

# 3D City Database for CityGML

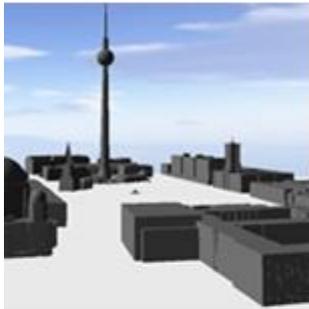
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Spreadsheet Generator Version 1.0.0

Plugin for

Importer/Exporter Version 1.4.0

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# Content

<b>1</b>	<b>DISCLAIMER</b> .....	<b>4</b>
<b>2</b>	<b>SPSHG PLUGIN</b> .....	<b>5</b>
	2.1 <i>Definition</i> .....	5
	2.2 <i>Plugin installation</i> .....	5
	2.3 <i>User Interface</i> .....	6
	2.3.1 <i>Main Parameters</i> .....	6
	2.3.1.1 <i>Columns</i> .....	7
	2.3.1.2 <i>Content Source</i> .....	12
	2.3.1.3 <i>Output</i> .....	13
	2.3.1.4 <i>Export</i> .....	15
	2.3.1.5 <i>Sharing settings</i> .....	15
<b>3</b>	<b>REQUIREMENTS</b> .....	<b>17</b>
<b>4</b>	<b>APPENDIXES</b> .....	<b>18</b>
	4.1 <i>Appendix A - An Example</i> .....	18
	4.2 <i>Appendix B - Linking Online Spreadsheet and 3D Visualization Models in Cloud</i> 23	
<b>5</b>	<b>REFERENCES</b> .....	<b>28</b>

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## 2 SPSHG PLUGIN

### 2.1 Definition

By using the SPSHG (Spreadsheet Generator) plugin, it is possible to export data from a 3D City Database (3DCityDB) instance into a CSV file or into an online spreadsheet hosted in a cloud service. The CSV file may be imported to either a spreadsheet application (like Microsoft Excel or Open Office Calc) or to a web based online spreadsheet service (like Google Docs). All features of spreadsheet programs, like calculation and graphing tools, are applicable to the exported data from a 3D City Database instance.

Online spreadsheets can be used for virtually interacting with exported visualization models in the cloud. In one of our examples, an online spreadsheet is used as the content source for information bubbles (so-called balloons) in a KML/COLLADA visualization model, they pop up when a city object is clicked on. To do that, appropriate data was exported by this plugin either directly into an online spreadsheet or to a CSV file which was uploaded afterwards. Then the link to the online spreadsheet was introduced to the KML/COLLADA visualization model.

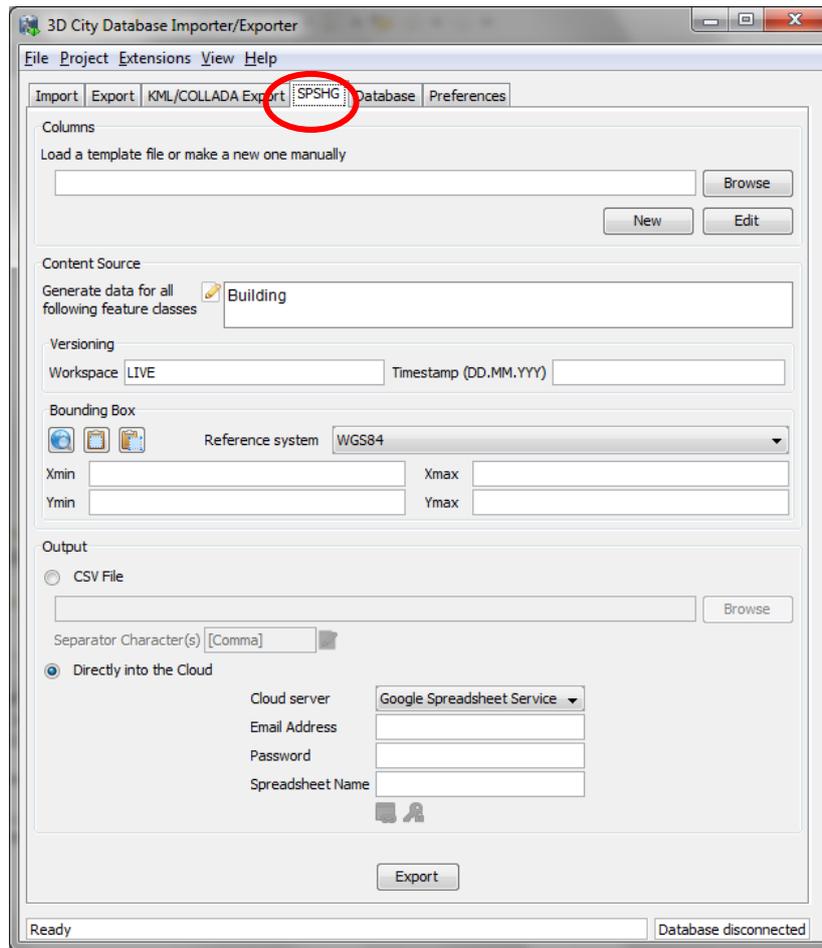
In addition, online spreadsheets offer features like sharing and collaborating in real-time with other users. As a result, in our example all users having access to the online spreadsheet linked to the KML/COLLADA visualization model were kept up-to-date with each modification in the information bubble contents made by a user with write privileges. See *Appendix B - Linking Online Spreadsheet and 3D Visualization Models in Cloud* for more details.

### 2.2 Plugin installation

Plugins are supported starting from *Importer/Exporter version 1.4.0*. The SPSHG plugin has been provided for the *Importer/Exporter version 1.4.0*. Therefore an installed instance of the *Importer/Exporter version 1.4.0* is required. Following simple steps will guide you through the install process of the SPSHG plugin:

- Download the SPSHG plugin zip file from the **official website of the 3D City Database at [1]**.
- Open the folder that contains your locally installed instance of the *Importer/Exporter version 1.4.0* (the installation directory).
- Open the *plugins* subfolder. If it is not available, create a new subfolder and name it “plugins”.
- Extract the downloaded SPSHG plugin zip file in the *plugins* folder. As a result a new folder named *spreadsheet* will be created. The *spreadsheet* folder will contain all required files and subfolders.

- Run the *Importer/Exporter*. The SPSHG plugin tab should be visible like in Figure 1.



