PROJECT INFORMATION

Project Title: Systemic Seismic Vulnerability and Risk Analysis for Buildings, Lifeline Networks and Infrastructures Safety Gain
Acronym: SYNER-G
Project N°: 244061
Call N°: FP7-ENV-2009-1
Project start: 01 November 2009
Duration: 36 months

DELIVERABLE INFORMATION

Deliverable title: D7.6 SYNER-G Toolbox and web portal
Date of issue: February 2013
Work Package: WP7 – Build prototype software
Deliverable/Task Leader: VCE – Vienna Consulting Engineers

REVISION: Final

Project Coordinator: Prof. Kyriazis Pitilakis
Institution: Aristotle University of Thessaloniki
e-mail: kpitilak@civil.auth.gr
fax: + 30 2310 995619
telephone: + 30 2310 995693
Abstract

This Deliverable should work as I first guideline for using the EQvis – Platform. It shows the user the most used features of the package and guides the user through a tutorial which explains many of the features in EQvis. This document can only serve as a starting point. Many of the analyses need special datasets that have to be prepared first. This Tutorial comes with a sample dataset for the city of Vienna with which the user can get through the analyses produced in this project. The web portal and the website are described as well. More information together with the open source software code and the dataset for this Tutorial can be downloaded at the Syner-G website: www.syner-g.eu

Keywords: Software, Tutorial, Manual, web portal, website
Acknowledgments

The research leading to these results has received funding from the European Community's Seventh Framework Programme [FP7/2007-2013] under grant agreement n° 244061.
Deliverable Contributors

VCE  David Schäfer
     Michael Pietsch
     Helmut Wenzel
     Francesco Ganelli
# Table of Contents

Abstract ..................................................................................................................................... 1  
Acknowledgments .................................................................................................................... 1  
Deliverable Contributors .......................................................................................................... 1  
Table of Contents ...................................................................................................................... 1  
List of Figures ........................................................................................................................... 4  
1 Introduction............................................................................................................................... 5  
  1.1 ABOUT EQVIS ........................................................................................................... 5  
    1.1.1 Methodology ...................................................................................................... 6  
    1.1.2 IT-Details ........................................................................................................ 6  
  1.2 USING THE MANUAL ................................................................................................ 7  
2 Installation.................................................................................................................................. 7  
  2.1 SYSTEM REQUIREMENTS ....................................................................................... 7  
  2.2 INSTALLATION PROCESS ........................................................................................ 7  
    2.2.1 Installation from DVD ...................................................................................... 7  
    2.2.2 Network installation ........................................................................................ 8  
    2.2.3 Installing Updates and New Modules .............................................................. 8  
3 Introductory example.................................................................................................................. 9  
  3.1 NEW SCENARIO ....................................................................................................... 9  
  3.2 ADDING DATA TO THE SCENARIO ....................................................................... 10  
    3.2.1 Adding the City Plan of Vienna ...................................................................... 10  
    3.2.2 Adding the Building Dataset ......................................................................... 12  
  3.3 EXECUTE ANALYSIS .............................................................................................. 14  
    3.3.1 Analysis 1: Create Scenario Earthquake ...................................................... 14  
    3.3.2 Analysis 2: Building Structural Damage ...................................................... 16  
  3.4 VIEW THE RESULTS ............................................................................................... 19  
    3.4.1 Table view .................................................................................................... 19  
  3.5 3D DAMAGE BARS ................................................................................................. 20  
  3.6 FILTERING DATA .................................................................................................... 21  
4 User Interface........................................................................................................................... 22  
  4.1 OVERVIEW .............................................................................................................. 22  
  4.2 SPECIAL FUNCTIONS ............................................................................................ 23  
    4.2.1 Managing the layers of the map ................................................................... 23  
    4.2.2 Improving the visualization ......................................................................... 23  
    4.2.3 Saved Analysis Workflows ......................................................................... 24  
    4.2.4 Filtering ....................................................................................................... 24  
5 Using the OOFIMS – Plug-in .................................................................................................. 24  
  5.1 USING OOFIMS: EXAMPLE DATASET IN VIENNA ........................................... 24
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1.1</td>
<td>Download/Unzip the data</td>
<td>24</td>
</tr>
<tr>
<td>5.1.2</td>
<td>Ingesting the datasets</td>
<td>24</td>
</tr>
<tr>
<td>5.1.3</td>
<td>Starting the Analysis</td>
<td>25</td>
</tr>
<tr>
<td>5.1.4</td>
<td>The OOFIMS Input mask</td>
<td>25</td>
</tr>
<tr>
<td>5.1.5</td>
<td>Running the analysis</td>
<td>27</td>
</tr>
<tr>
<td>5.1.6</td>
<td>Read the output of OOFIMS</td>
<td>27</td>
</tr>
<tr>
<td>5.1.7</td>
<td>Creating the Intersections</td>
<td>27</td>
</tr>
<tr>
<td>5.1.8</td>
<td>Creating the MCDA Sub City Districts file</td>
<td>27</td>
</tr>
<tr>
<td>6</td>
<td>Using the MCDA – Plug-in</td>
<td>28</td>
</tr>
<tr>
<td>6.1</td>
<td>STARTING MCDA IN DEFAULT MODE</td>
<td>28</td>
</tr>
<tr>
<td>6.2</td>
<td>USING THE OOFIMS RESULTS IN MCDA</td>
<td>28</td>
</tr>
<tr>
<td>7</td>
<td>The web-portal in Syner-G</td>
<td>29</td>
</tr>
<tr>
<td>References</td>
<td></td>
<td>37</td>
</tr>
</tbody>
</table>
List of Figures

