

Impact of construction materials on urban heat island and buildings energy demand

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plan

- 1. introduction about my thesis
- 2. The simulation
- 3. Review of range of researches and studies that relating to subject
- 4. Research case study
- 5. Simulation process and results
- 6. Conclusion

Introduction:

- In this century, the world saw the biggest increase in its population in human history and thus increased the use of the land and shrinking green areas, as a result our city is warmer climates in urban areas, as compared to rural areas. This phenomenon is known as Urban Heat Island (UHI).
- One of the main reasons of this UHI is building and urban soil materials. There are many attempts to avoid UHI through using a new type of materials such as using materials with high solar reflectance and far-infrared thermal emissivity or “Cool Materials”.

objective :

- The main objective of my study is to identify the effect of construction materials on UHI and energy consumption
- This study is conducted to evaluate the ability of different kinds of new construction materials which produce in France to avoid UHI and achieved energy consumption on residential complexes in Nineveh city – Iraq, which will be constructed in many cities in Iraq.

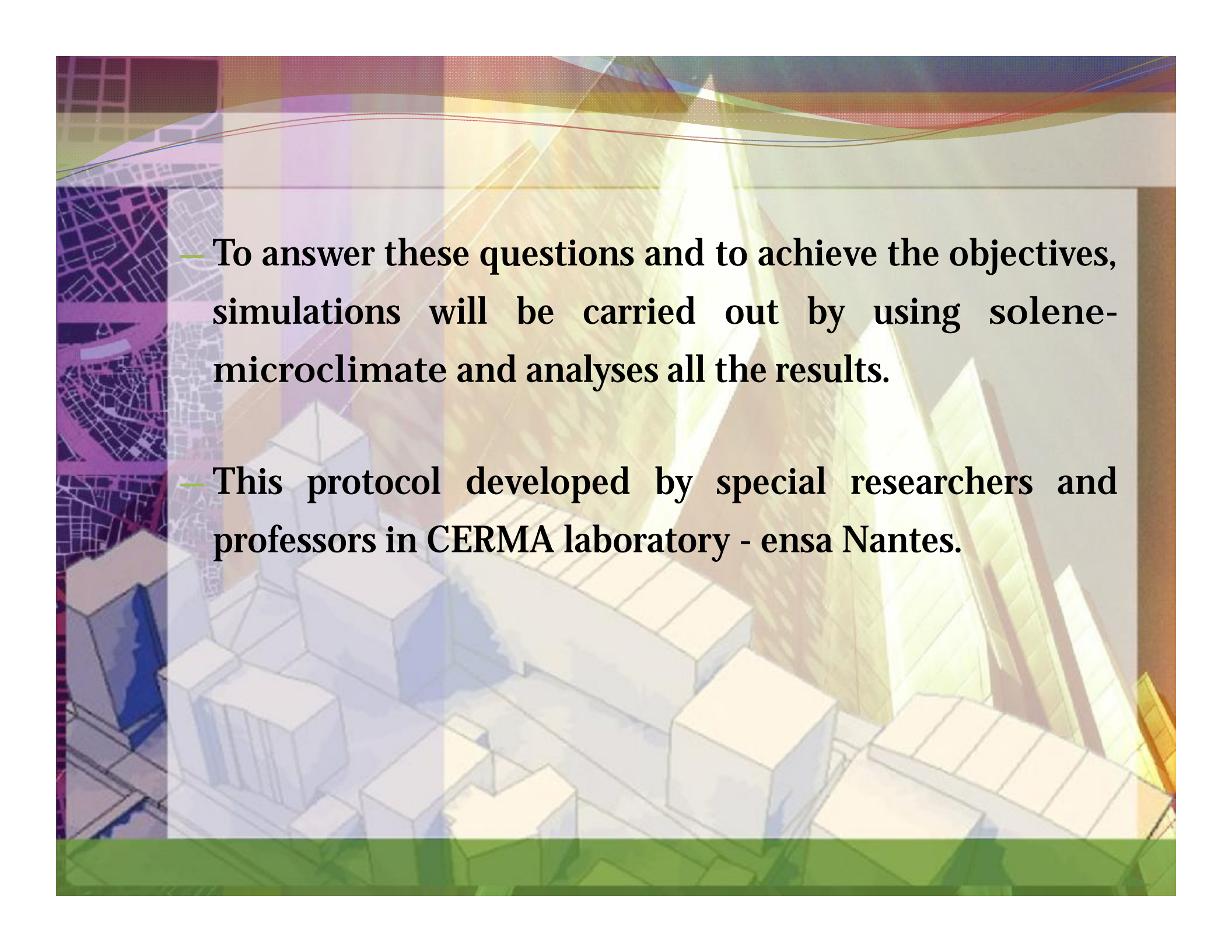


Ciments Calcia Italcementi Group

- This study will be conducted on the construction materials produced by the Calcia company,
- Calcia products can meet all the construction market requirements, as it is the world's fifth largest cement producer.

Research questions :

- This study offered three important questions that related with the selected case study:
 - 1. What are the types of the conventional construction materials that used for buildings and urban spaces and its impact on the urban heat island and energy consumption?
 - 2. What are the new types of construction materials that should be used in order to avoid or reduce the urban heat island and energy consumption? ;
 - 3. Do the building form, or the method to buildings grouped have an impact on the urban heat island?

- 
- To answer these questions and to achieve the objectives, simulations will be carried out by using solene-microclimate and analyses all the results.
 - This protocol developed by special researchers and professors in CERMA laboratory - ensa Nantes.

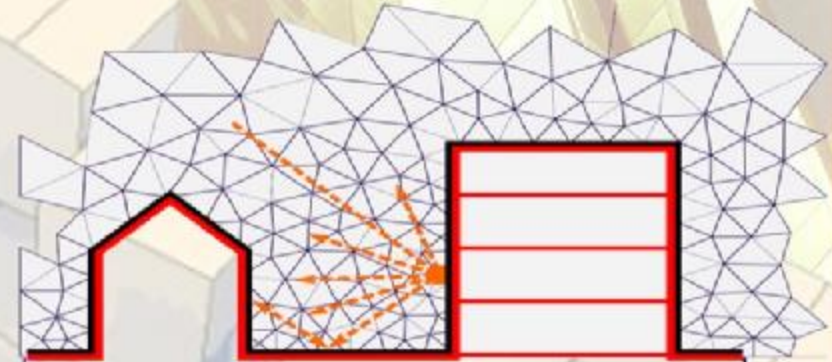
— In order to achieve the simulation , this study will consider :