**Figure 1:** The SPSHG plugin tab allowing for exporting from the 3DCityDB to a spreadsheet.

## 2.3 User Interface

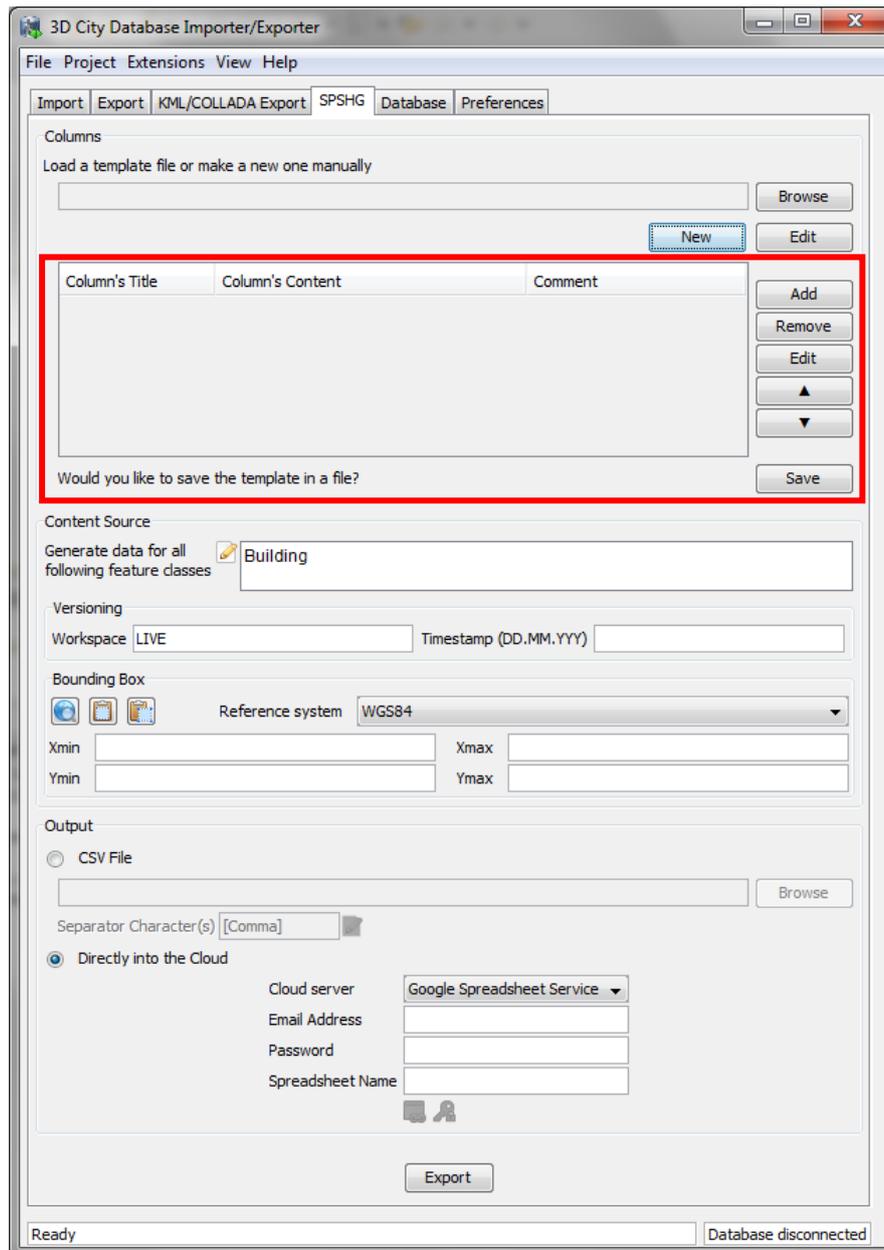
### 2.3.1 Main Parameters

The SPSHG plugin GUI is divided into three main parts. The upper part, titled *Columns*, refers to the columns of the output spreadsheet file. The *Content Source* in the middle section refers to the rows of the output spreadsheet. Each output row will always contain the GMLID of a city object and its corresponding selected values for each column. A list of the feature classes of city objects (Top-level features) whose data will be exported to the spreadsheet, the versioning information of the database and a geographic bounding box should be specified. Destination of export must be entered in the lower part. It may be sent to a local CSV file on the client machine or directly uploaded to a cloud server. All input data fields of the SPSHG plugin tab will be now described in more detail.

### 2.3.1.1 Columns

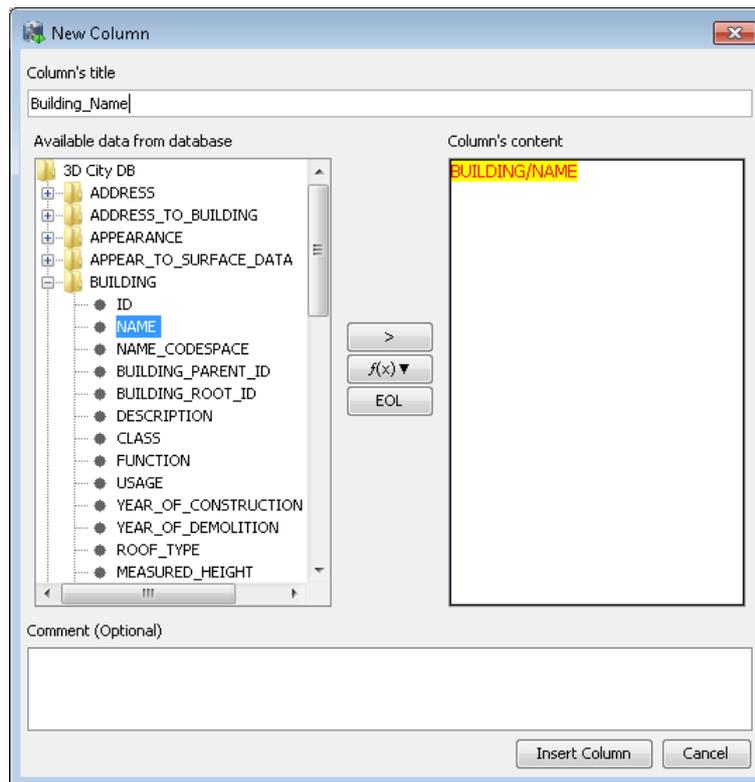
First of all, the columns of your resulting spreadsheet should be defined. You can choose to load a template file or manually create a new one:

*Load a template file:* type the template file's path directly into the text field or click on the *Browse* button to use an *Open* dialog for selecting the template file. The selected template file can be edited by clicking on the *Edit* button.



**Figure 2:** The part for manually creating a new template will appear when clicking on the *New* button. This part will also be shown when clicking on the *Edit* button after a template file is selected.

*Create a new template:* click on the *New* button to access the part for creating a template (marked in Figure 2). To add a new column click on the *Add* button and fill all necessary fields of the *New Column* dialog. A column contains a *title*, *content* and *comment*. The comment field is optional. Each row in the exported data will begin with the GMLID of the corresponding city object. It will be followed by the adapted value of each column for that city object (see next section for more information). Created columns will be listed in the table. You can use the *Remove*, *Edit*, *Up* (▲), and *Down* (▼) buttons to modify listed columns on the table and their order. By pressing the *Save* button, manually created (or adapted) templates will be saved in a text file. Path will be specified by the *Save* dialog.



**Figure 3:** The New Column dialog. Fill the Column's title, Column's content fields and click on the Insert Column button to add it to the list of columns. The Comment field is optional. When written to a template file its content serves informational purposes only.

### New Column dialog

By clicking on the *Add* button the *New Column* dialog will be shown (Figure 3). Using the New Column dialog, it is possible to define a new column for the output spreadsheet. A column may contain a *title*, *content* and *comment* fields. The title and content are mandatory. During export time, the content of each column will be adapted for each city object. For each specific column:

- The content may set to be a static value, e.g. *Berlin*. As a result, the value of that column in the exported spreadsheet will be equal to the specified static value (in this example *Berlin*) for all rows.
- The content of a column may be specified by an expression. The main part of an expression refers to a column in a specific table of a 3D City Database. Each row refers to one city object. Consequently, the value of the spreadsheet's column will be dynamically adapted for each row at export time. It means the value of the spreadsheet's column for a specific row will be equal to the value of that expression for the corresponding city object of that row. Expressions must follow specific rules. They can be added simply by using the GUI or written by hand.
- The content of a spreadsheet's column may contain a combination of static values and expressions.