Fig. 1.1 Interactive surface of EQvis................................................................. 5
Fig. 3.1 New scenario .................................................................................. 9
Fig. 3.2 Working environment ..................................................................... 10
Fig. 3.3 Select data type ............................................................................. 11
Fig. 3.4 Set attributes mappings ................................................................. 11
Fig. 3.5 Working environment ..................................................................... 11
Fig. 3.6 Display the data on the map ............................................................ 12
Fig. 3.7 Visualization view ........................................................................... 13
Fig. 3.8 3-D render ...................................................................................... 13
Fig. 3.9 Execute analysis ............................................................................... 14
Fig. 3.10 Filling the form ........................................................................... 15
Fig. 3.11 View results .................................................................................. 16
Fig. 3.12 Import fragilities .......................................................................... 16
Fig. 3.13 Create mapping ........................................................................... 17
Fig. 3.14 Building Structural Damage ........................................................ 18
Fig. 3.15 Building Structural Damage ........................................................ 18
Fig. 3.16 Execute ....................................................................................... 19
Fig. 3.17 View results .................................................................................. 20
Fig. 3.18 3-D damage bars .......................................................................... 21
Fig. 3.19 Filtering data ................................................................................ 22
Fig. 4.1 Overview ........................................................................................ 23
Fig. 4.2 Layers ............................................................................................ 23
Fig. 4.3 Saved analysis workflows .............................................................. 24
Fig. 7.1 The starting page of the Syner-G website with the animation of “System of Systems” ................................................................. 29
Fig. 7.2 The overview page of the website. In the “Project” button the user can find detailed information about the project ......................................................... 30
Fig. 7.3 The “News” section: Latest news about the project are written in this chapter, e.g. the final workshop in Milano ...................................................................................... 31
Fig. 7.4 The “Dissemination” section: All of the Deliverables are for free download here as well as all the Reference Reports of the project ......................................................... 32
Fig. 7.5 The “Case Studies” section: The two major case studies in Thessaloniki and Vienna are described here ............................................................. 33
Fig. 7.6 The “Downloads” section: All downloads like the Fragility Function Manager, Tutorials, etc. are available in this section .............................................................................. 34
Fig. 7.7 The “Links” section: In this section links to related projects are given together with a short description of the main subjects of each project ................................................................. 35
1 Introduction

In the Project Syner-G the development of a prototype software for end user was a very important goal. One objective was to implement the methodologies developed in the various other work packages into the software package.

1.1 ABOUT EQVIS

EQvis is an advanced seismic loss assessment, and risk management software which relies on the Consequence-based Risk Management (CRM) methodology. CRM provides the philosophical and practical bond between the cause and effect of the disastrous event and mitigation options.

EQvis follows the CRM methodology using a visually-based, menu-driven system to generate damage estimates from scientific and engineering principles and data, test multiple mitigation strategies, and support modelling efforts to estimate higher level impacts of earthquake hazards, such as impacts on transportation networks, social, or economic systems.

It enables policy-makers and decision-makers to ultimately develop risk reduction strategies and implement mitigation actions. In EQvis, a wide range of user-defined parameters are introduced. The breadth of user-defined parameters enables emergency planners to model a virtually unlimited number of scenarios.
EQvis is based on the open-source-platform MAEviz, developed by the Mid-America Earthquake (MAE) Center and the National Center for Supercomputing Applications (NCSA). It has an open-source framework which employs the advanced workflow tools to provide a flexible and modular path. It can run over 50 analyses ranging from direct seismic impact assessment to the modelling of socioeconomic implications. It provides 2D and 3D mapped visualizations of source and result data and it provides tables, charts, graphs and printable reports for result data. It is designed to be quickly and easily extensible.

1.1.1 Methodology

EQvis implements Consequence-Based Risk Management (CRM) using a visual, menu-driven system to generate damage estimates from scientific and engineering principles and data. It can also estimate impacts on transportation networks, social or economic systems.

It requires the following as inputs: hazard, inventory and fragility models. This information is useful to estimate the damage and the losses. It can consider different types of assets such as buildings, bridges and lifeline (gas, water, electric facilities, etc.).

