other exposure elements may be underestimated if the exposure data are incomplete.
- Structures overlapping the analysis extent may be assigned a hazard status lower than that to which they are exposed outside the analysis area.
- Numbers reported for structures have been rounded to the nearest 100 if more than 1,000 and less than 100,000; and nearest 1000 if more than 100,000.
- Rounding is applied to all structure counts greater than 1,000 which may cause discrepancies between subtotals and totals.
- Note that report rows containing totals are calculated from the entire analysis area totals and then rounded, whereas the subtotal rows are calculated from the aggregation areas and then rounded. Using this approach we avoid adding already rounded numbers and in so doing compounding the rounding.

7.1.12.1.2. Notes for continuous datasets:

7.1.12.1.3. Notes for classified datasets:

Actions:

- Which structures have warning capacity (e.g. sirens or speakers)?
- Are the water and electricity services still operating?
- Are the schools and hospitals still active?
- Are the health centres still open?
- Are the other public services accessible?
- Which buildings will be evacuation centres?
- Where will we locate the operations centre?
- Where will we locate warehouse and/or distribution centres?

Fields:

Name	Field Name	Type	Length	Precision

Exposure ID	exposure_id	Whole number	0

An ID attribute in the exposure layer A unique identifier for each exposure feature. If you provide this we will persist these identifiers in the output datasets so that you can do a table join back to the original exposure layer if needed.

7.1.12.2. Hazard classifications

A hazard classification is used to define a range of severity thresholds (classes) for a hazard layer. The classification will be used to create zones of data that each present a similar hazard level. During the analysis, each exposure feature will be assessed to determine which hazard class it coincides with, and then a determination will be made as to whether and how the exposure feature is likely to be impacted by the hazard.

7.1.13. Generic Structure Classification

Classification of structure based on OSM.

Classes:

Name	Default values
Residential	dorm,house,residence,residential,apartments
	A structure used to provide shelter for people.
Education	college,education,kindergarten,school,university,university/college
	A structure that provides a service in the education sector.
Health	clinic,clinic/doctor,dentist,doctor,doctors,health,hospital,pharmacy
	A structure that provides a service or facility in the health sector.
Transport	aerodrome,airport,bus station,bus stop,ferry terminal,station,terminal,transportation
	A structure that provides a service or facility in the transport sector.
Place of Worship	place of worship - buddhist,place of worship - christian,place of worship - hindu,place of worship - islam,place of worship,church,mosque,temple,synagogue,worship
	A structure or facility that is used for prayer or related religion activity.
Government	government
	A structure or facility that is used to provide a public service or other government activity.
Commercial	accommodation,atm,bank,cafe,clothes,commercial,convenience,economy,fast food,hotel,industrial,mall,market,restaurant,seafood,shoes,shop,supermarket,tailor,warehouse,works
	A structure or facility that is used for commercial or industrial purposes.
Recreation	amusement arcade,cinema,museum,pitch,recreation and entertainment,sport centre,sport,sports facility,stadium,theatre,zoo
	A structure or facility that is used for entertainment, sporting or recreation purposes.
Public Facility	convention hall,fire station,library,police station,prison,public building,public facility,toilet,public
	A structure or facility that provides a service or facility to the public including emergency services.
Evacuation Centre	evacuation centre,evacuation center,refuge,idp camp
	Evacuation centres provide a place of temporary refuge for people evacuated from homes in the vicinity of a disaster and for people who may be travelling through the affected area but are unable to continue.
Other	animal boarding,garage,lighthouse,other,utility,water well,construction,yes
	Any other structure frequently mapped.

7.1.14. Generic Data-driven Classification

Classification based on the content of the exposure dataset.

Classes:

Name	Default values

8. InaSAFE Defaults

Name	Default value	Default min	Default max	Description
Youth Ratio Global Default	0.266	0	1	Default ratio of youths per 100 people in the total population.
Adult Ratio Global Default	0.657	0	1	Default ratio of adults per 100 people in the total population.
Elderly Ratio Global Default	0.077	0	1	Default ratio of elderly people per 100 people in the total population.
Female Ratio Global Default	0.496	0	1	Default ratio of females per 100 people in the total population.
Feature Rate Global Default	1000000	0	1000000000	Default value for feature rate per m^2

9. Fields

9.1. Input dataset fields

9.1.1. Exposure fields

Name	Field Name	Type	Length	Precision
Exposure ID	exposure_id	Whole number	0	

An ID attribute in the exposure layer A unique identifier for each exposure feature. If you provide this we will persist these identifiers in the output datasets so that you can do a table join back to the original exposure layer if needed.

9.1.2. Hazard fields

Name	Field Name	Type	Length	Precision
Hazard ID	hazard_id	Whole number	0	

An ID attribute in the hazard layer. A unique identifier for each hazard feature. If you provide this we will persist these identifiers in the output datasets so that you can do a table join back to the original hazard layer if needed.

9.1.3. Aggregation fields

Name	Field Name	Type	Length	Precision
Aggregation ID	aggregation_id	Whole number	0	

An ID attribute in the aggregation layer. A unique identifier for each aggregation feature. If you provide this we will persist these identifiers in the output datasets so that you can do a table join back to the original aggregation layer if needed.

Aggregation Name	aggregation_name	Text	0	

This will be carried over to the impact layer if provided. The name can be useful to label the area names that are used in the report generation process. A NAME attribute in the aggregation layer.

9.2. Output dataset fields

9.2.1. Impact fields

Name	Field Name	Type	Length	Precision
Exposure ID	exposure_id	Whole number	0	
An ID attribute in the exposure layer A unique identifier for each exposure feature. If you provide this we will persist these identifiers in the output datasets so that you can do a table join back to the original exposure layer if needed.				
Exposure Class	exposure_class	Text	0	
A CLASS attribute in the exposure layer. The class attribute will be used to group features according to their types. For example several types of ("secondary, residential") may be grouped into a single class ("other").				
Hazard ID	hazard_id	Whole number	0	
An ID attribute in the hazard layer. A unique identifier for each hazard feature. If you provide this we will persist these identifiers in the output datasets so that you can do a table join back to the original hazard layer if needed.				
Hazard Class	hazard_class	Text	0	
Classes are used to group values in a hazard dataset. In the context of a hazard, classes indicate the intensity of the hazard and are typically presented as "Low", "Medium", "High" etc. A CLASS attribute for the hazard.				
Aggregation ID	aggregation_id	Whole number	0	
An ID attribute in the aggregation layer. A unique identifier for each aggregation feature. If you provide this we will persist these identifiers in the output datasets so that you can do a table join back to the original aggregation layer if needed.				
Aggregation Name	aggregation_name	Text	0	
This will be carried over to the impact layer if provided. The name can be useful to label the area names that are used in the report generation process. A NAME attribute in the aggregation layer.				
Feature Value	exposure_value	Decimal number	5	
The value field is used to indicate the financial value of an exposed feature. The value is usually calculated as the function of the length or area of a given exposure feature. The VALUE field in a layer.				
Feature Rate	exposure_rate	Decimal number	0	
The rate field is used to indicate the financial value of an exposed feature. The rate, when multiplied by the of the length or area of a given exposure feature, can be used to calculate an estimated value of the feature. For example in buildings the rate * the area of a building can be used to estimate the value of the building. The rate field in a layer.				
Female Ratio	female_ratio	Decimal number	2	
The proportion of females for each feature. "Female" is defined as: Relating to the characteristics of women. In cases where population data is available, InaSAFE will calculate the number of females per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The female count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) ratios in the input analysis data.				
Youth Ratio	youth_ratio	Decimal number	2	
The proportion of young people for each feature. "Youth" is defined as: A person aged between 0 and 14 years. In cases where population data is available, InaSAFE will calculate the number of youths per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The youth count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) ratios in the input analysis data.				
Adult Ratio	adult_ratio	Decimal number	2	

The proportion of adults for each feature. "Adult" is defined as: Person aged between 15 and 64 years, usually of working age. In cases where population data is available, InaSAFE will calculate the number of adults per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The adult count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) ratios in the input analysis data.			
Elderly Ratio	elderly_ratio	Decimal number	2
The proportion of elderly people for each feature. "Elderly" is defined as: Persons aged 65 years and over. In cases where population data is available, InaSAFE will calculate the number of adults per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The elderly count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) ratios in the input analysis data.			
Population count	population	Whole number, Decimal number	0
During the impact analysis, population counts are used to calculate the total number of people, expected number of impacted, displaced people and in some cases fatality counts. Population data are also used to calculate demographic data (e.g. how many women, youths, adults etc. were affected) and minimum needs data (i.e. what quantities of provisions and supplies are needed to support displaced persons.) A count of the population for each feature.			
Female Count	female	Whole number, Decimal number	0
The number of females for each feature. "Female" is defined as: Relating to the characteristics of women. In cases where population data is available, InaSAFE will calculate the number of females per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The female count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) counts or ratios in the input analysis data.			
Male Count	male	Whole number, Decimal number	0
The number of males for each feature. "Male" is defined as: Relating to the characteristics of men. In cases where population data is available, InaSAFE will calculate the number of males per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The male count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) counts or ratios in the input analysis data.			
Youth Count	youth	Whole number, Decimal number	0
The number of young people for each feature. "Youth" is defined as: A person aged between 0 and 14 years. This definition may not align well with the definition of youth in the humanitarian sector. It should be noted that this concept overlaps with the concepts of infant and child in InaSAFE. In cases where population data is available, InaSAFE will calculate the number of youths per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The youth count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) counts or ratios in the input analysis data.			
Adult Count	adult	Whole number, Decimal number	0
The number of adults for each feature. "Adult" is defined as: Person aged between 15 and 64 years, usually of working age. In cases where population data is available, InaSAFE will calculate the number of adults per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The adult count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) counts or ratios in the input analysis data.			
Elderly Count	elderly	Whole number, Decimal number	0
The number of elderly people for each feature. "Elderly" is defined as: Persons aged 65 years and over. In cases where population data is available, InaSAFE will calculate the number of adults per exposure feature, aggregate hazard area, aggregation area and for the analysis area as a whole. The elderly count is calculated based on standard ratios either provided as a global setting in InaSAFE, or (if available) counts or ratios in the input analysis data.			
Geometric Size	size	Decimal number	2