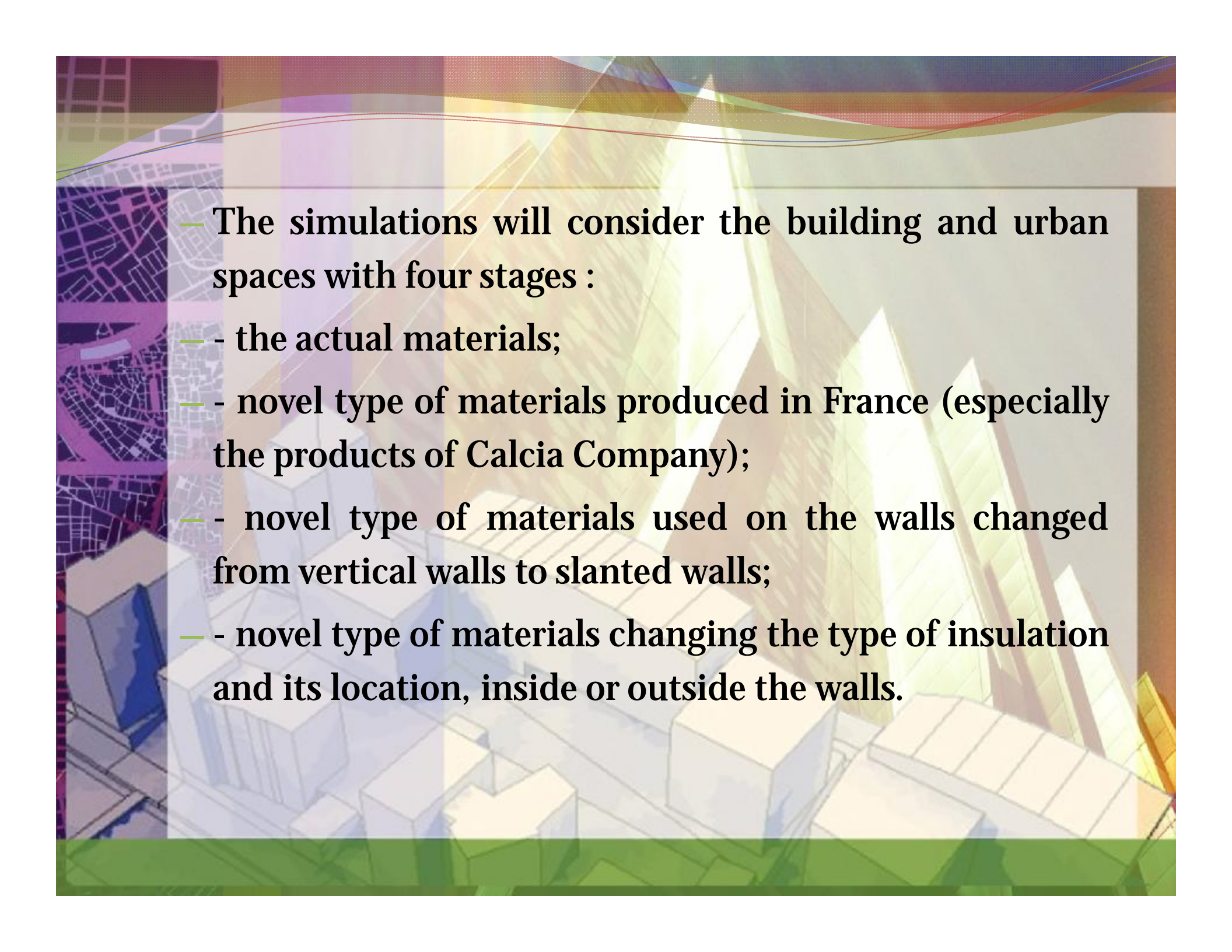
— 1 – The thermal model, to calculate :

- 1.1. Surfaces temperature
- 1.2. Energy conception

— 2 – The Aerodynamics model, to calculate :

- 2.1. Air temperature



- 
- The background of the slide is an abstract composition. On the left side, there is a vertical strip showing a purple-toned city street map. The rest of the background features a 3D architectural rendering of buildings with slanted walls, set against a backdrop of soft, overlapping colors in shades of purple, blue, yellow, and green. The overall aesthetic is modern and technical.
- The simulations will consider the building and urban spaces with four stages :
 - - the actual materials;
 - - novel type of materials produced in France (especially the products of Calcia Company);
 - - novel type of materials used on the walls changed from vertical walls to slanted walls;
 - - novel type of materials changing the type of insulation and its location, inside or outside the walls.



- **2. Review of range of researches and studies that relating to subject**

- **Study of LAURENT – MALYS in 2012 – Ph.D. thesis**

- vegetation envelopes :

- Energy consumption
- Indoor thermal comfort

- **Study of KHALED – ATHAMENA in 2012 – Ph.D. thesis**

- urban morphology :

- Outdoor thermal comfort

- **Study of Maxime – DOYA in 2010 – Ph.D. thesis**

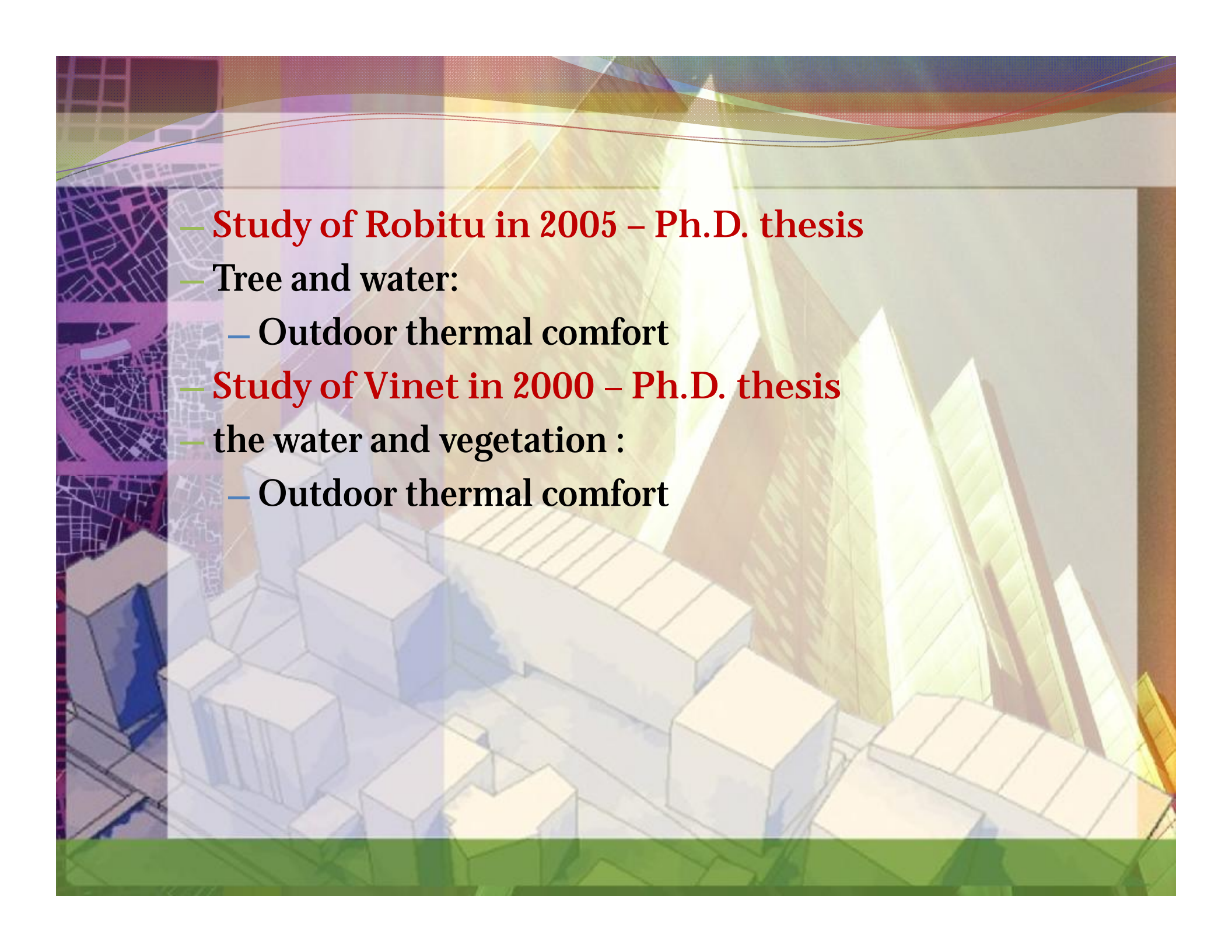
- cool-colored coatings (Analysis of façade radiative properties):