With regards to buildings, it estimates structural and non structural damage, economic losses and liquefaction damage. With regards to bridges, it computes damage, loss of functionality and repair cost analysis. For what concerns lifelines it calculates the network damage and the repair rate analysis. Finally, it computes socio-economic losses such as shelter needs, fiscal and business interruption.

1.1.2 IT-Details

EQvis is an open source software. It is written in Java Language and using Eclipse RCP. Eclipse RCP is a platform for building and deploying rich client applications. It includes Equinox, a component framework based on the OSGi standard, the ability to deploy native GUI applications to a variety of desktop operating systems, such as Windows, Linux and Mac OS X and an integrated update mechanism for deploying desktop applications from a central server. RCP made it possible to make EQvis modular and extensible. In fact, EQvis provides a framework to add new data and algorithms or update existing ones.

It also uses NCSA GIS Baseline that is a rich client application. This latter is composed by three main functions: data management (typing, ingestion, access, provenance tracking), visualization (support for 2D and 3D views, zoom, selection, highlighting), analysis execution (support for local multithreaded execution, visual dataflow system in development).

The extensions to NCSA GIS and RCP are all provided by plug-ins. The technologies used by EQvis are all open source software like geotools, vtk (Visualization Toolkit), Jasper Reports (for generating various kind of outputs), JfreeChart and Ktable. EQvis is also planning/developing a 'cyberinfrastructure/cyberenvironment' that wants to provide universal access to the calculated results through 'grid computing', both for the calculation part and the rendering part. By using as main transport SOAP/HTTP, the concept of repositories, and grid computing, the project is not only a client that makes risk analysis, but an entire platform that enables the user to use data from different places (data sources).

EQvis can easily integrate spatial information, data and visual information to perform seismic risk and analysis. It supports *.shp file that is really useful to visualize immediately input and output data. For what concerns output data it provides different formats of results such as
* .dbf table, .shp file and *pdf file. The level of resolution depends on the size of the geounit that can be defined by the user. The geographical unit could be a regional unit, a provincial unit, a local unit and it could be an arbitrary polygon (regular or irregular).

Finally, EQvis has a user-friendly GUI that guides the user through the analyses. In the catalog box, in the lower left corner, the databases are stored and the user can utilize this box to select default data or their own data that are saved herein. In the scenario box, in the upper left corner, the analyses that have been run can be selected and can be visualized on the right box of the GUI.

1.2 USING THE MANUAL

Many roads lead to Rome – this policy also applies to working with EQvis: graphics, tables and the data catalogue are on an equal footing.

If you are new to the program, you should work through the introductory example step by step. Thereby, you will get familiar with the most important features of EQvis.

2 Installation

2.1 SYSTEM REQUIREMENTS

In order to use EQvis comfortably, we recommend the following system requirements:

- Operating system Windows XP Sp3 / Vista / 7
- CPU with 2 GHz
- 2 GB RAM
- DVD-ROM and 3.5” disk drive for installation, alternatively a network installation is possible
- 1 GB hard disk capacity, including approximately 500 MB for installation
- Graphic card with OpenGL acceleration and a resolution of 1024 x 768 pixels

When working on large systems, huge amounts of data will be produced. As soon as the main memory is not sufficient for taking the data, the hard drive will take over. This can slow down the computer significantly. Therefore, an increased memory will speed up the calculation much more than a faster processor. When selecting a motherboard, make sure that the main memory can be expanded.

2.2 INSTALLATION PROCESS

2.2.1 Installation from DVD

Once you located the folder setup_files, follow the instruction reported in Network Installation.
2.2.2 Network installation

EQvis

1. Create the following local folder, and place here all the setup files
   \texttt{C:\EQvis\setup\_files}

2. Install Oracle Java JRE by launching
   \texttt{C:\EQvis\setup\_files\jre-6u30-windows-i586-s.exe}
   Install the software to the folder \texttt{C:\EQvis} by running
   \texttt{C:\EQvis\setup\_files\EQvis\-platform\-setup.exe}

OOFIMS Software

1. Install Matlab compiler runtime by launching
   \texttt{C:\EQvis\setup\_files\MCRInstaller.exe}

2. Copy the folder OOFIMS from setup\_files to
   \texttt{C:\EQvis}

MCDA

1. Copy the folder MCDA from setup\_files to
   \texttt{C:\EQvis}

Fragility Function Manager

1. Launch
   \texttt{C:\EQvis\setup\_files\Fragility Function Manager.msi}

2. Copy the folder Fragility Function Files to
   \texttt{C:\EQvis}

Database of Vienna

1. Copy the folder Data Vienna to
   \texttt{C:\EQvis}

2.2.3 Installing Updates and New Modules

New versions of the suite will be delivered.
3 Introductory example

This chapter helps you to become familiar with the most important functions of EQvis by using a simple example. As there are so many different ways to achieve specific objectives it might make sense to use one or the other, always depending on the situation and the user’s preferences. This example wants to inspire you to discover the possibilities and options of EQvis on your own.