Attribute where the size of the geometry is located. Attribute where the size of the geometry is located.			
Affected	affected	Text	0
The affected field indicates whether a feature is affected by the hazard. "Affected" is defined as: An exposure element (e.g. people, roads, buildings, land cover) that experiences a hazard (e.g. tsunami, flood, earthquake) and endures consequences (e.g. damage, evacuation, displacement, death) due to that hazard.			
Total %s	%s_exposure_count	Decimal number	5
The total exposure count field stores the cumulative total number of exposed features or entities. The total exposure count field is added to the analysis layer, aggregate impact layer and aggregate hazard impact layer during the impact analysis. It represents the cumulative count of affected exposured features (e.g. buildings) or entities (e.g. people) for each area.			
Total	total	Decimal number	2
The total field stores the cumulative total number of features or entities. The total field is added to the analysis layer, aggregate impact layer and aggregate hazard impact layer during the impact analysis. It represents the cumulative count of exposure features (e.g. buildings) or entities (e.g. people) for each area.			

9.2.2. Aggregate hazard fields

Name	Field Name	Type	Length	Precision
Aggregation ID	aggregation_id	Whole number	0	
An ID attribute in the aggregation layer. A unique identifier for each aggregation feature. If you provide this we will persist these identifiers in the output datasets so that you can do a table join back to the original aggregation layer if needed.				
Aggregation Name	aggregation_name	Text	0	
This will be carried over to the impact layer if provided. The name can be useful to label the area names that are used in the report generation process. A NAME attribute in the aggregation layer.				
Hazard ID	hazard_id	Whole number	0	
An ID attribute in the hazard layer. A unique identifier for each hazard feature. If you provide this we will persist these identifiers in the output datasets so that you can do a table join back to the original hazard layer if needed.				
Hazard Class	hazard_class	Text	0	
Classes are used to group values in a hazard dataset. In the context of a hazard, classes indicate the intensity of the hazard and are typically presented as "Low", "Medium", "High" etc. A CLASS attribute for the hazard.				
Total %s	%s_exposure_count	Decimal number	5	
The total exposure count field stores the cumulative total number of exposed features or entities. The total exposure count field is added to the analysis layer, aggregate impact layer and aggregate hazard impact layer during the impact analysis. It represents the cumulative count of affected exposured features (e.g. buildings) or entities (e.g. people) for each area.				
Affected	affected	Text	0	
The affected field indicates whether a feature is affected by the hazard. "Affected" is defined as: An exposure element (e.g. people, roads, buildings, land cover) that experiences a hazard (e.g. tsunami, flood, earthquake) and endures consequences (e.g. damage, evacuation, displacement, death) due to that hazard.				
Total	total	Decimal number	2	
The total field stores the cumulative total number of features or entities. The total field is added to the analysis layer, aggregate impact layer and aggregate hazard impact layer during the impact analysis. It represents the cumulative count of exposure features (e.g. buildings) or entities (e.g. people) for each area.				

9.2.3. Aggregation summary fields

Name	Field Name	Type	Length	Precision
Aggregation ID	aggregation_id	Whole number	0	
An ID attribute in the aggregation layer. A unique identifier for each aggregation feature. If you provide this we will persist these identifiers in the output datasets so that you can do a table join back to the original aggregation layer if needed.				
Aggregation Name	aggregation_name	Text	0	
This will be carried over to the impact layer if provided. The name can be useful to label the area names that are used in the report generation process. A NAME attribute in the aggregation layer.				
Affected %s	%s_affected	Decimal number	5	
The total affected field stores the cumulative total number of affected exposure features or entities. "Affected" is defined as: An exposure element (e.g. people, roads, buildings, land cover) that experiences a hazard (e.g. tsunami, flood, earthquake) and endures consequences (e.g. damage, evacuation, displacement, death) due to that hazard. The total affected field is added to the analysis layer, aggregate impact layer and aggregate hazard impact layer during the impact analysis. It represents the cumulative count of affected exposure features (e.g. buildings) or entities (e.g. people) for each area.				
Total Affected	total_affected	Decimal number	2	
The total affected field stores the cumulative total number of affected features or entities. "Affected" is defined as: An exposure element (e.g. people, roads, buildings, land cover) that experiences a hazard (e.g. tsunami, flood, earthquake) and endures consequences (e.g. damage, evacuation, displacement, death) due to that hazard. The total affected field is added to the analysis layer, aggregate impact layer and aggregate hazard impact layer during the impact analysis. It represents the cumulative count of affected exposure features (e.g. buildings) or entities (e.g. people) for each area.				

9.2.4. Exposure summary table fields

Name	Field Name	Type	Length	Precision
Exposure Class	exposure_class	Text	0	
A CLASS attribute in the exposure layer. The class attribute will be used to group features according to their types. For example several types of ("secondary, residential") may be grouped into a single class ("other").				
Total %s	%s_hazard_count	Decimal number	2	
The total affected field stores the cumulative total number of affected exposure features or entities. "Hazard" is defined as: A **hazard** represents a natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. For example; flood, earthquake, tsunami and volcano are all examples of hazards. The hazard count field is added to the analysis layer, aggregate impact layer and aggregate hazard impact layer during the impact analysis. It represents the cumulative count of hazard features for each area.				
Total Affected	total_affected	Decimal number	2	
The total affected field stores the cumulative total number of affected features or entities. "Affected" is defined as: An exposure element (e.g. people, roads, buildings, land cover) that experiences a hazard (e.g. tsunami, flood, earthquake) and endures consequences (e.g. damage, evacuation, displacement, death) due to that hazard. The total affected field is added to the analysis layer, aggregate impact layer and aggregate hazard impact layer during the impact analysis. It represents the cumulative count of affected exposure features (e.g. buildings) or entities (e.g. people) for each area.				
Total Not Affected	total_not_affected	Decimal number	2	
The total not affected field is added to the analysis layer, aggregate impact layer and aggregate hazard impact layer during the impact analysis. It represents the cumulative count of not affected exposure features (e.g. buildings) or entities (e.g. people) for each area. The total not affected field stores the cumulative total number of not affected features or entities.				
Total Not Exposed	total_not_exposed	Decimal number	2	

The total not exposed field stores the cumulative total number of not exposed features or entities. The total not exposed field is added to the analysis layer, aggregate impact layer and aggregate hazard impact layer during the impact analysis. It represents the cumulative count of not exposed exposure features (e.g. buildings) or entities (e.g. people) for each area.

Total	total	Decimal number	2

The total field stores the cumulative total number of features or entities. The total field is added to the analysis layer, aggregate impact layer and aggregate hazard impact layer during the impact analysis. It represents the cumulative count of exposure features (e.g. buildings) or entities (e.g. people) for each area.

9.2.5. Analysis fields

Name	Field Name	Type	Length	Precision
Analysis Name	analysis_name	Text	0	

This will be carried over to the analysis layer if provided. The name will provide context if the analysis layer is shared since the recipient of the layer will be able to tell what kind of analysis was carried out when generating the impact layer. For example when doing a flood on roads analysis, "flood on roads" will be written to the analysis name field in the analysis layer. A NAME attribute in the analysis layer.

Total %s	%s_hazard_count	Decimal number	2

The total affected field stores the cumulative total number of affected exposure features or entities. "Hazard" is defined as: A **hazard** represents a natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. For example; flood, earthquake, tsunami and volcano are all examples of hazards. The hazard count field is added to the analysis layer, aggregate impact layer and aggregate hazard impact layer during the impact analysis. It represents the cumulative count of hazard features for each area.

Total Affected	total_affected	Decimal number	2

The total affected field stores the cumulative total number of affected features or entities. "Affected" is defined as: An exposure element (e.g. people, roads, buildings, land cover) that experiences a hazard (e.g. tsunami, flood, earthquake) and endures consequences (e.g. damage, evacuation, displacement, death) due to that hazard. The total affected field is added to the analysis layer, aggregate impact layer and aggregate hazard impact layer during the impact analysis. It represents the cumulative count of affected exposure features (e.g. buildings) or entities (e.g. people) for each area.

Total Not Affected	total_not_affected	Decimal number	2

The total not affected field is added to the analysis layer, aggregate impact layer and aggregate hazard impact layer during the impact analysis. It represents the cumulative count of not affected exposure features (e.g. buildings) or entities (e.g. people) for each area. The total not affected field stores the cumulative total number of not affected features or entities.

Total Not Exposed	total_not_exposed	Decimal number	2

The total not exposed field stores the cumulative total number of not exposed features or entities. The total not exposed field is added to the analysis layer, aggregate impact layer and aggregate hazard impact layer during the impact analysis. It represents the cumulative count of not exposed exposure features (e.g. buildings) or entities (e.g. people) for each area.