### Rules for Column's Content field

- Expressions are coded in the following form:  
"TABLE/[AGGREGATION FUNCTION] COLUMN [CONDITION]".  
Aggregation function and condition are optional. Table refers to the underlying 3DCityDB table structure (see [2] for details).
- Expressions are not case-sensitive.
- For each row of output, each expression will only return the value of those entries relevant to the city object for that row. That means an implicit condition clause like "TABLE.CITYOBJECT\_ID = CITYOBJECT.ID" is always considered and does not need to be explicitly written.
- In a case that more than one entry for the corresponding city object are available, a comma separated list of values will be returned. When only interested in the first result of a list the aggregation function FIRST should be used. Other possible aggregation functions are LAST, MAX, MIN, AVG, SUM and COUNT.
- Conditions can be defined by a simple number (meaning which element from the result list must be taken) or a column name (that must exist in underlying 3DCityDB table structure) a comparison operator and a value. For instance: [12] or [NAME = 'abc'].
- Invalid results will be silently discarded
- Multiline content is supported. Use "[EOL]" to start a new line in the same column.
- For values generated from the SURFACE\_GEOMETRY table, and the TEXTUREPARAM table an implicit condition LOD=2 is always considered. This may be enhanced in the future.

## How to use the New Column dialog

Title and content of each column should be specified. On the left hand side of the New Column dialog, tables of the 3D City Database and their columns are displayed in a tree structure. Adding an expression is simple. Select a column in a table from the left hand side tree and click on the “>” button. In the case that aggregation functions are needed, select a column from the left hand side tree and click on the  $f(x)$  button then chose one of the aggregation functions. As a result of both cases a corresponding expression will be added into the column’s content in the right hand side.

A column’s content can be several lines long. Write “[EOL]” text in the column’s content wherever a new line should be started. You can also press the *EOL* button to automatically add “[EOL]” text to the content. During export time, the “[EOL]” text will be replaced by a new line.

After filling all necessary fields click on the *Insert Column* button. A new column will be created and added to the manually created template.

## Examples for Column’s Content

ADDRESS/STREET

Returns the content of the STREET column on the ADDRESS table for each city object. For instance:

Straße des 17. Juni

However ADDRESS table might contain more than one row for some city objects. In such a case a comma separated list of values will be returned. For instance:

Straße des 17. Juni, Straße des 17. Juni, Straße des 17. Juni, Straße des 17. Juni

To avoid that use a proper aggregation function. For instance:

ADDRESS/[FIRST]STREET

Although the ADDRESS table may contain several entries for a city object, result of the above expression will be equal to the street name of first found entry.

ADDRESS/[FIRST]STREET, ADDRESS/[FIRST]HOUSE\_NUMBER  
[EOL]ADDRESS/[FIRST]ZIP\_CODE ADDRESS/[FIRST]CITY

Returns the full address of each city object in two lines. For instance:

Straße des 17. Juni, 135  
10623 Berlin

```
CITYOBJECT_GENERICATTRIB/ATTRNAME
```

Returns the names of all existing generic attributes for each city object. All names will be separated by commas.

```
CITYOBJECT_GENERICATTRIB/REALVAL [ATTRNAME =
'SOLAR_SUM_INVEST' ] EUR
```

Returns the content of the REALVAL column of all existing generic attributes for each city object whose ATTRNAME is equal to 'SOLAR\_SUM\_INVEST'. The number will be followed by “EUR”. For instance:

23000EUR

### Rules for Columns' Template file

Rules for the template file are simple. A template file contains a list of columns and their description. It may be edited by hand or by saving a manually created template.

- A template file is a plain-text file.
- Each row of a template file may describe a column or be a comment.
- Comment rows **MUST** start by // or ;
- A column should be specified in one of following forms:
  - *Title:Content*

Title is the column's title and content is the column's content. In this case title is specified by user.
  - *Content*

Content is the column's content. In case the column's title is not specified by the user it will be automatically generated by the plugin.

### Example for Template File

Sample template file:

```
// This is a template file for the export of tabular data.
// Lines starting with // or ; are comments and will be ignored.
Street:ADDRESS/[FIRST]STREET
Houseno:ADDRESS/[FIRST]HOUSE_NUMBER
City:ADDRESS/[FIRST]CITY
Address:ADDRESS/[FIRST]STREET,
ADDRESS/[FIRST]HOUSE_NUMBER[EOL]ADDRESS/[FIRST]CITY
// INVEST
Investment:CITYOBJECT_GENERICATTRIB/REALVAL [ATTRNAME =
'SOLAR_SUM_INVEST' ] EUR
```

Figure 4 shows a sample export result.

	A	B	C	D	E	F
1	GMLID	Street	Houseno	City	Address	Investment
2	BLDG_0003000f0028da8a	Straße des 17. Juni	136	Berlin	Straße des 17. Juni, 136 Berlin	315700 EUR
3	BLDG_000300000008f6df	Straße des 17. Juni	115	Berlin	Straße des 17. Juni, 115 Berlin	0 EUR
4	BLDG_0003000f00250727	Straße des 17. Juni	118	Berlin	Straße des 17. Juni, 118 Berlin	263550 EUR
5	BLDG_000300000008f309	Straße des 17. Juni	124	Berlin	Straße des 17. Juni, 124 Berlin	38850 EUR
6	BLDG_0003000e00a0e27c	Straße des 17. Juni	152	Berlin	Straße des 17. Juni, 152 Berlin	444500 EUR
7	BLDG_0003000f0025072f	Straße des 17. Juni	144	Berlin	Straße des 17. Juni, 144 Berlin	493850 EUR
8	BLDG_0003000a001ce4b3	Hardenbergstr.	36	Berlin	Hardenbergstr., 36 Berlin	374150 EUR
9	BLDG_0003000f00093e86	Straße des 17. Juni	145	Berlin	Straße des 17. Juni, 145 Berlin	887950 EUR
10	BLDG_0003000f00093e88	Hardenbergstr.	40A	Berlin	Hardenbergstr., 40A Berlin	107100 EUR
11	BLDG_0003000e00858128	Hardenbergstr.	38	Berlin	Hardenbergstr., 38 Berlin	56700 EUR
12	BLDG_0003000000f51d29	Hardenbergstr.	36	Berlin	Hardenbergstr., 36 Berlin	0 EUR
13	BLDG_0003000e00858120	Hardenbergstr.	36A	Berlin	Hardenbergstr., 36A Berlin	399350 EUR
14	BLDG_0003000000f521db	Straße des 17. Juni	135	Berlin	Straße des 17. Juni, 135 Berlin	0 EUR
15	BLDG_0003000e00206fa4	Hardenbergstr.	128	Berlin	Hardenbergstr., 128 Berlin	124600 EUR
16	BLDG_0003000f00093e80	Ernst-Reuter-Platz	1	Berlin	Ernst-Reuter-Platz, 1 Berlin	233800 EUR
17	BLDG_0003000e00206f8e	Hardenbergstr.	41	Berlin	Hardenbergstr., 41 Berlin	31150 EUR
18					Straße des 17. Juni, 135	

**Figure 4:** Example of exported data based on sample template presented above from a 3D City Database instance.

### 2.3.1.2 Content Source

In this GUI section the feature class of city objects and their origin (versioning information and geographic bounding box) should be specified.