In this tutorial, the SYNER-G platform will be used to determine the impact of an earthquake occurring in Vienna, mainly on its buildings. The tool will be used as a specific Emergency Manager would use it.

In the process it will be shown how to launch the application, load the GIS data, and generate earthquake hazard information based on the scenario of interest.

When the base information are loaded it’s possible to choose and display information for specific items of interest such as buildings, and load fragility information about these particular structures.

3.1 NEW SCENARIO

- From the application’s menu bar, click File -> New Scenario

![Fig. 3.1 New scenario](image)

- Alternatively, you can click the New Scenario button from the Scenario View’s tool bar.
- Enter a name for your scenario, such as “Vienna”, and then optionally enter any descriptive information about the scenario in the large text box. Click next.
- Select Austria from the Country menu.
- Select Brigittenau district and select the box. A tick will appear next to the name. Then click next.
This wizard allows adding multiple regions of interest by selecting more boxes at the same time. Anyway this tutorial will only focus on Vienna.

- From the dropdown menu, select **Empty Defaults**, then click **finish**

This screen allows the selection of a default set. This will populate the analysis pages with default data where applicable (e.g. fragilities, fragility mapping, etc.). User Interface.

- At this point, your scenario has been created. It will appear on the list of the Scenario View. A blank outline of Vienna will also appear in the Visualization View.

![Working environment](image)

**Fig. 3.2 Working environment**

### 3.2 ADDING DATA TO THE SCENARIO

#### 3.2.1 Adding the City Plan of Vienna

- Right click on **Local Cache** (bottom-left area).
- Select **Ingest Dataset**.
- Select **Shapefile** and click **next**.
- Click **Browse** and go to the folder `C:\EQvis\Data Vienna\City Plan`
- Select the file `Strukturplan.shp` and Click next
- Select **Anonymous LineString-based geometry** and click **Next**.
Fig. 3.3 Select data type

- Click next.

Fig. 3.4 Set attributes mappings

Click next.

- Give “Vienna City Plan” as name and version number 1.
- Wait while ingesting. It does not take long.
- Double click Vienna City Plan (bottom left of the main window) to visualize a 2D render of the imported City Plan.

Fig. 3.5 Working environment
3.2.2 Adding the Building Dataset

Importing

- Right click on [Local Cache] (bottom-left area).
- Select [Ingest Dataset].
- Select Shapefile and click [next].
- Click [Browse] and go to the folder \EQvis\Data Vienna\Buildings Vienna.
- Click [Open].
- Define the data set by selecting Building Inventory v4.
- Press [next].

This page allows the user to import the information present in the database. The association of the information contained in the imported database with preset labels allowing the mapping is here possible. In this case, nothing has to be changed.
- Press [next].
- Give a descriptive name to the imported dataset, e.g. Buildings Vienna. Version number [1]. Press [finish].

At this stage of the tutorial the dataset have been imported in the local cache repository.

Display the data on the map

- Double click Buildings Vienna in the Catalog (bottom left) in order to display the building set on the 2D map. In alternative, you can drag and drop it to the Visualization View.

Fig. 3.6 Display the data on the map
**Change layer style**

- From [Scenario View](#), expand Vienna, then Mappable Data.
- Right click on [Change Layer Style](#).
- In [Style Editor](#), select the [Simple Style label](#).
- Adjust [color](#), [size](#) and the other properties as required.
- Once finished, confirm by pressing the [Apply style button](#) in the Style Editor’s tab bar.
- Navigate the 2D render.

To zoom/pan/etc, use the controls at the top of the Visualization View.

![Fig. 3.7 Visualization view](#)

- Right click on [Mappable Data](#), then [Render in 3D (VTK)](#).
  This will bring up a second Visualization View that shows the same map, but from a 3d rendered perspective.
- Click the [Zoom to full extent](#) button in the toolbar to restore the original default view.
- Navigate the 3D render.

![Fig. 3.8 3-D render](#)
3.3 EXECUTE ANALYSIS

3.3.1 Analysis 1: Create Scenario Earthquake

A basic map of the area of interest has been created in the previous section “Adding Data to the Scenario”. The next step regards the setup and the run of an Analysis. It’s meant by Analysis any sort of calculation which leads to the generation of outcomes data.

The first reported type of analysis is a deterministic earthquake map, based on a magnitude and epicentre input data.

Subsequently, a building damage analysis will be performed in order to proficiently estimate the occurring damages information on buildings. It will be based on both the created earthquake map, and on the imported building characterization (building inventory).

This section goes through all the procedure preliminary to the run.

- Launch the Run Analysis Wizard by clicking the Execute Analysis button.
- Expand Hazard and select Create Scenario Earthquake. Press finish.

![Fig. 3.9 Execute analysis](image)

- Select the scenario Vienna.
- In the Analysis Wizard (simple or complete) click on the red button Create Scenario Earthquake in order to access the input form.