Total Exposed	total_exposed	Decimal number	2

The total exposed field stores the cumulative total number of exposed features or entities. The total exposed field is added to the analysis layer, aggregate impact layer and aggregate hazard impact layer during the impact analysis. It represents the cumulative count of exposed exposure features (e.g. buildings) or entities (e.g. people) for each area.

Total	total	Decimal number	2

The total field stores the cumulative total number of features or entities. The total field is added to the analysis layer, aggregate impact layer and aggregate hazard impact layer during the impact analysis. It represents the cumulative count of exposure features (e.g. buildings) or entities (e.g. people) for each area.

10. Layer Geometry Types

10.1. Vector

10.1.1. Point

A layer composed of points which each represent a feature on the earth. Currently the only point data supported by InaSAFE are **volcano hazard** layers and building points.

10.1.2. Line

A layer composed of linear features. Currently only **road exposure** line layers are supported by InaSAFE.

10.1.3. Polygon

A layer composed of polygon features that represent areas of hazard or exposure. For example areas of flood represented as polygons (for a hazard) or building footprints represented as polygons (for an exposure). The polygon layer will often need the presence of specific layer attributes too – these will vary depending on whether the layer represents a hazard, exposure or aggregation layer . Polygon layers can also be used for aggregation – where impact analysis results per boundary such as village or district boundaries.

10.2. Raster

10.2.1. Raster

A raster data layer consists of a matrix of cells organised into rows and columns. The value in the cells represents information such as a flood depth value or a hazard class.

11. Layer Modes

11.1. Data type

The data type describes the values in the layer. Values can be continuous or classified

11.1.1. Continuous

Continuous data can be used in raster hazard or exposure data where the values in the data are either integers or decimal values representing a continuously varying phenomenon. For example flood depth is a continuous value from 0 to the maximum reported depth during a flood.

Raster exposure data such as population data are also continuous. In this example the cell values represent the number of people in cell.

Raster data is considered to be continuous by default and you should explicitly indicate that it is classified if each cell in the raster represents a discrete class (e.g. low depth = 1, medium depth = 2, high depth = 3).

11.1.2. Classified

Classified data can be used for either hazard or exposure data and can be used for both raster and vector layer types where the attribute values represent a classified or coded value.

For example, classified values in a flood raster data set might represent discrete classes where a value of 1 might represent the low inundation class, a value of 2 might represent the medium inundation class and a value of 3 might represent the high inundation class.

Classified values in a vector (polygon) volcano data set might represent discrete classes where a value of I might represent low volcanic hazard, a value of II might represent medium volcanic hazard and a value of III might represent a high volcanic hazard.

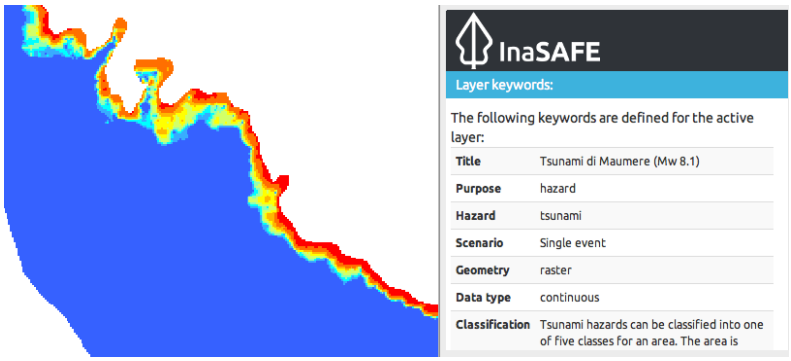
Classified values in a vector exposure data set might include building type or road type.

12. Layer Purposes

12.1. Hazard

A **hazard** represents a natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. For example; flood, earthquake, tsunami and volcano are all examples of hazards.

UNISDR (2009) Terminology on disaster risk reduction.



12.2. Exposure

Exposure represents people, property, systems, or other elements present in hazard zones that are subject to potential losses in the event of a flood, earthquake, volcano etc.

UNISDR (2009) Terminology on disaster risk reduction.

12.3. Aggregation

An **aggregation** layer represents regions that can be used to summarise impact analysis results. For example, we might summarise the affected people after a flood according to administration boundaries.

12.4. Impact Analysis

This **Impact Analysis** contains all the results for the spatial analysis of the hazard, exposure and aggregation layers (if used) within the analysis extent. This layer is not created if the input includes a continuous raster exposure layer (eg population raster).

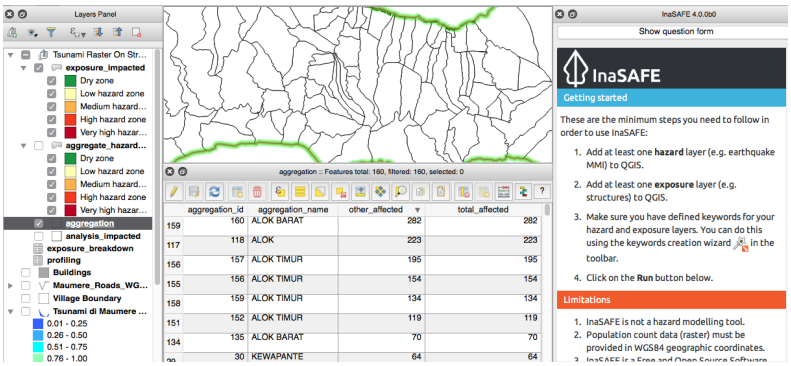
12.5. Hazard Aggregation Summary

An **hazard aggregation summary** is created during an InaSAFE analysis. This layer is a cross product between the hazard layer, the aggregate layer and the exposure summary layer. The layer geometries are firstly a union between the hazard layer and the aggregation layer. If the exposure is indivisible (e.g. building polygons) or point based (e.g. places, building points), the the aggregate hazard impacted layer will include a count of the number of features per intersected aggregate hazard polygon and, if

applicable, either the length or the area of the exposure features contained within each polygon. If the exposure data is divisible (e.g. landcover polygons), those polygons will again be unioned with the output from the aggregation layer / hazard layer intersection process. As well as simple metrics of area or distance, additional columns will be writen to the aggregate hazard layer breaking down features by their classes and providing other similar metrics.

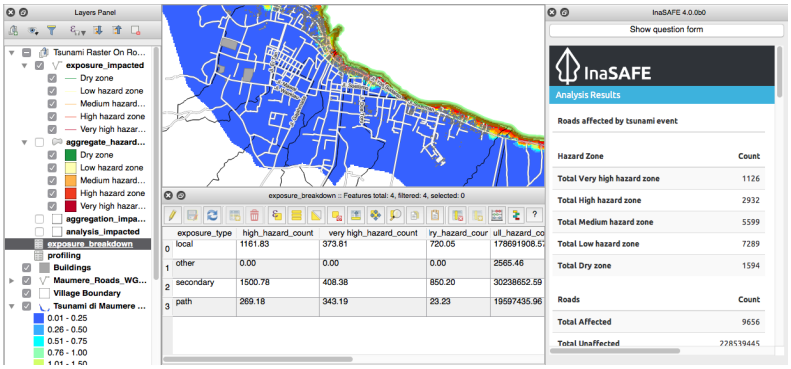
12.6. Aggregation Summary

This **aggregation summary** contains the analysis results for each exposure type by hazard type, summarised by aggregation area. Where an aggregation layer was not used; the analysis area is defined by the extent of the input layers or the 'analysis extent' set by the user.



12.7. Exposure Summary Table

This **exposure summary table** contains the analysis results for exposure type by hazard type, summarised by exposure type. It includes totals for affected and not affected status. It is used to generate reports and can be exported to a spreadsheet for further analysis.



12.8. Analysis Log

The **analysis log** contains information intended for developers and power users. The data in the analysis log can be sent to the developers of InaSAFE if you encounter long processing times. They will use the information to identify processing bottlenecks.

13. All Units

Name	Plural	Abbreviation	Details
Feet	feet	ft	**Feet** are an imperial unit of measure. There are 12 inches in 1 foot and 3 feet in 1 yard.
Generic	generic	generic	A generic unit for value that does not have unit or we do not know about the unit. It also can be used for normalised values.

kg/m2	kg/m2	kg/m2	**Kilograms per square metre** is a metric unit of measure where the weight is specified according to area. This unit is relevant for hazards such as volcanic ash.
km/h	km/h	km/h	**The kilometre per hour** is a unit of speed, expressing the number of kilometres covered in one hour.
mph	mph	mph	**The mile per hour** is a unit of speed, expressing the number of statute miles covered in one hour.
kn	kn	kn	**The knot** is a unit of speed, expressing the number of nautical miles covered in one hour.
m/s	m/s	m/s	**The Metres per second** is a unit of speed, expressing the number of metres covered in one second.
Kilometres	kilometres	km	**Kilometres** are a metric unit of measure. There are 1000 metres in 1 kilometre (km).
Metres	metres	m	**Metres** are a metric unit of measure. There are 100 centimetres in 1 metre.
Millimetres	millimetres	mm	**Millimetres** are a metric unit of measure. There are 1000 millimetres in 1 metre.
Centimetres	centimetres	cm	**Centimetres** are a metric unit of measure. There are 100 centimetres in 1 metre.
Square Metres	square metres	m^2	**Square Metres** are a metric unit of measure.
Hectare	hectares	ha	**Hectare** is an SI accepted metric system unit of area equal to 100 ares (10,000 m^2) and primarily used in the measurement of land
MMI	MMI	MMI	The **Modified Mercalli Intensity (MMI)** scale describes the intensity of ground shaking from a earthquake based on the effects observed by people at the surface.
Percentage	percentages	%%	Percentage values ranges from 0 to 100. It represents a ratio of hundred.
Count	Count		Number of people (or any other exposure element) per pixel, building or area. In a raster file, a pixel would have a value assigned to it representing the number (or count) of people in that pixel. In a vector file, a value would be assigned to an object (e.g. a building or area) representing the number of people in that object.
Density	Density	#	Number of people (or any other exposure element) per unit of area. e.g. 35 people per km^2
Unit	Units	#	Exposure unit defines the unit for the exposure, for example people can either be measured as count or density (count per area.
Thousand	Thousands	#	None or Null found from the data.
Million	Millions	#	None or Null found from the data.