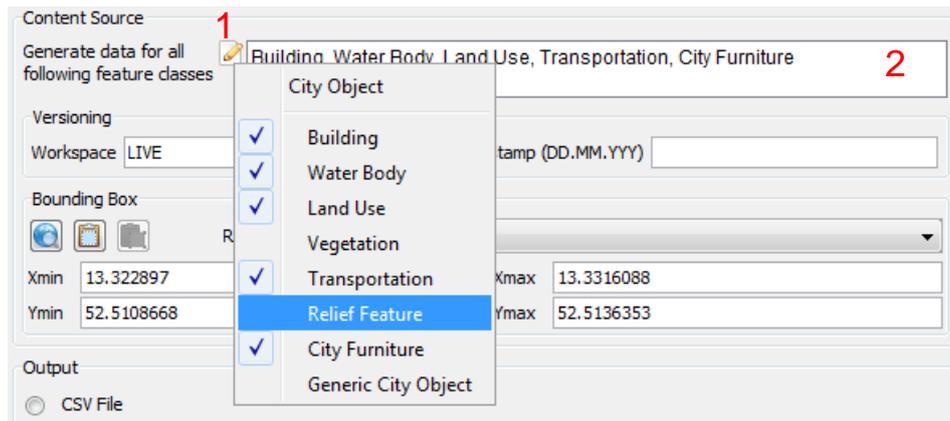
#### Feature Classes

City objects of the selected feature class(es) will be exported. Click on the edit button (marked by 1 in Figure 5) to insert or remove a feature class.

#### Versioning

Oracle's Workspace Manager enables storing of different versions of the database as named workspaces. The export process will use the specified workspace.

If version management is disabled or the current state of the database should be exported, the default workspace name LIVE must be entered and the timestamp field must remain empty.



**Figure 5:** Click on the *edit* button (marked by 1) to add or remove a CityGML feature class from the list of features classes (marked by 2).

## Bounding Box

Use the bounding box section to select an area of interest from which the selected features contained should be exported. Insert lower left and upper right coordinates of the bounding box or click on the map button to select the area from a map. Please refer to [3] for more details on the different options for specifying a bounding box.

### 2.3.1.3 Output

It is possible to export the data in a CSV file on the local computer, or directly into an online spreadsheet hosted in a cloud service.

#### CSV File

A Comma-Separated Values (CSV) file is not only human readable but also supported by most spreadsheet applications. It can be easily imported into a local spreadsheet processing program like Microsoft Excel and Open Office Calc or to a web based online spreadsheet service like Google Docs.

Click on the *CSV File* radio button, and write an output file path or select an output file by clicking on the *Browse* button. It is also possible to specify another separator character(s) instead of comma (default). Write any arbitrary separator phrase or click on the *edit* button (marked by 1 in Figure 6) to select it from a list.

**Figure 6:** Click on the *CSV File* radio button and write any output file path or click on the *Browse* button to select an output file. Type the separator character (s) or click on the *edit* button (marked by 1) and select one from a list.

### Directly into the Cloud

The SPSHG plugin is able to export data directly into an online spreadsheet hosted in a cloud service. Currently only Google Spreadsheet is supported. All you need is a Google Docs account. Click on the *Directly into the Cloud* radio button to enable this part. Choose a cloud server and insert the *Email Address* and *Password* of your Google Docs account. Specify a *Spreadsheet Name*. The exported spreadsheet will be shown later by this name in your documents list.

**Figure 7:** After authentication fails for several times, a CAPTCHA will be shown. Check your email address and password and write what you see in the picture (marked by 1) into the text field (marked by 2). Click on the *Export* button again.

By clicking on the *Export* button the SPSHG plugin will automatically authenticate your *Email Address* and *Password* by contacting to the Google Doc service and a corresponding message will be shown in the console. If the authentication fails several times a CAPTCHA will be shown (Figure 7). To retry, first check your *Email Address* and *Password* are properly written and then write the letters seen in the picture (marked by 1) into the text field (marked by 2) below the picture and try again.

After finishing the export process, the *Link Copy* and *Sharing Settings* buttons will become enabled (marked by 3 and 4 respectively). By clicking on the *Link Copy* button the URL address of the uploaded spreadsheet will be copied into the clipboard. Clicking on the *Sharing Settings* button will open the *Sharing Settings* dialog. See more information in section 2.3.1.5.

#### 2.3.1.4 Export

By clicking on the *Export* button, the export process will begin. If *Directly into the Cloud* is selected as the output form, the inserted *Email Address* and *Password* will be used for authentication and the corresponding message will be shown in the console. Then a connection to a database with the settings from the database tab will be established and export will be started. The output is stored in a temporary file<sup>1</sup> on the user's computer and then uploaded into the cloud. After the export is finished a summary will be shown in console and the temporary file is removed.

#### Overwriting

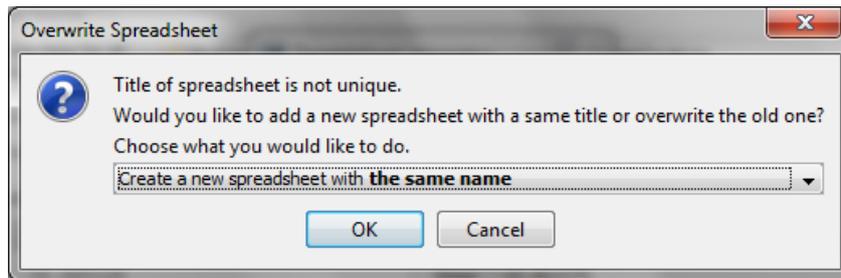
When exporting data directly into the cloud it is possible to overwrite an already existing spreadsheet document if there is already another spreadsheet with the same title stored in the cloud. As a result all settings of the old document will remain unchanged and its content will be updated. It means sharing settings, visibility and document link will not be altered. Whenever there is a spreadsheet name conflict, the program will ask you whether you wish to create a new spreadsheet with that title or overwrite an existing spreadsheet. Before uploading the spreadsheet a dialog as shown in Figure 8 will pop up. You can choose to create a new spreadsheet with the same name, or overwrite one of existing files. When overwriting, there may be more than one spreadsheet with the same name; all spreadsheets carrying this name will be shown sorted by their last modification time and last editing person.

#### 2.3.1.5 Sharing settings

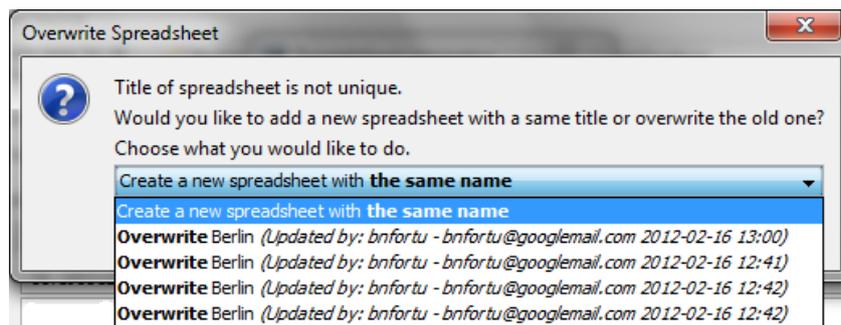
After a successful export into an online spreadsheet hosted in a cloud service, it is possible to change sharing settings of your spreadsheet. Click on the *Sharing Settings* button (marked by 4 in Figure 7) to open the *Sharing Settings* dialog (Figure 9).

---

<sup>1</sup> The temporary file will be created in the system-dependent default temporary-file directory. On UNIX systems it is typically `"/tmp"` or `"/var/tmp"`; on Microsoft Windows systems it is typically defined by the environment variable `TMP` or `TEMP`.