Filling the Required inputs:

**Basic information**

- Result Name: EQ Vienna
- Periodic Spectrum Method: NEHRP Spectrum
- Attenuation: Campbell and Bozorgnia 2006 NGA
Fig. 3.10 Filling the form

**Earthquake location**

Magnitude: 6
Depth: 15 Km

- Click **Select by clicking on the map** and specify the position of the Epicenter.
  It’s also possible to specify its exact location in the WGS 84 coordinate system. In this tutorial the epicenter will be located slightly south respect to the Vienna City Center.

**Raster Display Information**

- Set the Display raster to **PGA**.
  The other parameters define the area which will be displayed in the Visualization View. Leave them as **default**.

- **Advanced Parameters.**
  Depending on the Attenuation Functions that you choose, different parameters can be selected. In this tutorial they will be left as **Default**.
  - The button **execute** should appear green, press it.
  - The earthquake should be very quickly generated and the name should appear in the scenario view. **Close** the analysis and observe the 2D map.
3.3.2 Analysis 2: Building Structural Damage

Building characterization: importing the fragility curves

For this purpose, the fragility mapping file containing the fragility functions to associate to the buildings is assigned to the taxonomy contained in the building dataset shapefile.

- Click on Window, then Show View. Expand the subfolder other. Double click on SynerGMapper.
- Press Import Fragilities.

- When the fragilities are imported, click create mapping. It may take a while, depending on the number of the specified buildings.
Ingest the fragilities

- Right click on Local Cache (bottom-left area).
- Select Ingest Dataset.
- Select Fragility from the menu
- Browse C:\EQvis\Fragility Functions Files\OUT, show the .xml files and choose EQvis-Fragilities.xml
- Click next.
- Select Building Fragilities
- Click next
- Click next
- Specify EQvis Building Fragility, revision number 1. Click finish.

Ingest the Fragility Mapping

- Right click on Local Cache (bottom-left area).
- Select Ingest Dataset.
- Select Mapping from the menu
- Select SynerG-Mapping.xml
- Click next.
- Select Building Fragilities
- Click next
- Click next
- Specify EQvis Building Fragility Mapping, revision number 1. Click finish.
**Execute the Damage Analysis**

- Analysis Wizard by clicking the **Execute Analysis** button on the toolbar.
- Expand **SynerG Building** and select **Building Structural Damage** analysis.

**Fig. 3.14 Building Structural Damage**

- Specify the Scenario of interest: **Vienna**
- Click on **Building Structural Damage**

This page represents a graphical view of the damage analysis, including the required inputs. If the background of the Building Structural Damage button is red, the input data are missing.

- Under the tab **required** of the form, you will need to provide several inputs. If the form is blank no datasets containing Fragilities, Expected Value or Fragility have been defined.

**Result name:** **Building Structural Damage**

**Fig. 3.15 Building Structural Damage**
• To run this analysis, load datasets that contain the data: press the Find Dataset button. The window that appears contains a list box of all Fragilities Datasets that could be found in any of the connected data repositories.
  • Select Buildings Vienna (local cache) from the list, and click Finish.
  • Select the Hazard EQ Vienna
  • Import the Fragilities and the Fragility Mapping
  • Import the Fragility Mapping.
  • Import the Expected Values of Building Damage Ratios.
  • Click the Execute button to run the analysis.

3.4 VIEW THE RESULTS

3.4.1 Table view

First, the results will be viewed in a tabular grid, similar to excel.
  • In the Scenario View, right click on Building Structural Damage layer.
  • Select Show Attribute Table. The Table View appears in the bottom right of the application window. Moving or resizing operation is possible.

Localization of the most damaged buildings:

  • Scroll to the right edge of the table view, and click the column header labeled MeanDamage (0-1). This is the column where the mean damage values of the buildings are shown. The table is now sorted by mean damage value.
Visualization of the buildings on the map of the area:
At this stage, the Building Damage layer shall be selected in the Scenario View; and
the visualization should be the 2D visualization view.

- In the Table View, click on the first row with mean damage (Value of highest). The
dots correspondent to the selected building changes its color in the Visualization View.
- Hold shift and click the last row with desired mean damage value (e.g. 0.04). This will
select all the buildings in between the specified range. The whole set of building will
change color in the Visualization View.

![Fig. 3.17 View results](image)

### 3.5 3D DAMAGE BARS

- To facilitate the visualization of the damages across the area of interest, a 3-D bars
view can be activated.
- Right click the Building Damage layer in the Scenario View, and choose Ranged 3D
Visualization.
- During this step is possible to select the fields to be displayed on the map. In this case,
the chance of each damage state will be represented. Select Insignificant, Moderate,
Heavy, and Complete.
- Click next. In the next screen, associate colors to the various fields. Choose a
reasonable set of colors or use the defaults, then press finish.
- Open the 3-D Visualization. The damage bars have been added for each building.
- The size of each color in the bar represents the likelihood that the building will be in a
certain damage state.
3.6 FILTERING DATA

*Visualize buildings with less than 3 stories:*

- Right click the Building Damage layer, and select Filter.
- This brings up the filter dialog. In the Create a Filter dialog, double click the field `no_stories`.
- This adds the field to the query at the bottom of the page. Next, click the <= sign button. Finally, insert the number 3.
4 User Interface

4.1 OVERVIEW

The user interface of EQvis is flexible and modular. Each module can be displayed in several positions of the main window, or can be either minimized to a Taskbar. In the Figure below, the Taskbar is shown only on the right side but it could appear also on the other side, depending on its position.