Billion	Billions	#	None or Null found from the data.
Trillion	Trillions	#	None or Null found from the data.

14. Post Processors

14.1. Post Processor Input Types

Name	Description
constant	This type of input takes a constant value.
field	This type of input takes a value from a field.
dynamic_field	This type of input takes value from a dynamic field. It will require some additional parameter details.
keyword	This type of input takes value from a keyword for the layer being handled.
needs_profile	This type of input takes a value from current InaSAFE minimum needs profile.
geometry_property	This type of input takes a value from the geometry property.
layer_property	This type of input takes it's value from a layer property. For example the layer Coordinate Reference System of the layer.

14.2. Post Processor Input Values

Name	Description
size_calculator	This is a value for the layer_property input type. It retrieves Size Calculator of the layer CRS
layer_crs	This is a value for layer_property input type. It retrieves the layer Coordinate Reference System (CRS).
layer_property	This type of input takes it's value from a layer property. For example the layer Coordinate Reference System of the layer.

14.3. Post Processor Process Types

Name	Description
formula	This type of process is a formula which is interpreted and executed by the post processor.
function	This type of process takes inputs as arguments and processes them by passing them to a Python function.

14.4. Post Processors

Name	Input Fields	Output Fields
Size Value Post Processor	◦ geometry ◦ size_calculator	◦ Geometric Size function. : size (Simple postprocessor where we compute the size of a feature. :param geometry: The geometry. :type geometry: QgsGeometry :param size_calculator: The size calculator. :type size_calculator: safe.gis.vector.tools.SizeCalculator :return: The size.)
	A post processor to calculate the size of the feature. The unit is defined in the exposure definition.	

Affected Post Processor	◦ classification ◦ exposure ◦ hazard ◦ hazard_class	◦ Affected function. : post_processor_affected_function (Private function used in the affected postprocessor. It returns a boolean if it's affected or not, or not exposed. :param exposure: The exposure to use. :type exposure: str :param hazard: The hazard to use. :type hazard: str :param classification: The hazard classification to use. :type classification: str :param hazard_class: The hazard class of the feature. :type hazard_class: str :return: If this hazard class is affected or not. It can be `not exposed`. The not exposed value returned is the key defined in `hazard_classification.py` at the top of the file. :rtype: bool,'not exposed')
	A post processor to determine if a feature is affected or not (according to the hazard classification). It can be "not exposed".	
Population Fatality Ratio Post Processor	◦ classification ◦ earthquake_hazard ◦ hazard_class ◦ population ◦ population_exposure	◦ Fatality Ratio function. : post_processor_population_fatality_function (Private function used in the fatality postprocessor. :param classification: The hazard classification to use. :type classification: str :param hazard_class: The hazard class of the feature. :type hazard_class: str :param population: We don't use this value here. It's only used for condition for the postprocessor to run. :type population: float, int :return: The displacement ratio for a given hazard class. :rtype: float)
	A post processor to add the population fatality ratio according to the hazard class. Only the MMI classification has a fatality model.	
Fatalities Post Processor	◦ fatality_ratio ◦ population ◦ population_exposure	◦ Fatalities formula. : population * fatality_ratio
	A post processor to calculate the number of fatalities.	
Population Displacement Ratio Post Processor	◦ classification ◦ hazard ◦ hazard_class ◦ population ◦ population_exposure	◦ Population Displacement Ratio function. : post_processor_population_displacement_function (Private function used in the displacement postprocessor. :param hazard: The hazard to use. :type hazard: str :param classification: The hazard classification to use. :type classification: str :param hazard_class: The hazard class of the feature. :type hazard_class: str :param population: We don't use this value here. It's only used for condition for the postprocessor to run. :type population: float, int :return: The displacement ratio for a given hazard class. :rtype: float)
	A post processor to add the population displacement ratio according to the hazard class	
Displaced Post Processor	◦ displacement_ratio ◦ fatalities ◦ population ◦ population_exposure	◦ Displaced formula. : (population – fatalities) * displacement_ratio
	A post processor to calculate the number of displaced people. "Displaced" is defined as: Displaced people are people who, for different reasons and circumstances because of risk or disaster, have to leave their place of residence. In InaSAFE, demographic and minimum needs reports are based on displaced / evacuated people.	

Distance Post Processor	◦ distance_calculator ◦ earthquake_hazard ◦ latitude ◦ longitude ◦ place_exposure ◦ place_geometry	◦ Distance function. : calculate_distance (Simple postprocessor where we compute the distance between two points. :param distance_calculator: The size calculator. :type distance_calculator: safe.gis.vector.tools.SizeCalculator :param latitude: The latitude to use. :type latitude: float :param longitude: The longitude to use. :type longitude: float :param place_geometry: Geometry of place. :type place_geometry: QgsGeometry :param earthquake_hazard: The hazard to use. :type earthquake_hazard: str :param place_exposure: The exposure to use. :type place_exposure: str :return: distance :rtype: float)
	A post processor to calculate the distance between two points.	
Bearing Angle Post Processor	◦ earthquake_hazard ◦ latitude ◦ longitude ◦ place_exposure ◦ place_geometry	◦ Bearing Angle function. : calculate_bearing (Simple postprocessor where we compute the bearing angle between two points. :param place_geometry: Geometry of place. :type place_geometry: QgsGeometry :param latitude: The latitude to use. :type latitude: float :param longitude: The longitude to use. :type longitude: float :param earthquake_hazard: The hazard to use. :type earthquake_hazard: str :param place_exposure: The exposure to use. :type place_exposure: str :return: Bearing angle :rtype: float)
	A post processor to calculate the bearing angle between two points.	
Cardinality Post Processor	◦ angle ◦ earthquake_hazard ◦ place_exposure	◦ Direction function. : calculate_cardinality (Simple postprocessor where we compute the cardinality of an angle. :param angle: Bearing angle. :type angle: float :param earthquake_hazard: The hazard to use. :type earthquake_hazard: str :param place_exposure: The exposure to use. :type place_exposure: str :return: Cardinality text. :rtype: str)
	A post processor to calculate the cardinality of an angle.	
Male Post Processor	◦ male_ratio ◦ population_displaced ◦ population_exposure	◦ Male Displaced Count formula. : population_displaced * male_ratio
	A post processor to calculate the number of displaced males."Male" is defined as: Relating to the characteristics of men.. "Displaced" is defined as: Displaced people are people who, for different reasons and circumstances because of risk or disaster, have to leave their place of residence. In InaSAFE, demographic and minimum needs reports are based on displaced / evacuated people.	
Female Post Processor	◦ female_ratio ◦ population_displaced ◦ population_exposure	◦ Female Displaced Count formula. : population_displaced * female_ratio
	A post processor to calculate the number of displaced females."Female" is defined as: Relating to the characteristics of women.. "Displaced" is defined as: Displaced people are people who, for different reasons and circumstances because of risk or disaster, have to leave their place of residence. In InaSAFE, demographic and minimum needs reports are based on displaced / evacuated people.	
Weekly Hygiene Packs Post Processor	◦ female_displaced ◦ hygiene_packs_ratio ◦ population_exposure	◦ Weekly Hygiene Packs function. : multiply (Simple postprocessor where we multiply the input values. :param kwargs: Dictionary of values to multiply :type kwargs: dict :return: The result. :rtype: float)