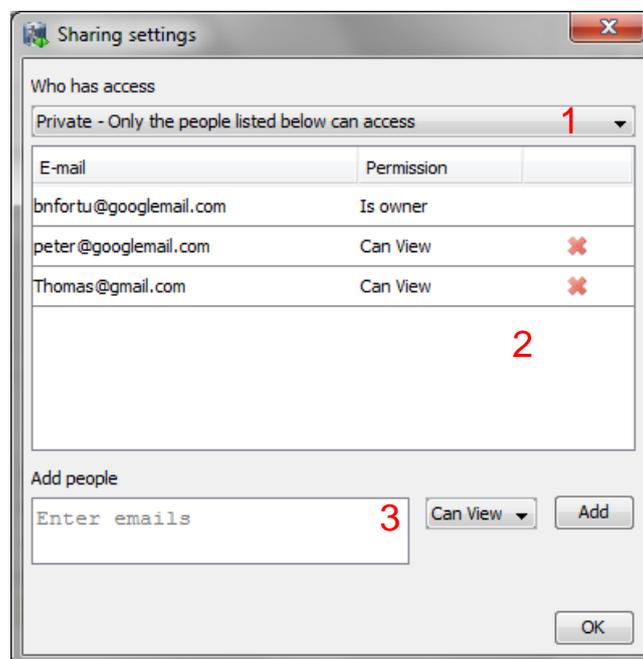


(a)



(b)

**Figure 8:** Overwrite spreadsheet dialog. In the case that a document with the same title is existing on your account, this dialog will be shown. It is possible to create a new spreadsheet with the same name, or to choose one of the existing documents to be overwritten. (b) Shows there may be more than a document with the same name (e.g. Berlin). By choosing one of the available spreadsheets its content will be updated.



**Figure 9:** Sharing settings. Use this dialog to globally modify access to the current document including changing visibility settings and giving people access rights

By using the *Sharing settings* dialog it is possible to share a document with many or just a few people by assigning a visibility option to the document. There are three different visibility options: *private*, *anyone with the link*, and *public on the web*. Furthermore, the document can be shared with selected people as well. Their e-mail address and a sharing rule must be specified.

### Visibility Options

Shows who can view or edit this spreadsheet document (Figure 9, marked by 1).

- *Private - Only the people listed below can access*: when you create a private spreadsheet, just people listed in the table, marked by 2, can have access.
- *Anyone who has the link can view/edit*: people can only view the document if they have the exact URL of the spreadsheet. If you select the *Anyone who has the link can edit* option, anyone with the URL will also be able to *edit* your spreadsheet.
- *Public on the web - Anyone on the Internet can find and view/edit*: public spreadsheets may show up in search results, and anyone who finds the web address of the spreadsheet can access it. If you select *Anyone on the Internet can find and edit* option, any person who finds the spreadsheet document will also be able to view, comment and edit it.

*Note: People who are listed in the table have already access to the spreadsheet, regardless of the selected visibility option.*

### Table of selected people

People who are listed in the table (marked by 2 in Figure 9) have access and their own permission regardless of the visibility option. Their names or email addresses are listed in the table followed by their permission and a delete icon (red cross). To modify access of one specific user click on his/her permission in the table or click on the delete icon to remove him/her from the list. As it was explained before; access rights for all people not listed in the table follow the visibility condition of the document.

### Add People

Just click on the text area below 'Add people' (marked by 3 in Figure 9) and type any email address, choose their permission and click on Add button. To add more people with just one click write a list of their emails separated by commas.

## 3 REQUIREMENTS

An installed instance of the Importer/Exporter version 1.4.0 is required. Plugins are supported starting from version 1.4.0 of the Importer/Exporter. Requirements of the Importer/Exporter 1.4.0 or later versions are explained in the corresponding chapter in their specific documentation. Please see [3] for more information.

## 4 APPENDIXES

### 4.1 Appendix A - An Example

Here is a step by step guide for creating a spreadsheet, uploading it directly into cloud, and sharing it. Assume the spreadsheet should contain the addresses of all a buildings in a specific area.

- Open the *Importer/Exporter* and select *SPSHG* tab (Figure 1).
- First of all, columns of the spreadsheet should be defined by a template. There are two different ways to do that. Please follow one of them:
  - Manually Creating a Template:
    - Click on the *New* button to open the section for creating a template manually (Figure 2).
    - Click on the *Add* button to open *New Column* dialog (Figure 3).
    - Write the *Column's Title*. In this case type „Address“.

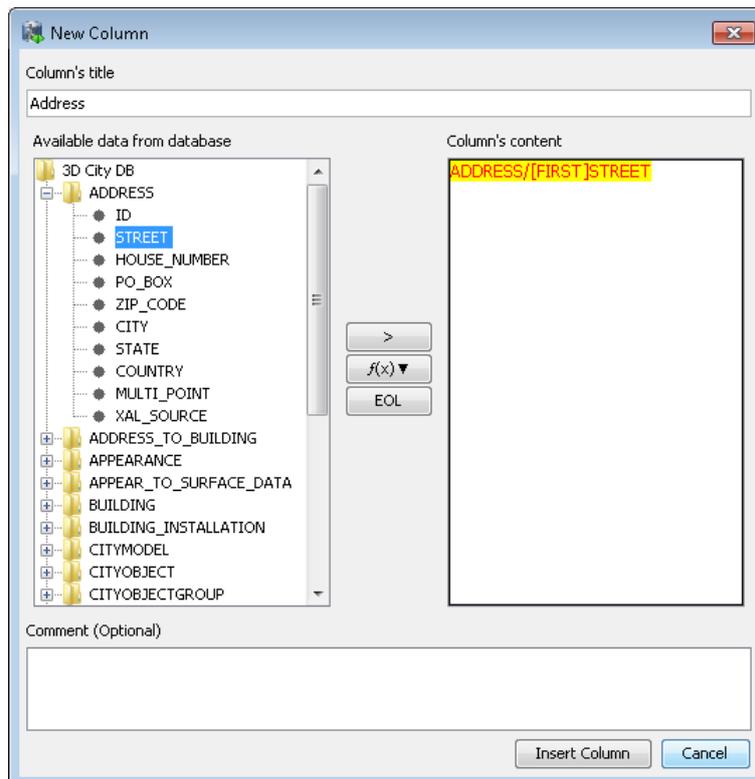
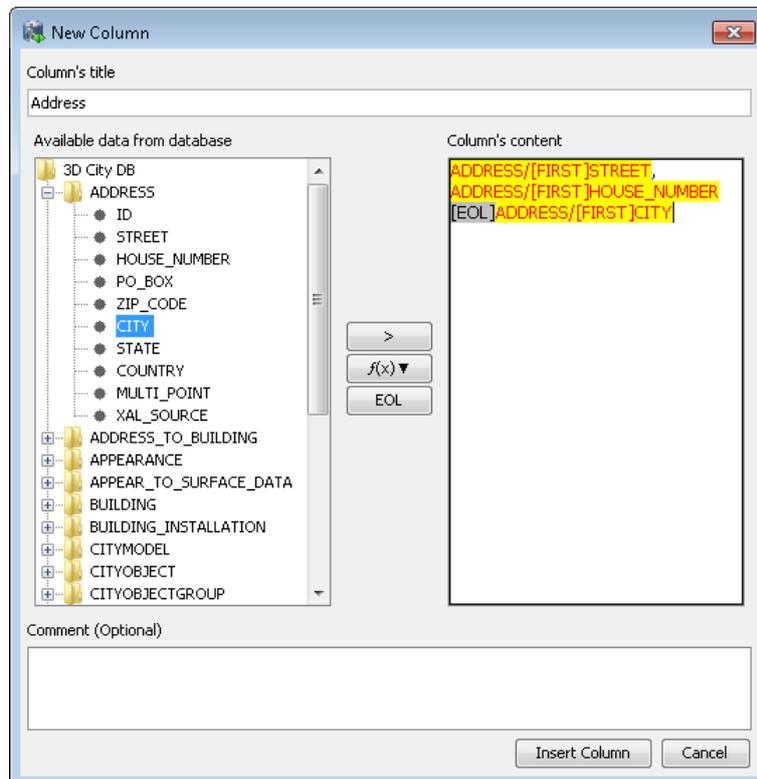


Figure 10: New Column dialog.