- building energy efficiency in a dense urban environment

- **Study of Julien - BOUYER in 2009 – Ph.D. thesis**

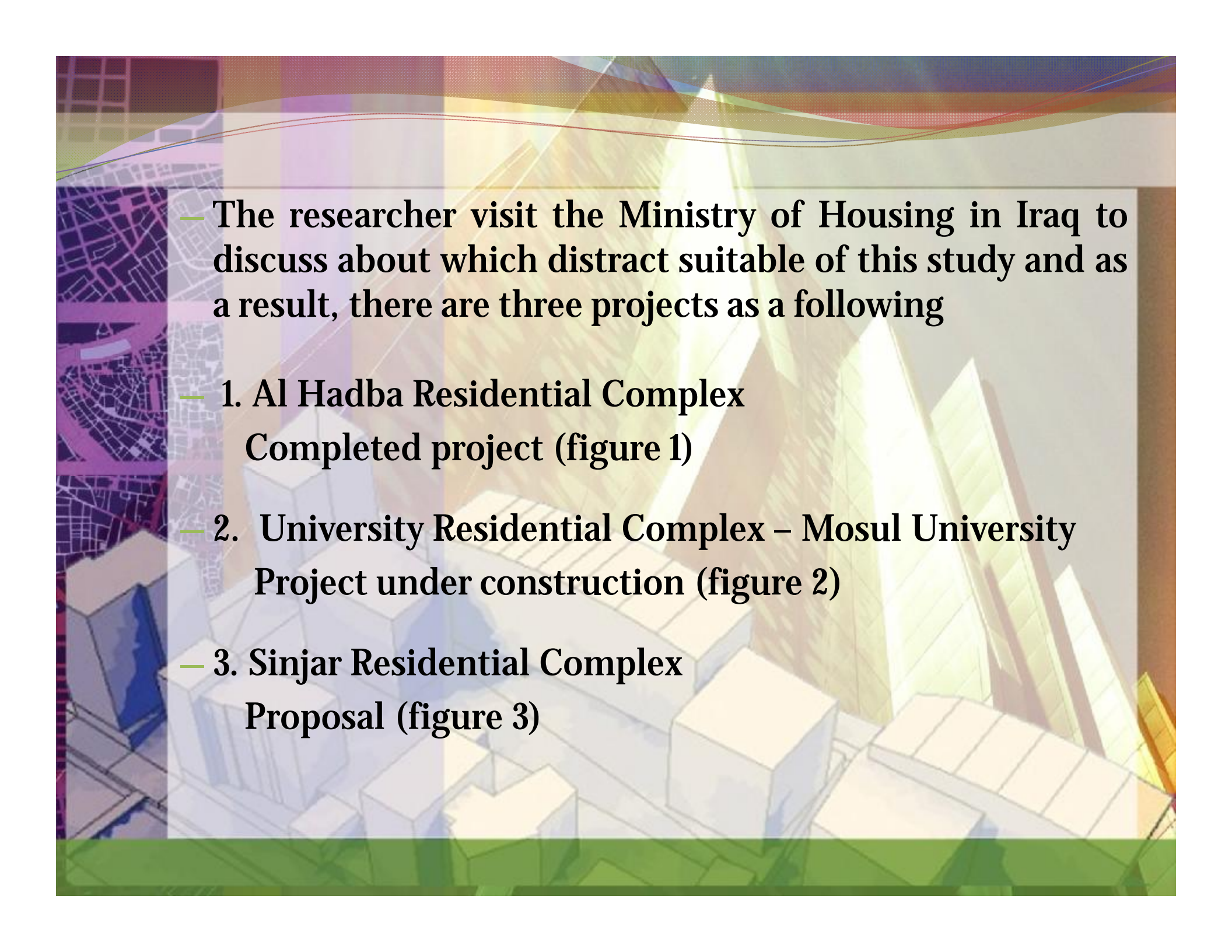
- Urban with vegetation and without vegetation :

- Energy consumption in buildings

- 
- The background of the slide is a complex, multi-layered illustration. It features a cityscape with various buildings in shades of blue, green, and yellow. Overlaid on the left side is a purple-toned map or grid pattern. The top of the image has a curved, multi-colored band in shades of blue, green, and yellow. The overall style is abstract and artistic.
- **Study of Robitu in 2005 – Ph.D. thesis**
 - Tree and water:
 - Outdoor thermal comfort
 - **Study of Vinet in 2000 – Ph.D. thesis**
 - the water and vegetation :
 - Outdoor thermal comfort