	A post processor to calculate needed hygiene packs weekly for women who are displaced. "Displaced" is defined as: Displaced people are people who, for different reasons and circumstances because of risk or disaster, have to leave their place of residence. In InaSAFE, demographic and minimum needs reports are based on displaced / evacuated people.	
Infant Post Processor	◦ infant_ratio ◦ population_displaced ◦ population_exposure	◦ Infant Displaced Count function. : multiply (Simple postprocessor where we multiply the input values. :param kwargs: Dictionary of values to multiply :type kwargs: dict :return: The result. :rtype: float)
	A post processor to calculate the number of displaced infant. "Infant" is defined as: A very young child or baby aged between 0 and 4 years. "Displaced" is defined as: Displaced people are people who, for different reasons and circumstances because of risk or disaster, have to leave their place of residence. In InaSAFE, demographic and minimum needs reports are based on displaced / evacuated people.	
Child Post Processor	◦ child_ratio ◦ population_displaced ◦ population_exposure	◦ Child Displaced Count function. : multiply (Simple postprocessor where we multiply the input values. :param kwargs: Dictionary of values to multiply :type kwargs: dict :return: The result. :rtype: float)
	A post processor to calculate the number of displaced child. "Child" is defined as: A young person aged between 5 and 14 years, usually below the age of puberty. "Displaced" is defined as: Displaced people are people who, for different reasons and circumstances because of risk or disaster, have to leave their place of residence. In InaSAFE, demographic and minimum needs reports are based on displaced / evacuated people.	
Youth Post Processor	◦ population_displaced ◦ population_exposure ◦ youth_ratio	◦ Youth Displaced Count function. : multiply (Simple postprocessor where we multiply the input values. :param kwargs: Dictionary of values to multiply :type kwargs: dict :return: The result. :rtype: float)
	A post processor to calculate the number of displaced youth. "Youth" is defined as: A person aged between 0 and 14 years. "Displaced" is defined as: Displaced people are people who, for different reasons and circumstances because of risk or disaster, have to leave their place of residence. In InaSAFE, demographic and minimum needs reports are based on displaced / evacuated people.	
Adult Post Processor	◦ adult_ratio ◦ population_displaced ◦ population_exposure	◦ Adult Displaced Count function. : multiply (Simple postprocessor where we multiply the input values. :param kwargs: Dictionary of values to multiply :type kwargs: dict :return: The result. :rtype: float)
	A post processor to calculate the number of displaced adults. "Adult" is defined as: Person aged between 15 and 64 years, usually of working age.. "Displaced" is defined as: Displaced people are people who, for different reasons and circumstances because of risk or disaster, have to leave their place of residence. In InaSAFE, demographic and minimum needs reports are based on displaced / evacuated people.	
Elderly Post Processor	◦ elderly_ratio ◦ population_displaced ◦ population_exposure	◦ Elderly Displaced Count function. : multiply (Simple postprocessor where we multiply the input values. :param kwargs: Dictionary of values to multiply :type kwargs: dict :return: The result. :rtype: float)
	A post processor to calculate the number of displaced elderly people. "Elderly" is defined as: Persons aged 65 years and over.. "Displaced" is defined as: Displaced people are people who, for different reasons and circumstances because of risk or disaster, have to leave their place of residence. In InaSAFE, demographic and minimum needs reports are based on displaced / evacuated people.	
Taco Post Processor	◦ amount ◦ population	◦ Taco function. : multiply (Simple postprocessor where we multiply the input values. :param kwargs: Dictionary of values to multiply :type kwargs: dict :return: The result. :rtype: float)

	A displaced person should be provided with 100.0 piece/ pieces/ NULL of Taco. Though no less than 0.0 and no more than 100.0. This should be provided weekly.	
Under 5 Years Old Post Processor	◦ population_displaced ◦ population_exposure ◦ under_5_ratio	◦ Under 5 Displaced Count function. : multiply (Simple postprocessor where we multiply the input values. :param kwargs: Dictionary of values to multiply :type kwargs: dict :return: The result. :rtype: float)
	A post processor to calculate the number of displaced under 5 years old. "Under 5 Years Old" is defined as: Persons aged under 5 years. "Displaced" is defined as: Displaced people are people who, for different reasons and circumstances because of risk or disaster, have to leave their place of residence. In InaSAFE, demographic and minimum needs reports are based on displaced / evacuated people.	
Over 60 Years Old Post Processor	◦ over_60_ratio ◦ population_displaced ◦ population_exposure	◦ Over 60 Years Displaced Count function. : multiply (Simple postprocessor where we multiply the input values. :param kwargs: Dictionary of values to multiply :type kwargs: dict :return: The result. :rtype: float)
	A post processor to calculate the number of displaced over 60 years old. "Over 60 Years Old" is defined as: Persons aged 60 years and over. "Displaced" is defined as: Displaced people are people who, for different reasons and circumstances because of risk or disaster, have to leave their place of residence. In InaSAFE, demographic and minimum needs reports are based on displaced / evacuated people.	
Disability Vulnerability Post Processor	◦ over_60_ratio ◦ population_displaced ◦ population_exposure	◦ Disabled Displaced Count function. : multiply (Simple postprocessor where we multiply the input values. :param kwargs: Dictionary of values to multiply :type kwargs: dict :return: The result. :rtype: float)
	A post processor to calculate the number of displaced people who are especially vulnerable because they have disabilities. "Disabled" is defined as: A person having a physical or mental condition that limits their movements, senses, or activities.. "Displaced" is defined as: Displaced people are people who, for different reasons and circumstances because of risk or disaster, have to leave their place of residence. In InaSAFE, demographic and minimum needs reports are based on displaced / evacuated people.	
Child Bearing Age Post Processor	◦ child_bearing_age_ratio ◦ population_displaced ◦ population_exposure	◦ Child Bearing Age Displaced Count function. : multiply (Simple postprocessor where we multiply the input values. :param kwargs: Dictionary of values to multiply :type kwargs: dict :return: The result. :rtype: float)
	A post processor to calculate the number of displaced child bearing age. "Child Bearing Age" is defined as: The span of ages (usually 15–49) at which individuals are capable of becoming parents. The phrase can be applied to men and women but most frequently refers to women. "Displaced" is defined as: Displaced people are people who, for different reasons and circumstances because of risk or disaster, have to leave their place of residence. In InaSAFE, demographic and minimum needs reports are based on displaced / evacuated people.	
Pregnant Post Processor	◦ population_displaced ◦ population_exposure ◦ pregnant_ratio	◦ Lactating Displaced Count function. : multiply (Simple postprocessor where we multiply the input values. :param kwargs: Dictionary of values to multiply :type kwargs: dict :return: The result. :rtype: float)
	A post processor to calculate the number of displaced pregnant women. "Pregnant" is defined as: A female having a child developing in the uterus. "Displaced" is defined as: Displaced people are people who, for different reasons and circumstances because of risk or disaster, have to leave their place of residence. In InaSAFE, demographic and minimum needs reports are based on displaced / evacuated people.	

Lactating Women Post Processor	◦ lactating_lactating_ratio ◦ population_displaced ◦ population_exposure	◦ Pregnant Displaced Count function. : multiply (Simple postprocessor where we multiply the input values. :param kwargs: Dictionary of values to multiply :type kwargs: dict :return: The result. :rtype: float)
	A post processor to calculate the number of displaced lactating women. "Lactating" is defined as: A female producing milk to feed a baby. "Displaced" is defined as: Displaced people are people who, for different reasons and circumstances because of risk or disaster, have to leave their place of residence. In InaSAFE, demographic and minimum needs reports are based on displaced / evacuated people.	
Productivity Post Processor	◦ productivity_rate ◦ size	◦ Productivity formula. : productivity_rate * size
	A post processor to calculate the productivity for each feature.	
Production Cost Post Processor	◦ production_cost_rate ◦ size	◦ Production Cost formula. : production_cost_rate * size
	A post processor to calculate the production cost for each feature	
Production Value Post Processor	◦ production_value_rate ◦ size	◦ Production Value formula. : production_value_rate * size
	A post processor to calculate the production value for each feature	
Additional Weekly Rice kg for Pregnant and Lactating Women Post Processor	◦ additional_rice_ratio ◦ lactating_displaced ◦ pregnant_displaced	◦ Additional Weekly Rice kg for Pregnant and Lactating Women formula. : (pregnant_displaced + lactating_displaced) * additional_rice_ratio
	A post processor to calculate additional rice for pregnant and lactating women who are displaced. "Displaced" is defined as: Displaced people are people who, for different reasons and circumstances because of risk or disaster, have to leave their place of residence. In InaSAFE, demographic and minimum needs reports are based on displaced / evacuated people.	

15. Reporting

Note: This section of the help documentation is intended for advanced users who want to modify reports which are produced by InaSAFE.

15.1. Overview

Whenever InaSAFE completes an analysis, it will automatically generate a number of reports. Some of these reports are based on templates that are shipped with InaSAFE, and can be customised or over-ridden by creating your own templates. The following reports are produced in InaSAFE:

Name	Customisable?	Example	Description
Infographic report	Yes		Only generated for cases where the exposure dataset is population, the infographic report provides a visual "at a glance" overview of the impacts population. It uses the Indonesian minimum needs profile, so users in other countries should probably implement a customised version of this report which caters for their local minimum needs profile.

Impact report	No		The impact report provides a tabular overview of the analysis including details of the analysis question, the general report, the minimum needs and other demographic breakdowns (when exposure is population), a list of notes and assumptions and basic details of the datasets used in the analysis.
Portrait map	Yes		A standard map report is produced in a portrait layout for this report. We provide both portrait and landscape layouts so that the reports can accommodate different shapes of reporting area. The master template for this report is found in the InaSAFE plugin directory under "resources/qgis-composer-templates/inasafe-map-report-portrait.qpt". If you make a copy of this report to your "/.qgis2/inasafe" directory, you can edit this copy and override the default layout and content options provided by InaSAFE. See also the manual for details about expressions and composer elements that you can use in your reports. In addition to this basic override mechanism, you can provide hazard / exposure specific variants of this template by using the following path and naming convention: "(home)/.qgis2/inasafe/inasafe-map-report-portrait-(hazard)-(exposure).qpt" (where (home) is replaced by the path to your home directory, (hazard) by the class of hazard, and (exposure) by the class of exposure).
Landscape map	Yes		A standard map report is produced in a landscape layout. We provide both portrait and landscape layouts so that the reports can accommodate different shapes of reporting area. The master template for this report is found in the InaSAFE plugin directory under "resources/qgis-composer-templates/inasafe-map-report-landscape.qpt". If you make a copy of this report to your "/.qgis2/inasafe" directory, you can edit this copy and override the default layout and content options provided by InaSAFE. See also the manual for details about expressions and composer elements that you can use in your reports. In addition to this basic override mechanism, you can provide hazard / exposure specific variants of this template by using the following path and naming convention: "(home)/.qgis2/inasafe/inasafe-map-report-landscape-(hazard)-(exposure).qpt" (where (home) is replaced by the path to your home directory, (hazard) by the class of hazard, and (exposure) by the class of exposure).
Action checklist	No		The action checklist report provides a list of actions for the DRR practitioner to be aware of or think about. These include general items such as "how will warnings be disseminated?" and specific items such as things that relate to displaced people if the exposure of the analysis is population.