- From the left hand *tree* click on *ADDRESS* and then *STREET*. Click on *f(x)* button and choose *FIRST*. As a result the *Column's Content* should be equal to the column's content illustrated in Figure 10.
- Repeat the previous step to add *HOUSE\_NUMBER*, and then click on *EOL* button to add new line and repeat it once again to add *CITY*. The *Column's Content* should be equal to the column's content illustrated in Figure 11.



**Figure 11:** New Column dialog.

- Click on the *Insert Column* button to close the dialog and add current column into the table (Figure 12).
- Loading a template:
  - Create a new plain-text file in your computer and set its name “sample\_template.txt”. Copy and paste the content of the following box into that file and save it.

```
ADDRESS/[FIRST]STREET, ADDRESS/[FIRST]HOUSE_NUMBER
[EOL]ADDRESS/[FIRST]CITY
```

- On the *SPSHG* tab of *Importer/Exporter* click on the *Browse* button. Find the “sample\_template.txt” file and select it. Then press the *Open* button.

- (Optional) Click on the *Edit* button to see columns of the selected template file. It should be similar to Figure 12.

Columns

Load a template file or make a new one manually

Column's Title	Column's Content	Comment
Address	ADDRESS/[FIRST]STREET, ADDRESS/[FIR...	

Would you like to save the template in a file?

**Figure 12:** List of current columns shown in the table. Double click on a column or press the edit button to modify that column's content. Use the *Save* button to store the current template into a text file.

- Content Source

- Click on the *edit* button of feature classes list (marked by 1 in Figure 13). Select *Building* on the pop-up menu and unselect the rest. Click on the list (marked by 2 in Figure 13) to close the pop-up menu. The list should just contain *Building* like in Figure 13.
- Set proper settings for *Workspace* and *Timestamp* in the database *Versioning* part, if required for your database.
- Use the *Bounding Box* part to select your desired area. Insert lower-left and upper-right corner coordinates or use the *Map Viewer* dialog. Be sure that the database connection settings in database tab point to the relevant database.

Content Source

Generate data for all following feature classes   2

Versioning

Workspace  Timestamp (DD.MM.YYY)

Bounding Box

Reference system

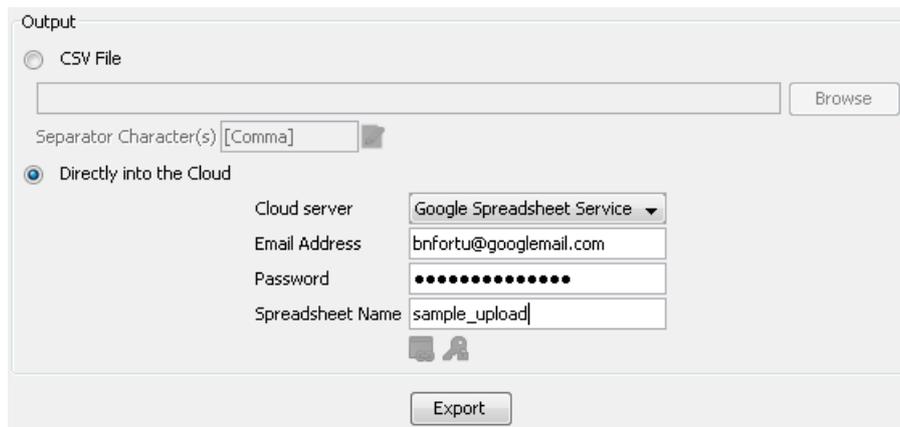
Xmin  Xmax

Ymin  Ymax

1

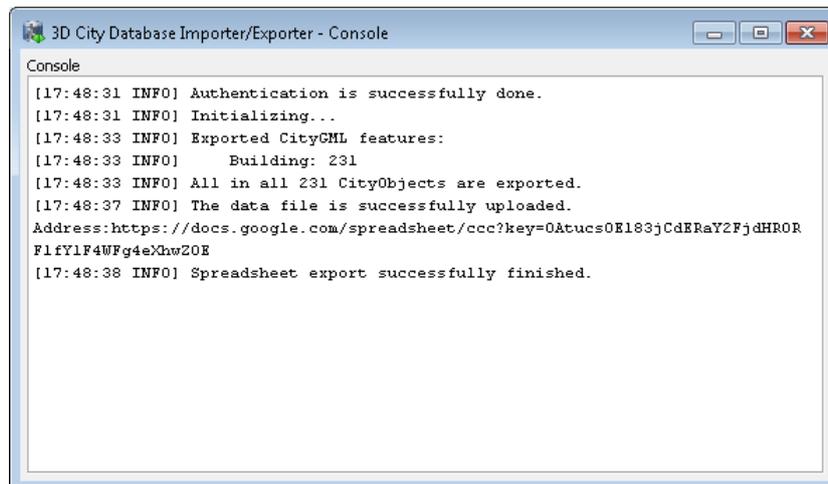
**Figure 13:** Sample settings for *Content Source*

- Output
  - Click on the *Directly into the Cloud* radio button.
  - Choose a *Cloud Server* like *Google Spreadsheet Service*.
  - Insert your *Email address* and *Password* for the selected cloud server. If you chose Google Spreadsheet Service, you just need an ordinary Google account.
  - Write a title for the spreadsheet in the *Spreadsheet Name* field, e.g. “sample\_upload”. Figure 14 shows a snapshot of proper settings for the output part.



The screenshot shows a dialog box titled "Output". It has two radio buttons: "CSV File" (unselected) and "Directly into the Cloud" (selected). Below the "Directly into the Cloud" option, there are several fields: "Cloud server" is a dropdown menu set to "Google Spreadsheet Service"; "Email Address" is a text box containing "bnfortu@googlemail.com"; "Password" is a text box with masked characters; "Spreadsheet Name" is a text box containing "sample\_upload". There is also a "Separator Character(s)" field set to "[Comma]" and a "Browse" button next to it. At the bottom of the dialog is an "Export" button.

**Figure 14:** Sample settings for *Output*.

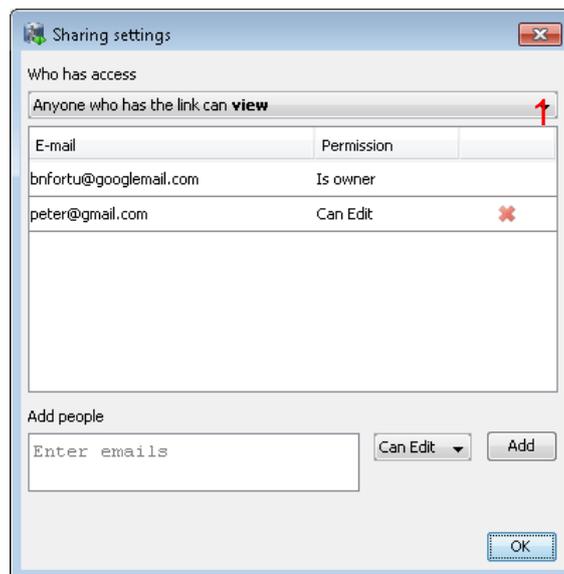


```
3D City Database Importer/Exporter - Console
Console
[17:48:31 INFO] Authentication is successfully done.
[17:48:31 INFO] Initializing...
[17:48:33 INFO] Exported CityGML features:
[17:48:33 INFO]     Building: 231
[17:48:33 INFO] All in all 231 CityObjects are exported.
[17:48:37 INFO] The data file is successfully uploaded.
Address:https://docs.google.com/spreadsheets/ccc?key=0Atucs0E183jCdERaY2FjdHR0R
FlfY1F4WFg4eXhw20E
[17:48:38 INFO] Spreadsheet export successfully finished.
```

**Figure 15:** Console logs for a successful export and upload.

- Export
  - Click on the *Export* button to start the export process.