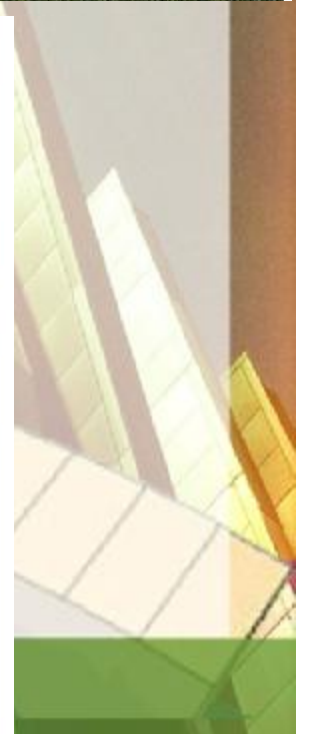
Research case study :

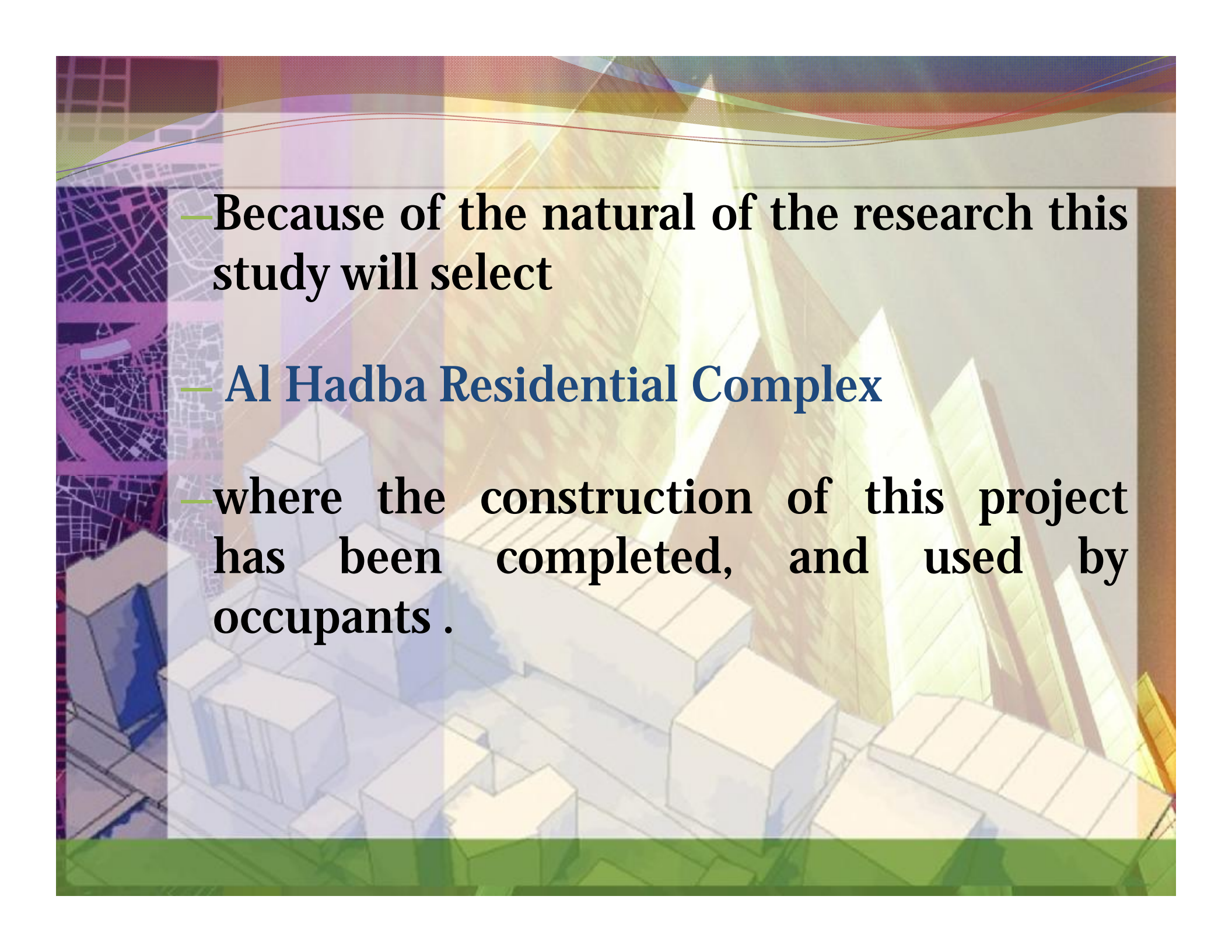
- The orientation of this research will be to study the impact of construction materials on the urban heat island phenomena and also energy consumption on the level of urban form in one of residential district in Iraq (Researcher country).


- 
- The researcher visit the Ministry of Housing in Iraq to discuss about which distract suitable of this study and as a result, there are three projects as a following
 - 1. Al Hadba Residential Complex
Completed project (figure 1)
 - 2. University Residential Complex – Mosul University
Project under construction (figure 2)
 - 3. Sinjar Residential Complex
Proposal (figure 3)