The EQvis workbench is built by a number of Views containing and displaying information about the specific modules. Each View is like a sub-window within main window, and can be minimized, maximized, or moved from the main window into its own window. These interactions are done by clicking the minimize/maximize icons in the view’s title bar, or by clicking and dragging on the view’s border or title bar.
4.2 SPECIAL FUNCTIONS

4.2.1 Managing the layers of the map

The layers can be sorted by means of these buttons. To optimize the render view, keep the layer with the contour plot of the simulated Earthquake as last item of the list. In this way, it will be the background for the other layers.

4.2.2 Improving the visualization

In the Style Editor of the EQ Vienna layer it is possible to select several options to improve and customize the 2-D or the 3-D renders. For example, it is possible to vary the chromatic scale for the representation.
4.2.3 Saved Analysis Workflows

Under Mappable Data is present a special function called Saved Analysis Workflows. Under this name the software stores – and give direct access – to the input forms of the launched analysis. This function is very practical for frequent updates and tests on the model.

![Saved Analysis Workflows](image)

Fig. 4.3 Saved analysis workflows

4.2.4 Filtering

See the section 4.2 Filtering Data.

5 Using the OOFIMS – Plug-in

The usage of the OOFIMS software is generally described in Deliverable 2.1. The software generally starts with the input file, which normally is filled within excel. This input procedure has been changed to the EQvis platform. The input can be given directly in the platform now. There is still the option to manipulate the input file directly, it is located at C:\EQvis\OOFIMS\oofims_in.xls.

5.1 USING OOFIMS: EXAMPLE DATASET IN VIENNA

5.1.1 Download/Unzip the data

In order to use the OOFIMS software correctly, the user has to unzip the data-files provided in the OOFIMS_Data_Example.zip file. It contains all the necessary data to complete this tutorial. The tutorial will explain the main functions on behalf of the Vienna test case on buildings. When EQvis has been installed successfully the first calculations with the OOFIMS – Plug-on can be started.

5.1.2 Ingesting the datasets

The first things to be done are ingesting the needed data files into the platform. For this Tutorial it is sufficient to ingest 4 data-files:
1. Seismic Shapefile: Right-click on the Local Cache button and choose “Ingest dataset”. Select Shapefile as the dataset and click “Next”. Choose the Seismic Shapefile for OOFIMS that you have downloaded together with this Tutorial and click next. The data type you have to set to “Seismic Shapefile”, click “Next”. Click Next two times until you reach the Descriptive Data window. Enter the name “Seismic Shape Vienna_OOFIMS” and give it the number 1, then click Finish. The shapefile is now ingested.

2. Seismic Shapefile: Right-click on the Local Cache button and choose “Ingest dataset”. Select Shapefile as the dataset and click “Next”. Choose the Sub City Districts file that you have downloaded together with this Tutorial and click next. The data type you have to set to “Building Census”, click “Next”. Click Next two times until you reach the Descriptive Data window. Enter the name “Sub City Districts_Vienna” and give it the number 1, then click Finish. The shapefile is now ingested.

3. Seismic Shapefile: Right-click on the Local Cache button and choose “Ingest dataset”. Select Shapefile as the dataset and click “Next”. Choose the Land Use Plan for Vienna that you have downloaded together with this Tutorial and click next. The data type you have to set to “Land Use Plan”, click “Next”. Click Next two times until you reach the Descriptive Data window. Enter the name “Land Use Plan_Vienna” and give it the number 1, then click Finish. The shapefile is now ingested.

4. Seismic Shapefile: Right-click on the Local Cache button and choose “Ingest dataset”. Select Shapefile as the dataset and click “Next”. Choose the Building Census file for Vienna that you have downloaded together with this Tutorial and click next. The data type you have to set to “Building Census”, click “Next”. Click Next two times until you reach the Descriptive Data window. Enter the name “Building Census_Vienna” and give it the number 1, then click Finish. The shapefile is now ingested.

5.1.3 Starting the Analysis

To start the analysis, click the execute analysis button in the left window. If you do not have selected a scenario yet, the user is asked to select the scenario. This is only the case if more than one scenario has been created already. Now you should be in the Execute Analysis window. Click on the “Syner-G Oofims” Button and you should see 4 different options. The first thing to do is to create the input file. Click on “Create Oofims Input” and then “Finish”.