Analysis provenance	No		When providing a report generated by InaSAFE to a decision make, it is important that there is accompanying information that describes which datasets were used, what settings were used, and so on. The provenance report is designed to address this need by providing detailed technical information about the analysis.

In the sections that follow, we provide more technical information about the custom QGIS Expressions and special template elements that can be used to customise your templates.

15.2. QGIS Expressions

InaSAFE adds a number of expressions that can be used to conveniently obtain provenance data to the active analysis results. The expressions can also be used elsewhere in QGIS as needed..

Name	Description
action_checklist_report	Retrieve the action checklist section from InaSAFE analysis report of current selected analysis. Examples: ◦ **action_checklist_report()**
additional_minimum_needs_section_header_element	Retrieve additional minimum needs section header string from definition. Examples: ◦ **additional_minimum_needs_section_header_element()**
age_gender_section_header_element	Retrieve age gender section header string from definitions. Examples: ◦ **age_gender_section_header_element()**
age_gender_section_notes_element	Retrieve age gender section notes string from definitions. Examples: ◦ **age_gender_section_notes_element()**
aggregation_not_used_text_element	Retrieve reference title header string from definitions. Examples: ◦ **aggregation_not_used_text_element()**

aggregation_postprocessors_report	Retrieve the aggregation postprocessors section from InaSAFE analysis report of current selected analysis. Examples: ◦ **aggregation_postprocessors_report()**
aggregation_result_report	Retrieve the aggregation result section from InaSAFE analysis report of current selected analysis. Examples: ◦ **aggregation_result_report()**
analysis_detail_report	Retrieve the analysis detail section from InaSAFE analysis report of current selected analysis. Examples: ◦ **analysis_detail_report()**
analysis_provenance_details_report	Retrieve the analysis provenance details section from InaSAFE analysis report of current selected analysis. Examples: ◦ **analysis_provenance_details_report()**
analysis_question_report	Retrieve the analysis question section from InaSAFE analysis report of current selected analysis. Examples: ◦ **analysis_question_report()**
analysis_summary_report	Retrieve an HTML table report of current selected analysis. Examples: ◦ **analysis_summary_report()**
analysis_title_header_element	Retrieve analysis title header string from definitions. Examples: ◦ **analysis_title_header_element()**

bearing_to_nearest_place	If the impact layer has a distance field, it will return the bearing to the nearest place in degrees. Examples: ◦ **bearing_to_nearest_place()** → 280
beautify_date	Given an InaSAFE analysis time, it will convert it to a date with year-month-date format. Examples: ◦ **beautify_date(@start_datetime)** → will convert datetime provided by qgis_variable.
beautify_time	Given an InaSAFE analysis time, it will convert it to a time with hour:minute format. Examples: ◦ **beautify_date(@start_datetime)** → will convert datetime provided by qgis_variable.
caution_text_element	Retrieve caution text string from definitions. Examples: ◦ **caution_text_element()**
caution_title_header_element	Retrieve caution title header string from definitions. Examples: ◦ **caution_title_header_element()**
crs_text_element	Retrieve coordinate reference system text string from definitions. Examples: ◦ **crs_text_element('EPSG:3857')** → Coordinate Reference System - WGS 84 / Pseudo Mercator
default_inasafe_html_resources	Retrieve default InaSAFE HTML resources (style and script) from InaSAFE analysis report of current selected analysis. Examples: ◦ **inasafe_html_resources()**

direction_to_nearest_place	If the impact layer has a distance field, it will return the direction to the nearest place. Examples: ◦ **direction_to_nearest_place()** → NW
disclaimer_text_element	Retrieve disclaimer text string from definitions. Examples: ◦ **disclaimer_text_element()**
disclaimer_title_header_element	Retrieve disclaimer title header string from definitions. Examples: ◦ **disclaimer_title_header_element()**
distance_to_nearest_place	If the impact layer has a distance field, it will return the distance to the nearest place in metres. Examples: ◦ **distance_to_nearest_place()** → 1234
female_vulnerability_section_header_element	Retrieve female vulnerability section header string from definitions. Examples: ◦ **female_vulnerability_section_header_element()**
general_report	Retrieve the general report section from InaSAFE analysis report of current selected analysis. Examples: ◦ **general_report()**
hazard_extra_keyword	Given a keyword, it will return the value of the keyword from the hazard layer's extra keywords. Examples: ◦ **hazard_extra_keyword('depth')** → will return the value of 'depth' in current hazard layer's extra keywords Available keywords:

- **earthquake_x_minimum** → The minimum value of x coordinate of the shakemaps. It indicates the extent of the event.

- **volcano_alert_level** → This information shows the estimated severity level of the model. It is usually a choice between Normal, Advisory, Watch, or Warning.

- **analysis_type** → Analysis type

- **earthquake_magnitude** → The magnitude of the earthquake in Richter scale.

- **volcano_height** → The height of the vent of a volcano. It is calculated from the sea level in metres.

- **flood_event_time** → The time of the flood event.

- **volcano_eruption_height** → The ash column height. It is calculated from the vent of the volcano in metres.

- **flood_event_id** → The ID of the flood event. It is constructed from the timestamp of the flood in YYYYMMDDHH-[extra information]. The extra information can be a period and the region level, for example 6-province that represent 6 hours period and province level.

- **earthquake_x_maximum** → The maximum value of x coordinate of the shakemaps. It indicates the extent of the event.

- **volcano_latitude** → The latitude of the volcano.

- **earthquake_latitude** → The latitude of the earthquake epicentre.

- **earthquake_event_time** → The time of the earthquake happen.

- **volcano_name** → The name of the volcano.

- **earthquake_longitude** → The longitude of the earthquake epicentre.

- **volcano_longitude** → The longitude of the volcano.

- **earthquake_y_maximum** → The maximum value of y coordinate of the shakemaps. It indicates the extent of the event.

- **earthquake_event_id** → The ID of the earthquake event or shakemap. It is constructed from the timestamp of the event in YYYYMMDDHHmmSS format.

- **earthquake_description** → Additional description of the earthquake event.

- **volcano_forecast_duration** → The duration in which the volcanic ash model is valid. It is calculated after the model is generated and the value varies between 1 day or 3 day(s). After this duration, the forecast information in the model is expired.

- **time_zone** → Time zone

- **earthquake_source** → Source of the earthquake, it can be initial or post-processed (data-informed).

- **earthquake_y_minimum** → The minimum value of y coordinate of the shakemaps. It indicates the extent of the event.

- **earthquake_location** → The location information of the earthquake event. It usually refers to the nearest city in the location.

- **volcano_event_id** → The ID of the volcano eruption. It is constructed from YYYYMMDDHHmm[zoneoffset]_[volcano_name]. YYYYMMDDHHmm is the format of the eruption event time. [zone offset] is the offset of its time zone. [volcano_name] is the name of the volcano. For example: 201712012200+0800_Agung

- **volcano_eruption_event_time** → The time of the eruption of the volcano.

- **earthquake_depth** → The depth of earthquake epicentre in kilometre unit.

inasafe_analysis_summary_field_value	Retrieve a value from a field in the analysis summary layer. Examples: • **inasafe_analysis_summary_field_value('total_not_exposed')** → 3
inasafe_exposure_summary_field_values	Retrieve all values from a field in the exposure summary layer. Examples: • **inasafe_exposure_summary_field_values('exposure_name')** → ['jakarta']
inasafe_field_header	Retrieve a header name of the field name from definitions. Examples: • **inasafe_field_header('minimum_needs__clean_water')** → Clean water
inasafe_logo_black_path	Retrieve the full path of inasafe-logo-black.svg Examples: • **inasafe_logo_black_path()**
inasafe_logo_white_path	Retrieve the full path of inasafe-logo-white.svg. Examples: • **inasafe_logo_white_path()**
inasafe_place_value_coefficient	Given a number, it will return the coefficient of the place value name. It needs to be used with inasafe_number_denomination_unit. Examples: • **inasafe_place_value_coefficient(1700)** → 1.7 • **inasafe_place_value_coefficient(10)** → 1

inasafe_place_value_name	Given a number, it will return the place value name. It needs to be used with inasafe_place_value_coefficient. Examples: ◦ **inasafe_place_value_name(1700)** → Thousand ◦ **inasafe_place_value_name(10)** → Ten
inasafe_place_value_percentage	Given a number and total, it will return the percentage of the number to the total. Examples: ◦ **inasafe_place_value_percentage(50,100)** → 50.0% ◦ **inasafe_place_value_percentage(inasafe_analysis_summary_field_value('female_displaced'), inasafe_analysis_summary_field_value('displaced'))** → will calculate the percentage of female displaced count to total displaced count.
inasafe_sub_analysis_summary_field_value	Retrieve a value from a field in the sub analysis summary layer from a multi exposure analysis layer. Examples: ◦ **inasafe_sub_analysis_summary_field_value('population', 'total_not_exposed')** → 3
infographic_header_element	Get a formatted infographic header sentence for an impact function. Examples: ◦ **infographic_header_element('flood')** → Estimated impact of a flood
information_title_header_element	Retrieve information title header string from definitions. Examples: ◦ **information_title_header_element()**
land_cover_analysis_summary_report	Retrieve an HTML land cover analysis table report from a multi exposure analysis. Examples: ◦ **land_cover_analysis_summary_report()**