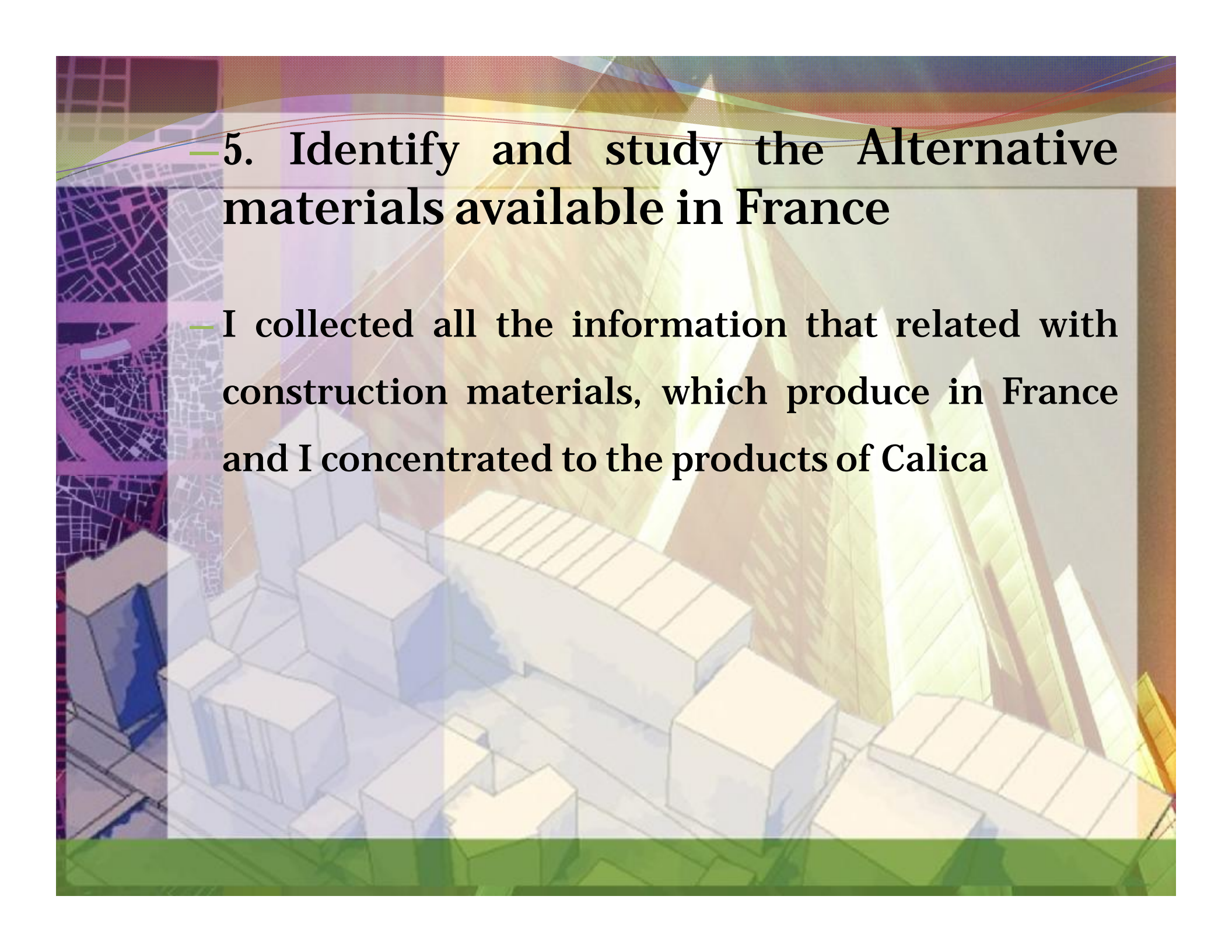






- 
- Because of the nature of the research this study will select
 - **Al Hadba Residential Complex**
 - where the construction of this project has been completed, and used by occupants .

- 
- 4. Identify the construction materials used for
 - Al-Hadba Residential Complex
 - The researcher identified the types of construction materials for this project in two direction:
 - Actual materials,
 - alternative materials that used in Iraq, and
 - finally alternative materials that produce and manufactured in Europe generally and France specially.

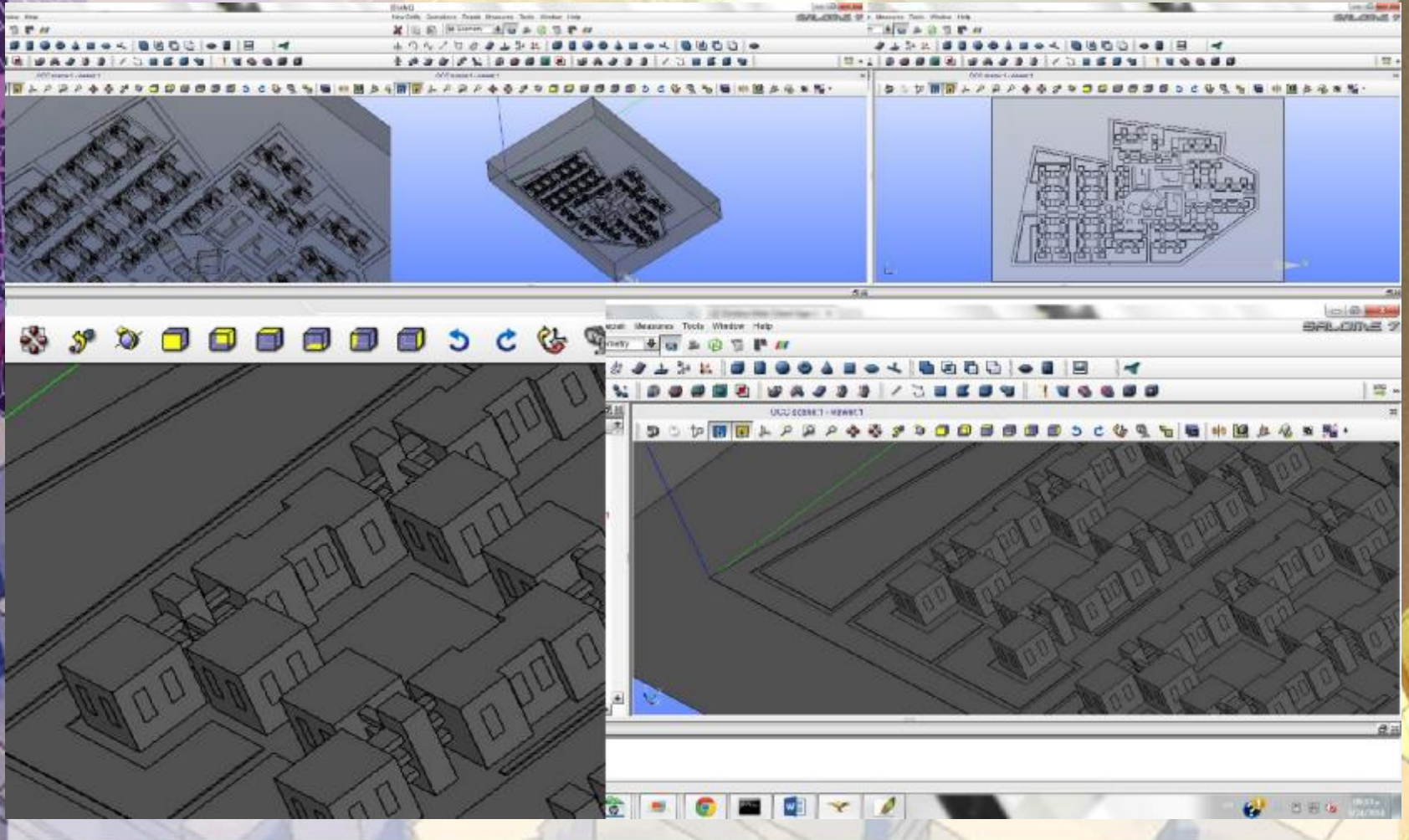


–5. Identify and study the Alternative materials available in France

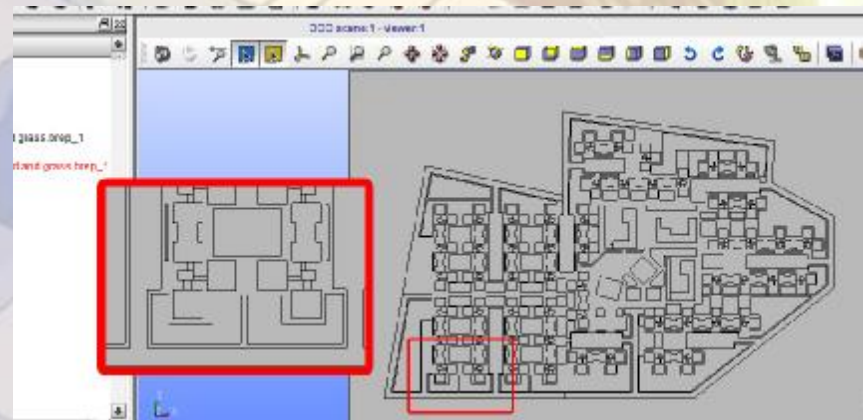
- I collected all the information that related with construction materials, which produce in France and I concentrated to the products of Calica**