5.1.4 The OOFIMS Input mask

Now you are at the starting page of the OOFIMS Input. In principle it is divided into 5 sections: “Analysis”, “Seismic”, “Buildings”, “Water Supply System” and “Road Network”. The usage of these sections is described in Deliverable 2.1. In general, the use of these input masks is very simple. In order to complete the Tutorial you may enter the following inputs:

Analysis

As the simulation method you should choose “mcs”. Various new parameters show up, but you can leave them in default.(10, 10, 0.02).
Seismic

At first you have to specify the seismic shape file. Now you can use the file that you important earlier. Click on Search and take the “Seismic Shape Vienna_OOFIMS” file. In the following table you may find the input you should input:

Table 1 Input values for the OOFIMS Tutorial – “Analysis”

<table>
<thead>
<tr>
<th>Ground Motion Prediction Equation</th>
<th>AkkarBommer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary IM</td>
<td>PGA</td>
</tr>
<tr>
<td>Landslide susceptibility map name</td>
<td>None</td>
</tr>
<tr>
<td>VS30 map name</td>
<td>None</td>
</tr>
<tr>
<td>Liquefaction susceptibility map name</td>
<td>None</td>
</tr>
<tr>
<td>Amplification method</td>
<td>Gmpe</td>
</tr>
<tr>
<td>Source model</td>
<td>areaFault</td>
</tr>
<tr>
<td>Number of step – Longitude</td>
<td>20</td>
</tr>
<tr>
<td>Number of step – Latitude</td>
<td>20</td>
</tr>
</tbody>
</table>

Table 2 Input values for the OOFIMS Tutorial – “Buildings”

| Study Region-Num.Step Longitude  | 1                 |
| Study Region-Num.Step Latitude   | 1                 |
| # of refinements                 | 4                 |
| Good weather – fully usable      | 1                 |
| Good weather – partially usable  | 0.7               |
| Bad weather – fully usable       | 0.8               |
| Bad weather – partially usable   | 0.5               |
Buildings

In the “Buildings” section you have to define also the shapefiles that you have imported earlier (Sub City Districts, Land Use Plan and Buildings Census).

When all the parameters are correct you may click an “Execute”. Now the input excel file is written and stored in C:\EQvis\OOFIMS.

5.1.5 Running the analysis

To run the analysis, you have to open “Window”, then “Show View” -> Other. Then Choose the “OOFIMS Runner”.

On the screen you should now be able to see the Console and a button called “run module”. Click on that button and the analysis will start. Depending on the amount of data that you have specified, the computing time varies. Once the simulation is finished, the console reads: “done” and an output file is created in a new folder in : C:\EQvis\OOFIMS\output.

5.1.6 Read the output of OOFIMS

If you want to display the results of the simulation you have to execute a new analysis in the Syner-G Oofims field called “Read Oofims Output”. Here you have to specify a name for the result, which will then appear in the Scenario View on the left side. You have two options now. You can either display a specific file of the analysis by clicking manually selecting file, or you can specify the number of the run you want to display. For the tutorial write “OOFIMS Output - raw “, click “Manually select files” and then press Execute.

Now the output of the OOFIMS plug-in is read but the structure of this output does not fit to the original geometry of the input files. The output is now generated in rectangular cells.

5.1.7 Creating the Intersections

In order to get the intersection points of these cells with the original you have to click on the Execute Analysis button and choose “Create Intersections” in the Syner-G OOFIMS field. Specify the result name (Intersections_Vienna), and provide the 2 datasets that are required: The “OOFIMS Output – raw” file and the original file with the Sub City Districts (“Sub City Districts_Vienna”).

5.1.8 Creating the MCDA Sub City Districts file

In order to be able to use the dataset one more analysis has to be performed. “Create MCDA SCDs” is now filling the data into certain format which can be used in the MCDA Plug-in. There are mainly 3 dataset to be filled. “Oofims3 Cells” is the name of the “Create Intersections” file (Intersections_Vienna) and “Sub City Districts” is again the Sub City Districts file for Vienna (“Sub City Districts_Vienna”). The results of the OOFIMS run can now be specified or EQvis takes the last run of the OOFIMS – Runner. If you want to specify the file yourself you have to check the box “Manually select SimulationResults?”. If you check that you have to specify the right SimulationResult.xls! Set the result name to “MCDA_SCDs_Vienna”. This file contains now all the information in the correct (original) format.
6 Using the MCDA – Plug-in

Another Plug-in in EQvis is the MCDA Plug-in. It analyses the data with respect to socio-economic consequences (referring to Work Package 4, Deliverables 4.1 – 4.6).

6.1 STARTING MCDA IN DEFAULT MODE

In General the MCDA software can be started with the second left Button under the “EQvis Scenarios”. If you hold your mouse over it there appears “Open MCDA”. If you open it in this way the default configuration of MCDA is started.

6.2 USING THE OOFIMS RESULTS IN MCDA

To get to the MCDA Plug in with the Data produced in OOFIMS you may open the “Execute Analysis” window and choose Syner-G MCDA and then “MCDA Input”. This Analysis again divides in the 2 known categories: Required and Optional.