legend_title_header_element	Retrieve legend title header string from definitions. Examples: ◦ **legend_title_header_element()**
map_overview_header_element	Retrieve map overview header string from definitions. Examples: ◦ **map_overview_header_element()**
minimum_needs_report	Retrieve the minimum needs section from InaSAFE analysis report of current selected analysis. Examples: ◦ **minimum_needs_report()**
minimum_needs_section_header_element	Retrieve minimum needs section header string from definitions. Examples: ◦ **minimum_needs_section_header_element()**
minimum_needs_section_notes_element	Retrieve minimum needs section notes string from definitions. Examples: ◦ **minimum_needs_section_notes_element()**
minimum_needs_unit	Retrieve units of the given minimum needs field name. Examples: ◦ **minimum_needs_unit('minimum_needs__clean_water')** → l/weekly
mmi_detail_report	Retrieve the mmi detail section from InaSAFE analysis report of current selected analysis. Examples: ◦ **mmi_detail_report()**

multi_exposure_analysis_summary_report	Retrieve an HTML multi exposure analysis table report. Examples: ◦ **multi_exposure_analysis_summary_report()**
name_of_the_nearest_place	If the impact layer has a distance field, it will return the name of the nearest place. Examples: ◦ **name_of_the_nearest_place()** → Tokyo
north_arrow_path	Retrieve the full path of user specified north arrow image. If the custom north arrow logo is not found, it will return the default north arrow image. Examples: ◦ **north_arrow_path()**
notes_assumptions_report	Retrieve the notes assumptions section from InaSAFE analysis report of current selected analysis. Examples: ◦ **notes_assumptions_report()**
organisation_logo_path	Retrieve the full path of user specified organisation logo. If the custom organisation logo is not found, it will return the default organisation logo. Examples: ◦ **organisation_logo_path()**
people_section_header_element	Retrieve people section header string from definitions. Examples: ◦ **people_section_header_element()**
place_analysis_summary_report	Retrieve an HTML place analysis table report from a multi exposure analysis. Examples: ◦ **place_analysis_summary_report()**

population_analysis_summary_report	Retrieve an HTML population analysis table report from a multi exposure analysis. Examples: • **population_analysis_summary_report()**
population_chart_header_element	Retrieve population chart header string from definitions. Examples: • **population_chart_header_element()**
reference_title_header_element	Retrieve reference title header string from definitions. Examples: • **reference_title_header_element()**
road_analysis_summary_report	Retrieve an HTML road analysis table report from a multi exposure analysis. Examples: • **road_analysis_summary_report()**
source_title_header_element	Retrieve source title header string from definitions. Examples: • **source_title_header_element()**
structure_analysis_summary_report	Retrieve an HTML structure analysis table report from a multi exposure analysis. Examples: • **structure_analysis_summary_report()**
time_title_header_element	Retrieve time title header string from definitions. Examples: • **time_title_header_element()**

unknown_source_text_element	Retrieve reference title header string from definitions. Examples: ◦ **unknown_source_text_element()**
version_title_header_element	Retrieve version title header string from definitions. Examples: ◦ **version_title_header_element()**
vulnerability_section_header_element	Retrieve vulnerability section header string from definitions. Examples: ◦ **vulnerability_section_header_element()**

15.3. Composer Elements

InaSAFE looks for elements with specific id's on the composer page and replaces them with InaSAFE specific content.

ID	Description
people-section-notes	If used, the element-id "people-section-notes" in the composer layout will be replaced by text explaining the different groups of people reported on (displaced, exposed, etc.).
population-chart-legend	If used, the element-id "population-chart-legend" in the composer layout will be replaced by a chart illustrating the number of people in different groups (displaced, exposed, etc.).

16. Developer Guide

This section of the help documentation is intended for advanced users who want to modify the internals of InaSAFE. It assumes that you have basic coding skills. All examples are in python unless otherwise stated.

16.1. Defining a new hazard type

16.1.1. Background

In the previous versions of InaSAFE, we spent a lot of effort building one impact function per hazard/exposure combination (and sometimes multiple impact functions per combination). In our new architecture, we try to deal with everything in the same way - by following a standardized process of converting the hazard dataset into a classified polygon layer and then calculating the impacted and affected areas using a standard work-flow. A simplified version of this work-flow is described in illustration 1.

Because of this change, you will no longer see an impact function selector in the dock widget and there are no longer any 'impact function options' as we had in previous versions of InaSAFE. In the new system, almost all

configuration is managed through metadata (created using the keywords wizard).

Also, in all versions prior to Version 4.0, we made heavy use of interpolation in order to determine whether buildings or other exposure layers are impacted. While this is a commonly used technique in GIS, it often leads to non - intuitive looking reports. Under our new architecture, we always use geometric overlay operations to make a determination whether an exposure feature is affected or not. The implication of this is that we produce intuitive and easily verifiable impact layers. You can see an example in Illustration 2.

Stepping away from the two previously mentioned paradigms allows us to simply add new hazard types to the metadata driven impact function by adding new metadata types to the InaSAFE sources. In the next chapter we show you how this was achieved and how it can be repeated for further hazards using the example of tropical cyclones.

16.1.2. Adding a new hazard

The whole work needed can be looked at in Pull Request #3539 . Please bear in mind that the paths of the files are now safe/definitions/xxx.py and not safe/definitionsv4/xxx.py since v4 is the default codebase. In the next sections we will show each file that needs to be extended in order to add a new hazard type.

16.1.3. safe/definitions/units.py

If you are adding an hazard that uses units that are not yet known to InaSAFE, you need to define them in units.py

```
unit_kilometres_per_hour = {
    'key': 'kilometres_per_hour',
    'name': tr('km/h'),
    'plural_name': tr('km/h'),
    'measure': tr('Speed'),
    'abbreviation': tr('km/h'),
    'description': tr(
        'The kilometre per hour is a unit of speed,
expressing the '
        'number of kilometres covered in one hour.'),
    'citations': [
        {
            'text': None,
            'link': None
        }
    ]
}
```

16.1.4. safe/definitions/colors.py

If you are adding an hazard that has more classes than any other hazards you'll need to add additional colors for the additional classes in colors.py. You might also define other colors if you don't want to use the standard colors. For the sake of homogeneous map reports, this addition should not be taken lightly.

```
very_dark_red = Qcolor('#710017')
```

16.1.5. safe/definitions/hazard_classifications.py

Add the classifications you want to make available for your new hazard type. You can add as many classes as you want in the classes list.