6. Simulation process

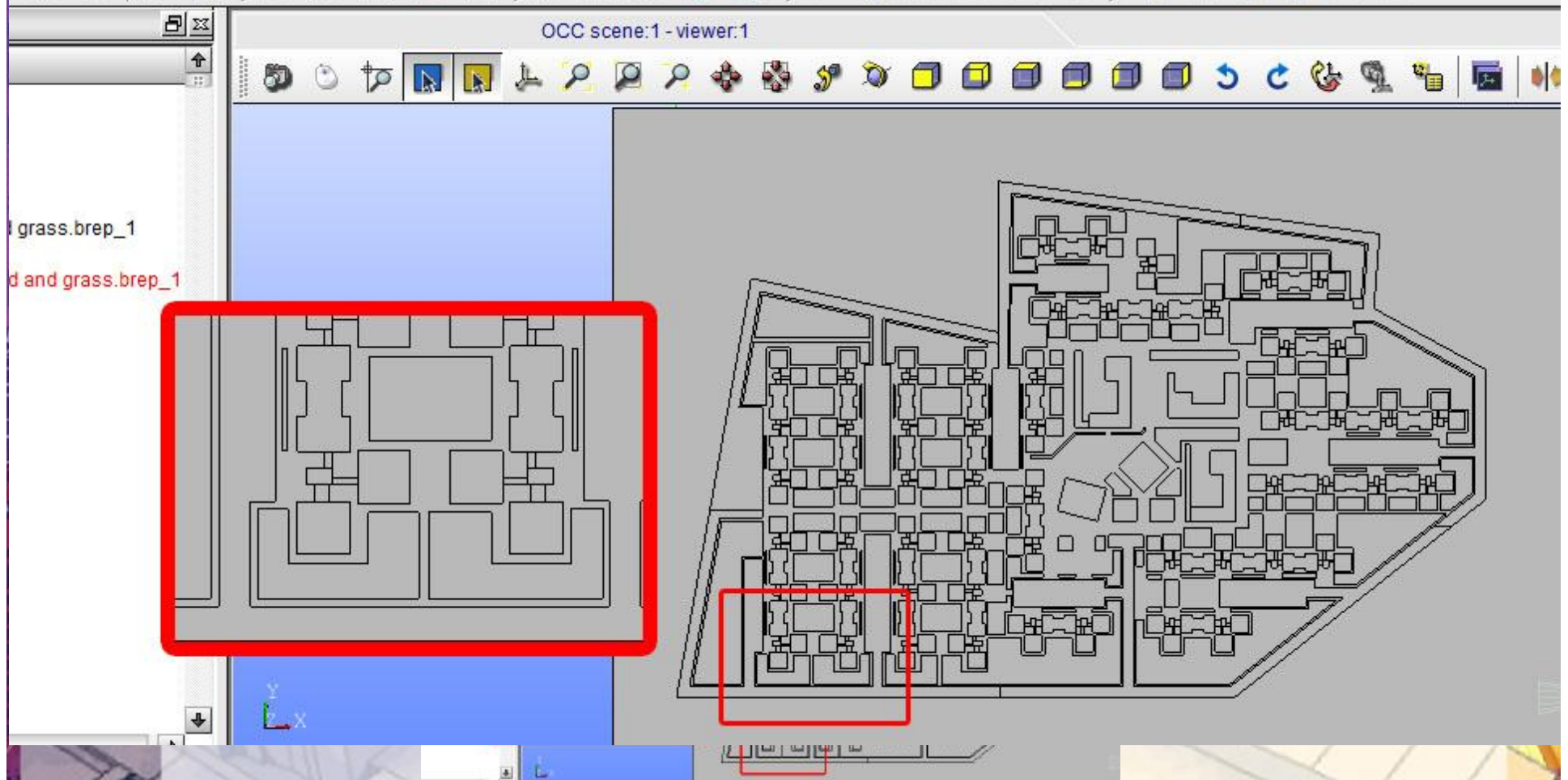
6.1. Create the geometry with Salome and Gmsh, as a figure below

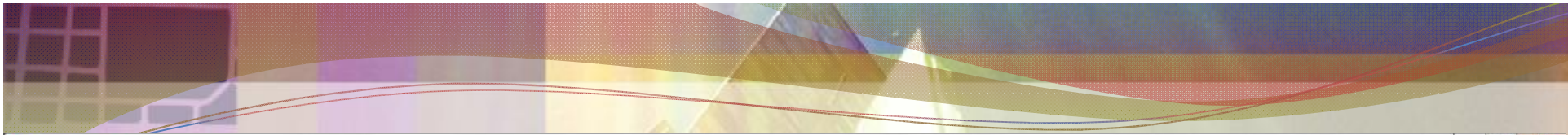


- **6.2. Created all the necessary files for a simulation like materials file, family file, and weather file.**
- **6.3. Completion the simulation by using Solem-Microclimate**
- **I completed the simulation for a part of buildings group where the simulation achieved for June and during 6 hours from 12:00 to 17:00, as the figures below :**



- 6.2. Created all the necessary files for a simulation like materials file, family file, and weather file.