- Look for relevant messages in the *console*. Figure 15 shows a snapshot of a successful export.
- (Optional) Change Sharing Settings:
  - Click on the *Sharing Settings* icon (marked by 4 in Figure 7) to open the *Sharing Settings* dialog (Figure 16).
  - Change the *Visibility Option* (marked by 1 in Figure 16) from *Private - Only the people listed below can access* to *Anyone who has the link can view*.
  - Press the OK button.
  - Click on the *Link Copy* icon (marked by 3 in Figure 7) to copy the link of your uploaded spreadsheet into the clipboard.
  - Use a web-browser to see the link.



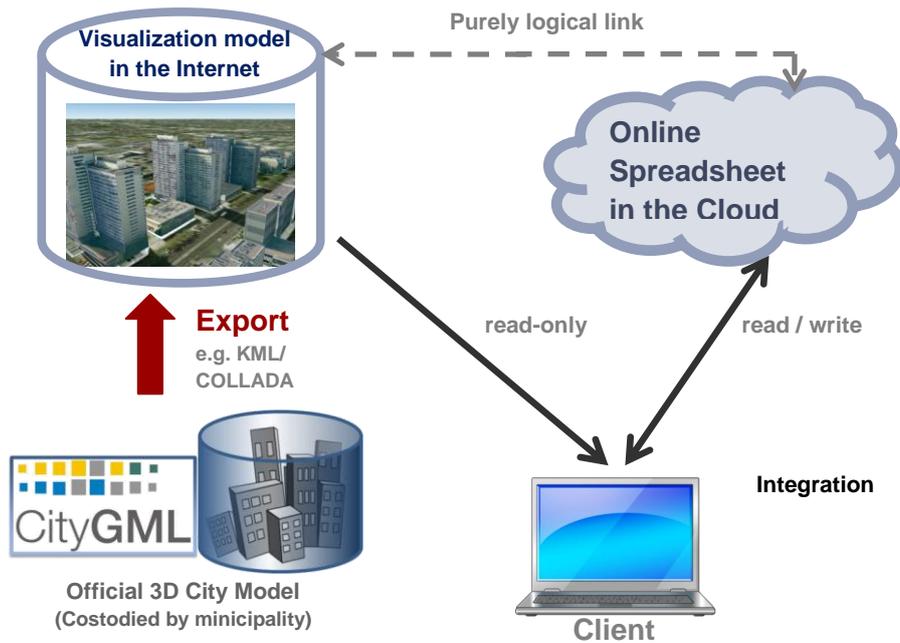
**Figure 16:** Sharing settings dialog. Visibility is set to *Anyone who has the link can view*. In addition to the owner another user can also edit the spreadsheet.

## **4.2 Appendix B - Linking Online Spreadsheet and 3D Visualization Models in Cloud**

Coupling of online spreadsheets with 3D visualization models (i.e. a KML/COLLADA visualization model) in the cloud opens new possibilities for collaborative model maintenance and augmentation without affecting the original (possibly official) 3D city model hosted in a separate and most likely access-restricted environment.

As an example, an online spreadsheet can serve the contents of the information bubbles (so-called balloons) in a KML/COLLADA visualization model that pop up when a city object is clicked on. For this purpose a visualization model should be generated once without any balloon's content and uploaded to a cloud server. Then an online spreadsheet could be linked to that visualization model serving the balloons' contents. Different online spreadsheets can be linked to one and the same visualization model. They may be used by different groups without any intersection. Moreover each spreadsheet could be visible for only a special group of people. Each user may have read or read/write access to the document. Any change in the spreadsheet content will be applied in real-time. Therefore, all users see the latest version of the balloons' content after each request. Figure 17 illustrates the generic idea of coupling an online spreadsheet with a 3D visualization model in the cloud.

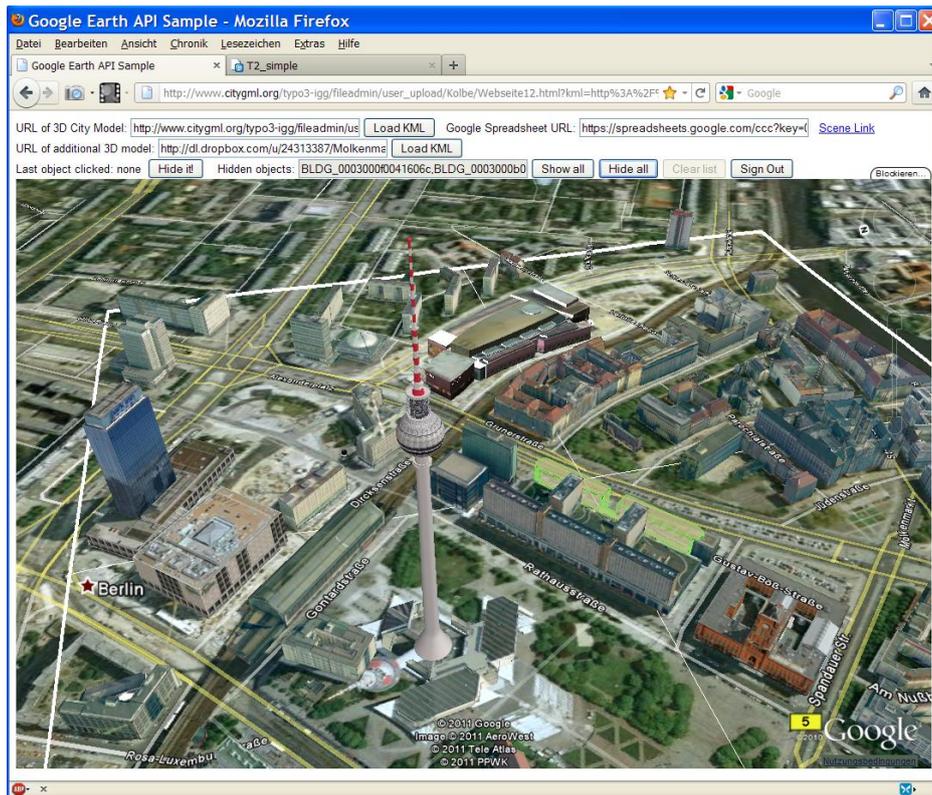
A city object in the visualization model and a row in an online spreadsheet will be linked based on their GMLID. Each city object has a unique GMLID. On request, a city object's balloon will be generated based on the contents of the corresponding spreadsheet's row (the row with the same GMLID). The generation process will be done in a webpage designed for integrating an online spreadsheet with visualization models.