In the “Required” field you have to insert the MCDA Sub City Districts file called “MCDA_SCDs_Vienna”.

The next field in the required mask is the “Indicators” field. It divides in 4 categories and sets the initial values for each of the categories. Once you have inserted all the necessary information, the Execute button appears green and the analysis can be started. At the end of this analysis the data is automatically loaded in the MCDA input file and MCDA is started.

The detailed description of the usage of the MCDA tool is given in detail in work package 4.
The web-portal in Syner-G

The web-portal in Syner-G (www.syner-g.eu) has evolved through the project. Many different sections have been created. The usage of the website has been very extensive. Many partners used the website and gave contributions to it. The dissemination effect of the website can be stated as very good. This chapter shows the state of the website at the end of the project.

The following screenshots show the actual content and design of the website.

Fig. 7.1 The starting page of the Syner-G website with the animation of “System of Systems”
Fig. 7.2 The overview page of the website. In the “Project” button the user can find detailed information about the project.

The overview section shows detailed information about the project. The objectives of the project are defined as well as detailed information about the work packages. At the end of this page descriptions and links to all the partners in the project are given.
Fig. 7.3 The “News” section: Latest news about the project are written in this chapter, e.g. the final workshop in Milano

The News section informs about all the latest news in the project like workshops, dates, etc.
Fig. 7.4 The “Dissemination” section: All of the Deliverables are for free download here as well as all the Reference Reports of the project.

In the Dissemination section the user can find all relevant Dissemination activities of the project. All publicly available Deliverables can be downloaded here. Additionally the user gets informed about Reference Reports, Publications and the workshops performed within the project.
The inventory includes information about material, code level, number of storey, structural type and volume for each building. The information is given in building block level. The database is based on previous project results (Kappes et al. 2006) and has been expanded within SYNER-G using remote sensing techniques. In total 27,500 buildings are included covering the entire municipality of Thessaloniki. The municipality is divided in 20 sub city districts according to the Urban Audit (UA) database of EUROSTAT. The indicators provided in the UA database will be used together with the results of the systemic analysis in order to estimate the expected socioeconomic losses.

Three-dimensional finite element analysis with a nonlinear biaxial failure criterion was used to derive fragility curves for masonry buildings that consider in-plane and out-of-plane failure (Fig. 1). Fragility curves for RC buildings that account for shear failure and consider modal uncertainties and the scatter of material and geometric properties were produced following the assessment method of Eurocode 8.

The inventory for the roadway network in the metropolitan area of Thessaloniki includes about 246 km of road-lines. The network has been discretized in nodes (600) and sides (676) according to the specifications of the SYNER-G software (Fig. 16). Node type can be intersection, Traffic Analysis Zone and external. The majority of bridges are in the ring road and the main exits of the city. Their classification is based on the number of spans (single or multiple), the design seismic code level (low or upgraded), the pier type (single or multiple columns) and the span continuity (continuous or simple support). Connectivity losses are calculated considering the road closures due to building collapses, as well as the damages in the roadway infrastructure (bridges, road pavements etc).

**Fig. 7.5** The "Case Studies" section: The two major case studies in Thessaloniki and Vienna are described here.

In the Case Studies sections the two main case studies of Thessaloniki and Vienna are described and the main results are presented. The detailed results can then be downloaded in Reference Reports section (Reference Report 6).
The web – portal in Syner-G

Fig. 7.6 The “Downloads” section: All downloads like the Fragility Function Manager, Tutorials, etc. are available in this section.

In the Downloads section the user can download information and software packages as well as the Syner-G Tutorial, the Fragility Manager, the Syner-G leaflet and relevant presentations about the project.
Fig. 7.7 The “Links” section: In this section links to related projects are given together with a short description of the main subjects of each project.

In the Links section one can find relevant links to associated and related projects.
References

[2] Deliverable 2.1 "D2.1 - General methodology for systemic vulnerability assessment,
events.
Natural Hazards and Intentional Disruptions. Ph.D. Dissertation, Georgia Institute of
Technology.
Based on Inelastic Response. MS Thesis, Department of Civil and Environmental
Engineering, University of Illinois at Urbana-Champaign, Urbana, IL.
for Populations of Buildings Based on Inelastic Response. The 14th World
Infrastructure. Ph.D. Dissertation, University of Illinois at Urbana-Champaign.
Performance of Interdependent Lifeline Systems, Mid-America Earthquake Center,
University of Illinois at Urbana-Champaign, CD Release 07-16, September.
mitigation for critical urban infrastructure systems (NSEL-007). Newmark Structural
Engineering Lab, Urbana, IL: University of Illinois.
[21] Mid-America Earthquake Center, 2009, Impact of New Madrid Seismic Zone
Earthquakes on the Central USA, MAE Center Report No. 09-03
of Institute of Civil Engineers (part II), v 1, 325-378.