ParaView 4.1.0 64-bit

File Edit View Sources Filters Tools Macros Help

Time: 0

Tse Wireframe

Navigation icons: +X, -X, +Y, -Y, +Z, -Z, Rotate, Pan, Zoom

Pipeline Browser

- builtin:
- resultPARAVIEW*

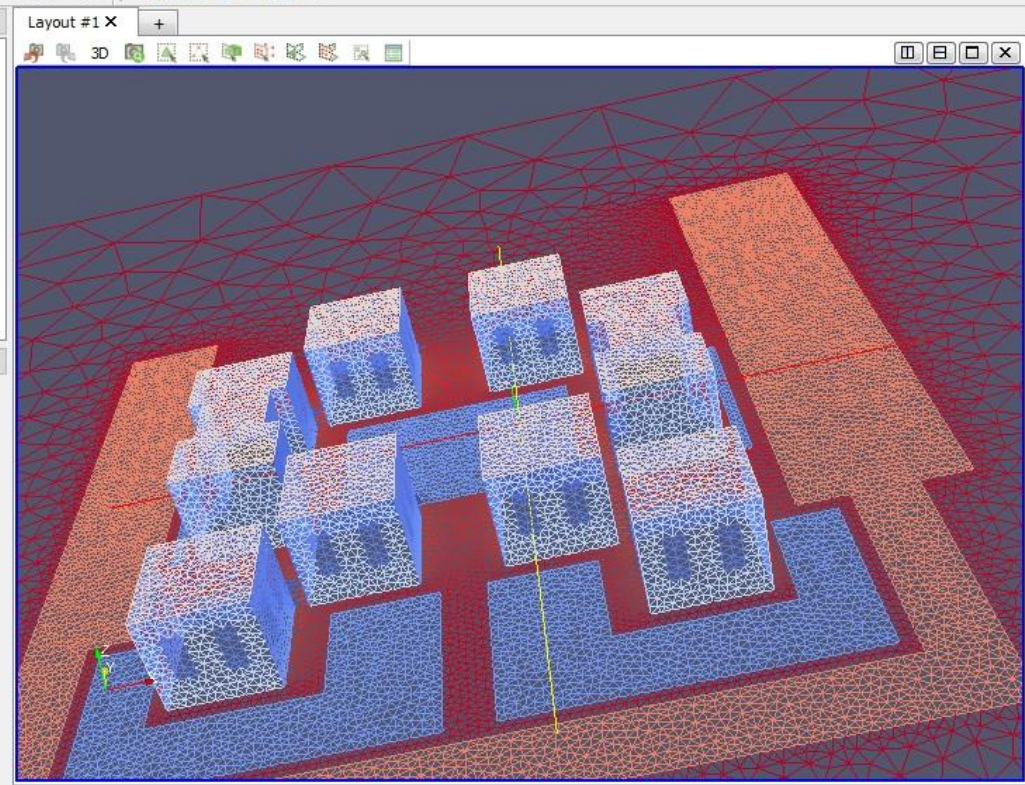
Properties

Apply Reset Delete

Search ... (use Esc to clear text)

Properties (resultPARAVIEW*)

- Cell/Point Array Status
- GLO_Ciel_Net
- GLO_Scene_Net
- GLO_Tota_Net
- Ta
- Tn1
- Tn2
- Tse
- Tse_veg
- ecl abs total



Color Map Editor

Search...

Interpret Values As Categories

Mapping Data

Data:

Use log scale when mapping data to colors

Enable opacity mapping for surfaces

Automatically rescale transfer functions to fit data

Color Mapping Parameters

Lock Scalar Range

Color Space: Diverging

Nan Color: [Black]

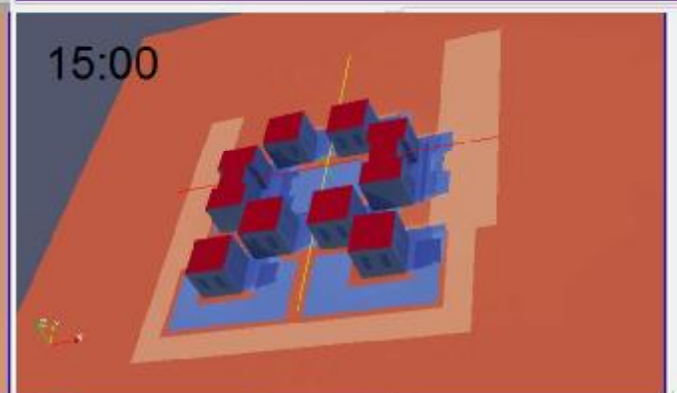
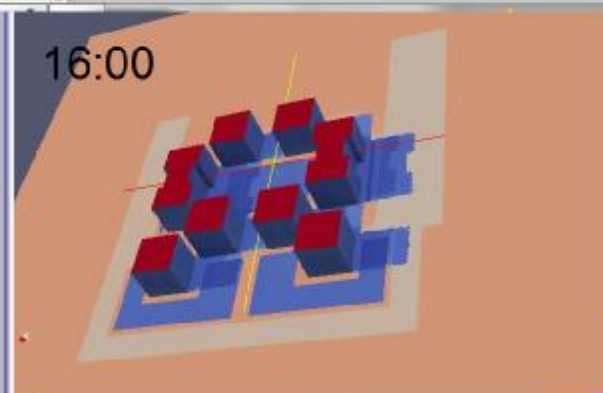
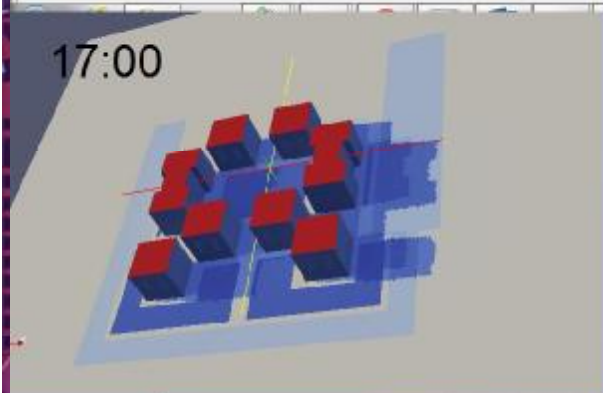
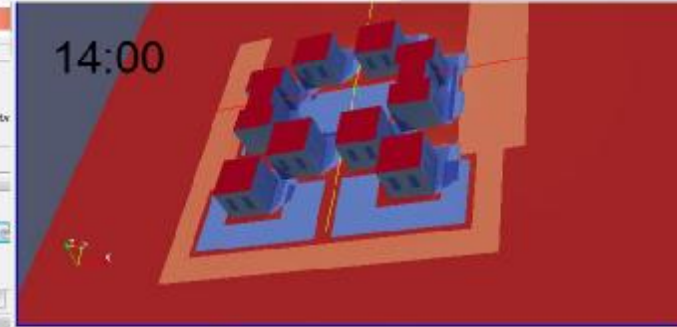
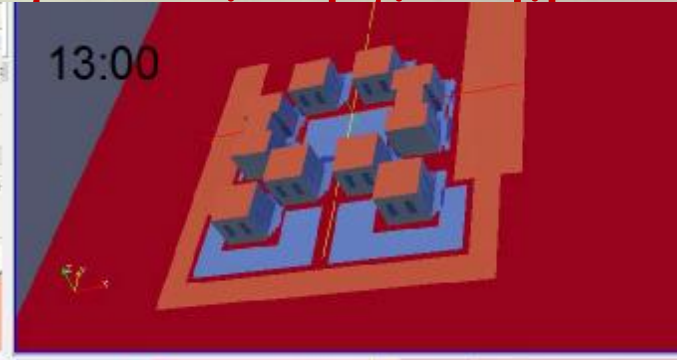
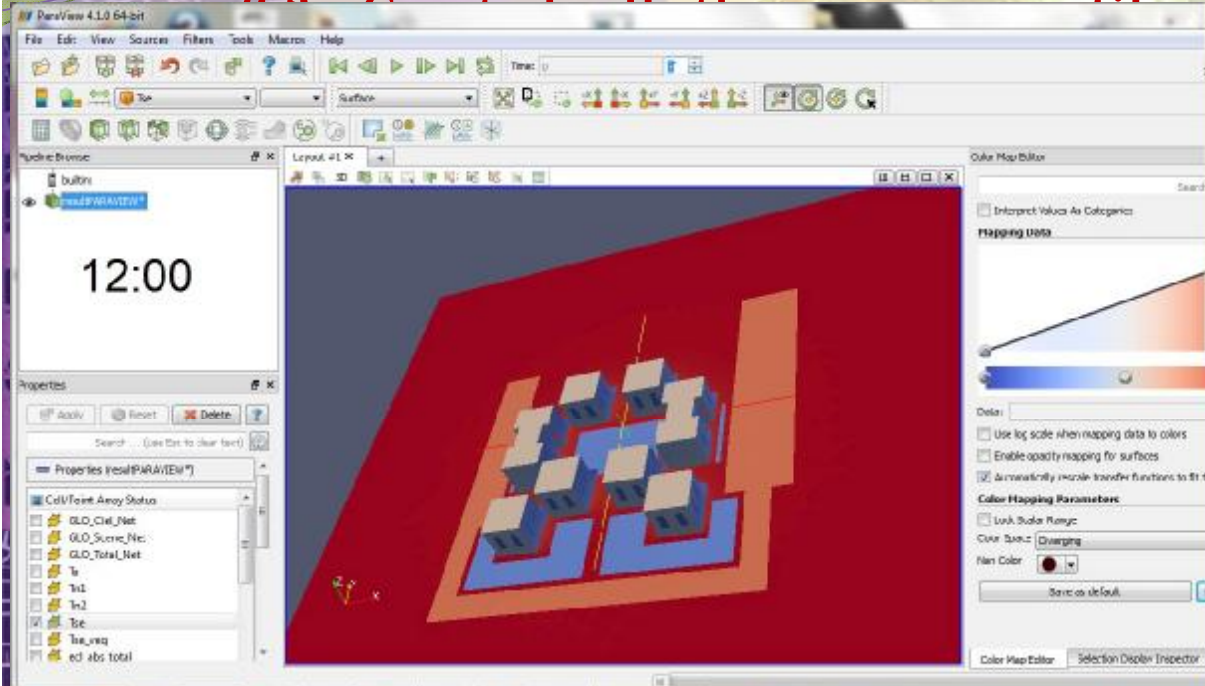
Save as default Update