Also, a classification can support multiple units so you don't have to define different classifications just to have the same classification in two or more different units. These are defined in the multiple_units attribute of the classification.

```
cyclone_au_bom_hazard_classes = {
    'key': 'cyclone_au_bom_hazard_classes',
    'name': tr('Cyclone classes (AU - BOM)'),
    'description': tr(
        '**Tropical cyclone** intensity is classified using
five classes '
        'according to the Australian Bureau of
Meteorology. Tropical Cyclone '
        'intensity is defined as the maximum mean wind
speed over open flat '
        'land or water, averaged over a 10-minute period.
This is sometimes '
        'referred to as the maximum sustained wind and
will be experienced '
        'around the eye-wall of the cyclone.'),
    'type': hazard_classification_type,
    'citations': [
        {
            'text': tr(
                'Australian Bureau of Meteorology -
Tropical Cyclone '
                'Intensity and Impacts'),
            'link':

u'http://www.bom.gov.au/cyclone/about/intensity.shtml#WindC'

        },
        {
            'text': tr('Tropical cyclone scales -
wikpedia'),
            'link':
u'https://en.wikipedia.org/wiki/Tropical_cyclone_scales'
                    u'#Australia_and_Fiji'
        }
    ],
    'multiple_units': [
        unit_miles_per_hour,
        unit_kilometres_per_hour,
        unit_knots,
        unit_metres_per_second],
    'classes': [
        {
            'key': 'category_5',
            'value': 5,
            'color': very_dark_red,
            'name': tr('Category 5 (severe tropical
cyclone)'),
            'affected': True,
            'description': tr(
                'Extremely dangerous with widespread
destruction. A Category '
                '5 cyclone\'s strongest winds are VERY
DESTRUCTIVE winds with '
                'typical gusts over open flat land of more
than 151 kt. '
            ),
            'fatality_rate': None,
            'displacement_rate': 1.0,
            'numeric_default_min': {
                unit_knots['key']: 153,
                unit_metres_per_second['key']: 79,
                unit_miles_per_hour['key']: 176,
                unit_kilometres_per_hour['key']: 283
            },
            'numeric_default_max': big_number,
            'string_defaults': ['cat 5', 'category 5'],
            'citations': [
                {
                    'text': tr(
                        'Displacement rate is a
generalized estimate ('
                        'personal communication Craig
Arthur)'),
                    'link':
u'https://github.com/inasafe/inasafe/issues/3762'
                            u'#issuecomment-283839365'
                }
            ]
        },
        {
            'key': 'category_4',
```

```
            'value': 4,
            'color': dark_red,
            'name': tr('Category 4 (severe tropical
cyclone)'),
            'affected': True,
            'description': tr(
                'Significant roofing loss and structural
damage. Many '
                'caravans destroyed and blown away.
Dangerous airborne debris '
                '. Widespread power failures. A Category 4
cyclone\'s '
                'strongest winds are VERY DESTRUCTIVE
winds with typical '
                'gusts over open flat land of 122 - 151
kt. '
            ),
            'fatality_rate': None,
            'displacement_rate': 0.97,
            'numeric_default_min': {
                unit_knots['key']: 121,
                unit_metres_per_second['key']: 63,
                unit_miles_per_hour['key']: 140,
                unit_kilometres_per_hour['key']: 224
            },
            'numeric_default_max': {
                unit_knots['key']: 153,
                unit_metres_per_second['key']: 79,
                unit_miles_per_hour['key']: 176,
                unit_kilometres_per_hour['key']: 283
            },
            'string_defaults': ['cat 4', 'category 4'],
            'citations': [
                {
                    'text': tr(
                        'Displacement rate is a
generalized estimate ('
                        'personal communication Craig
Arthur)'),
                    'link':
u'https://github.com/inasafe/inasafe/issues/3762'
                            u'#issuecomment-283839365'
                }
            ]
        },
        {
            'key': 'category_3',
            'value': 3,
            'color': red,
            'name': tr('Category 3 (severe tropical
cyclone)'),
            'affected': True,
            'description': tr(
                'Some roof and structural damage. Some
caravans destroyed. '
                'Power failures likely. A Category 3
cyclone\'s strongest '
                'winds are VERY DESTRUCTIVE winds with
typical gusts over '
                'open flat land of 90 - 121 kt. '
            ),
            'fatality_rate': None,
            'displacement_rate': 0.55,
            'numeric_default_min': {
                unit_knots['key']: 90,
                unit_metres_per_second['key']: 47,
                unit_miles_per_hour['key']: 103,
                unit_kilometres_per_hour['key']: 167
            },
            'numeric_default_max': {
                unit_knots['key']: 121,
                unit_metres_per_second['key']: 63,
                unit_miles_per_hour['key']: 140,
                unit_kilometres_per_hour['key']: 224
            },
            'string_defaults': ['cat 3', 'category 3'],
            'citations': [
                {
                    'text': tr(
                        'Displacement rate is a
generalized estimate ('
```

```
                        'personal communication Craig
Arthur)'),
                    'link':
u'https://github.com/inasafe/inasafe/issues/3762'
                           u'#issuecomment-283839365'
                }
            ]
        },
        {
            'key': 'category_2',
            'value': 2,
            'color': orange,
            'name': tr('Category 2 (tropical cyclone)'),
            'affected': True,
            'description': tr(
                'Minor house damage. Significant damage to
signs, trees '
                'and caravans. Heavy damage to some crops.
Risk of '
                'power failure. Small craft may break
moorings. A Category 2 '
                'cyclone\'s strongest winds are
DESTRUCTIVE winds with '
                'typical gusts over open flat land of 68 -
89 kt. '
            ),
            'fatality_rate': None,
            'displacement_rate': 0.06,
            'numeric_default_min': {
                unit_knots['key']: 67,
                unit_metres_per_second['key']: 34,
                unit_miles_per_hour['key']: 77,
                unit_kilometres_per_hour['key']: 126
            },
            'numeric_default_max': {
                unit_knots['key']: 90,
                unit_metres_per_second['key']: 47,
                unit_miles_per_hour['key']: 103,
                unit_kilometres_per_hour['key']: 167
            },
            'string_defaults': ['cat 2', 'category 2'],
            'citations': [
                {
                    'text': tr(
                        'Displacement rate is a
generalized estimate ('
                        'personal communication Craig
Arthur)'),
                    'link':
u'https://github.com/inasafe/inasafe/issues/3762'
                           u'#issuecomment-283839365'
                }
            ]
        },
        {
            'key': 'category_1',
            'value': 1,
            'color': yellow,
            'name': tr('Category 1 (tropical cyclone)'),
            'affected': True,
            'description': tr(
                'Negligible house damage. Damage to some
crops, trees and '
                'caravans. Craft may drag moorings. A
Category 1 cyclone\'s '
                'strongest winds are GALES with typical
gusts over open '
                'flat land of 49 - 67 kt. '
            ),
            'fatality_rate': None,
            'displacement_rate': 0.0,
            'numeric_default_min': {
                unit_knots['key']: 49,
                unit_metres_per_second['key']: 24,
                unit_miles_per_hour['key']: 56,
                unit_kilometres_per_hour['key']: 90
            },
            'numeric_default_max': {
                unit_knots['key']: 67,
                unit_metres_per_second['key']: 34,
                unit_miles_per_hour['key']: 77,
```

```
                unit_kilometres_per_hour['key']: 126
            },
            'string_defaults': ['cat 1', 'category 1'],
            'citations': [
                {
                    'text': tr(
                        'Displacement rate is a
generalized estimate ('
                        'personal communication Craig
Arthur)'),
                    'link':
u'https://github.com/inasafe/inasafe/issues/3762'
                            u'#issuecomment-283839365'
                }
            ]
        },
        {
            'key': 'tropical_depression',
            'value': 0,
            'color': green,
            'name': tr('Tropical Depression'),
            'affected': False,
            'description': tr(
                'A tropical depression is a tropical
disturbance, that has a '
                'clearly defined surface circulation,
which has maximum '
                'sustained winds of less than 34 kt.'),
            'fatality_rate': None,
            'displacement_rate': 0.0,
            'numeric_default_min': 0,
            'numeric_default_max': {
                unit_knots['key']: 49,
                unit_metres_per_second['key']: 24,
                unit_miles_per_hour['key']: 56,
                unit_kilometres_per_hour['key']: 90
            },
            'string_defaults': ['tropical depression',
'no', 'false'],
            'citations': [
                {
                    'text': tr(
                        'Displacement rate is a
generalized estimate ('
                        'personal communication Craig
Arthur)'),
                    'link':
u'https://github.com/inasafe/inasafe/issues/3762'
                            u'#issuecomment-283839365'
                }
            ]
        },
    ],
    'exposures': [
        exposure_land_cover,
        exposure_place,
        exposure_population,
        exposure_road,
        exposure_structure
    ],
    'classification_unit': tr('cyclone category')
}
```

16.1.6. safe/gui/tools/wizard/wizard_strings.py

Define the questions for the wizard:

```
cyclone_kilometres_per_hour_question = tr('wind speed in
km/h')
```

```
cyclone_miles_per_hour_question = tr('wind speed in mph')
```

```
cyclone_knots_question = tr('wind speed in kn')
```

16.1.7. safe/definitions/hazard.py

Finally define new hazard and add it to the hazard_all list:

```
hazard_cyclone = {
    'key': 'cyclone',
    'name': tr('Cyclone'),
    'description': tr(
        'A **Tropical Cyclone** is a rapidly rotating storm
system '
        'characterised by a low-pressure centre, a closed
low-level '
        'atmospheric circulation, strong winds, and a
spiral arrangement '
        'of thunderstorms that produce heavy rain. It is
also referred '
        'to as **hurricane** in the Atlantic Ocean or **typhoon**
'
        'in the North West Pacific Ocean.'),
    'notes': [
        {
            'item_category': 'cyclone_general',
            'item_header': tr('cyclone general notes'),
            'item_list': [  # additional generic notes for
flood - IF has more
                tr('The analysis performed here only
considers the impact '
                   'of **severe winds** from tropical
cyclones. The impact '
                   'of other associated hazards (storm
surge inundation, '
                   'flood) must be analysed separately.'),
                caveat_simulation,
                caveat_local_conditions,
                caveat_analysis_extent,
            ]
        }
    ],
    'continuous_notes': [  # notes specific to continuous
data
        tr(
            'Continuous data are normally used to
represent the gust wind '
            'speed of the cyclone, representing the 10-m
above ground wind '
            'speed.'
        )
    ],
    'classified_notes': [  # notes specific to classified
data
        tr('Classified cyclone hazard data is not
presently supported.')
    ],
    'single_event_notes': [  # notes specific to single
event data
    ],
    'multi_event_notes': [  # notes specific to multi
event data
    ],
    'actions': [  # these are additional generic actions

    ],
    'citations': [
        {
            'text': None,
            'link': None
        }
    ],
    'continuous_hazard_units': [
        unit_miles_per_hour,
        unit_kilometres_per_hour,
        unit_knots,
        unit_metres_per_second
    ],
    'allowed_geometries': [
        'polygon',
        'raster'
    ],
    'classifications': [
        cyclone_au_bom_hazard_classes,
        cyclone_sshws_hazard_classes,
        generic_hazard_classes
    ],
    'compulsory_fields': [hazard_value_field],
    'fields': hazard_fields,
```

```
    'extra_fields': [],
    'field_groups': [],
    'layer_modes': [layer_mode_classified,
layer_mode_continuous],
    'disabled_exposures': [
        exposure_road
    ]
}
```

Finally define new hazard and add it to the hazard_all list:

```
hazard_all = [
    hazard_flood,
    hazard_tsunami,
    hazard_earthquake,
    hazard_volcano,
    hazard_volcanic_ash,
    hazard_cyclone,
    hazard_generic,
    hazard_dam_break
]
```