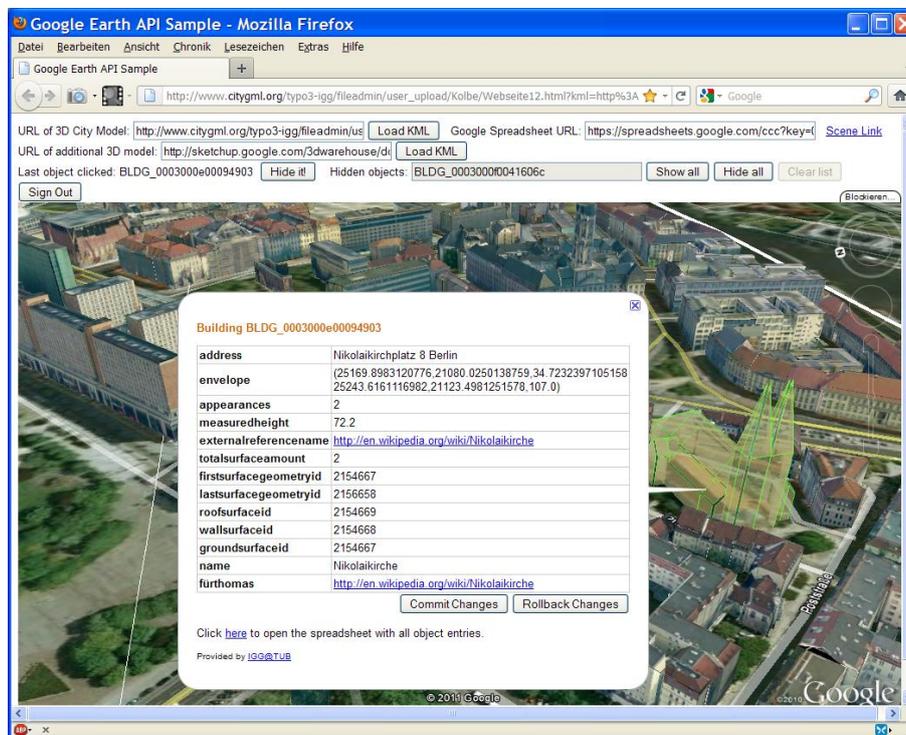
**Figure 17** Coupling an online spreadsheet and a 3D visualization model (i.e. a KML/COLLADA visualization model) in cloud.

Following points describe how to link an online spreadsheet with a 3D visualization model in the cloud:

- The visualization model should be accessible through a direct link on the Internet. The only thing you need is a direct URL of a KML/COLLADA visualization model. Such a model can be created using the KML/COLLADA Exporter of the 3DCityDB (see [3]). If you have your own KML/COLLADA file you can upload your file in personal server or use one of the cloud services for file sharing available on the Internet like Dropbox [4].
- Export a spreadsheet with proper settings. City objects located in same geographic area as the visualization model should be exported. The export can be done directly into a cloud service or to a CSV file. However the CSV file should be manually uploaded into a spreadsheet cloud service later on. Save the link of the spreadsheet after successful upload. The link can be reached by clicking on the corresponding icon (marked by 3 in Figure 7). A step-by-step guide for exporting into a cloud service is specified in *Appendix A - An Example*.
- Change the spreadsheet's sharing settings by clicking on the corresponding icon (marked by 4 in Figure 7). Minimum necessary visibility option is *Anyone who has the link can view*. Give edit access to anyone you want. For more information about sharing settings please refer to 2.3.1.5 and for an example of the corresponding settings see *Appendix A - An Example*.



**Figure 18** Webpage that integrates an online spreadsheet and a visualization model. URL of KML/COLLADA visualization model uploaded into a cloud service, and URL of an online spreadsheet are needed.



**Figure 19** Webpage that integrates an online spreadsheet and a visualization model. By clicking on a city object, a balloon will be shown if an entry in the online spreadsheet with the same GMLID is present



	A	B	C	D	E	F	G	M	N
	ID	Address	Envelope	Appearances	Measured height	External reference name	Total surface amount	name	Für Thomas
118	BLDG_0003000b003beca0	Neue Jüdenstr. 1 Berlin	(25406.5701729394, 25409.5492075483,2	1	28.37369	0003000b003beca0	133		
119	BLDG_0003000b003becb6	Neue Jüdenstr. 1 Berlin	(25429.1334754814, 25463.8786424231,2	1	31.37192	0003000b003becb6	35		
120	BLDG_0003000b000dcb6	Neue Jüdenstr. 1 Berlin	(25418.0257089968, 25447.9974802371,2	1	32.32451	0003000b000dcb6	36		
121	BLDG_0003000e00968449	Nikolaikirchplatz 1 Berlin	(25173.8590647632, 25206.0987502987,2	1	18.44972	=	11		
122	BLDG_0003000e000e1cbc	Nikolaikirchplatz 4 Berlin	(25211.7870326248, 25226.9788580294,2	1	19.37756	0003000e000e1cbc	10		
123	BLDG_000300090076ced	Nikolaikirchplatz 5 Berlin	(25218.9843015136, 25233.7327994992,2	1	19.06376	000300090076ced	10		
124	BLDG_000300090076cfd	Nikolaikirchplatz 6 Berlin	(25226.9788580294,2 25239.2917797373,2	1	15.27501	000300090076cfd	10		
125	BLDG_000300090076cfb	Nikolaikirchplatz 7 Berlin	(25233.2856003899, 25242.3794317084,2	1	15.12411	000300090076cfb	10		
126	BLDG_0003000e00094903	Nikolaikirchplatz 8 Berlin	(25169.8983190776, 25243.6161116982,2	2	72.2	<a href="http://en.wikipedia.org/wiki/Nikolaikirche">http://en.wikipedia.org/wiki/Nikolaikirche</a>	2	Nikolaikirche	changed in Google Spreadsheet
127	BLDG_00030000019d62d	Otto-Braun-Str. 70 Berlin	(25920.2169799826, 25923.423004033,2	1	3.805	00030000019d62d	9		
128	BLDG_00030000019da45	Otto-Braun-Str. 70 Berlin	(25982.8199770781,2 25982.8199770781,2	1	35.71833	00030000019da45	10		
129	BLDG_0003000a00048746	Otto-Braun-Str. 70 Berlin	(25908.5607539928, 25984.4528538445,2	1	36.99986	0003000a00048746	52		
130	BLDG_0003000004336a9	Panoramastr. 1 Berlin	(25317.8384473055, 25384.4683606356,2	1	25.14684	0003000004336a9	86		
131	BLDG_0003000e0057ab7d	Panoramastr. 1A Berlin	(25371.1829758453, 25390.4770241547,2	2	5.40541	0003000e0057ab7d	9		
132	BLDG_0003000e0057ab48	Panoramastr. 1A Berlin	(25339.3500226505, 25374.8479673495,2	2	5.52562	0003000e0057ab48	9		
133		Panoramastr. 1A Berlin	(25309.1112886333						

**Figure 21** The online spreadsheet will be updated as a result of committing the changes successfully inside the balloons.

## 5 REFERENCES

- [1] 3D City Database official website, Weblink (accessed February 2012): <http://www.3dcitydb.net>
- [2] Kolbe, T. H.; König, G.; Nagel, C.; Stadler, A. (2009): *3D-Geo-Database for CityGML*, Version 2.0.1, Documentation, April 24th. <http://www.3dcitydb.net>
- [3] Kolbe, T. H.; Nagel, C.; Herreruella, J. (2012): 3D City Database Version 2.0.6 Importer/Exporter Version 1.4.0 Addendum to the 3D City Database Documentation Version 2.0.1, March 19th. <http://www.3dcitydb.net>
- [4] Dropbox website, Weblink (accessed February 2012): <http://www.dropbox.com>