Color Map Editor Selection Display Inspector

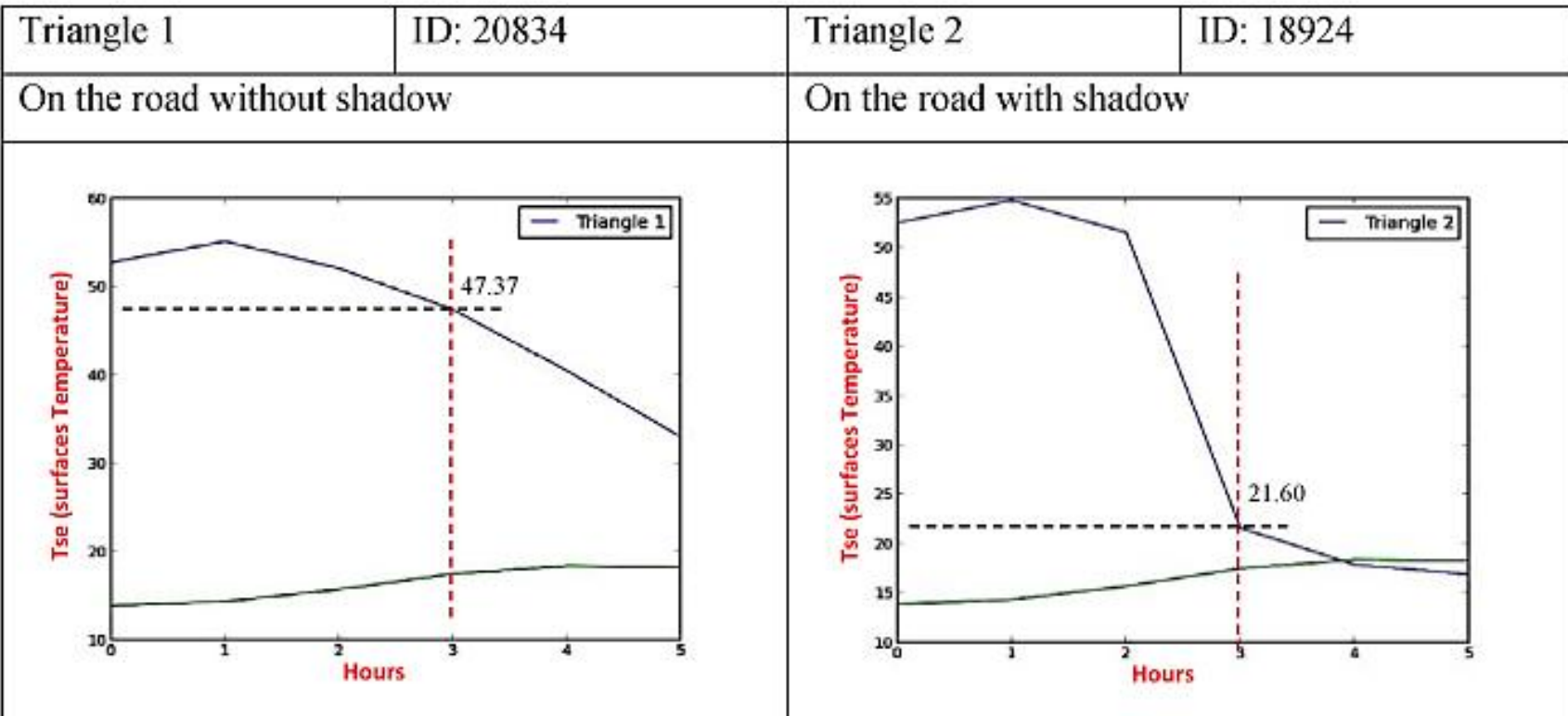
Windows taskbar: Start button, Internet Explorer, File Explorer, HP, Chrome, D:\, Word, ParaView, and other applications.

System tray: AR, help icon, volume, network, and date/time: 09:21 3/24/2014





The result simulation for surface temperature for component of urban form at 15:00 h as a following

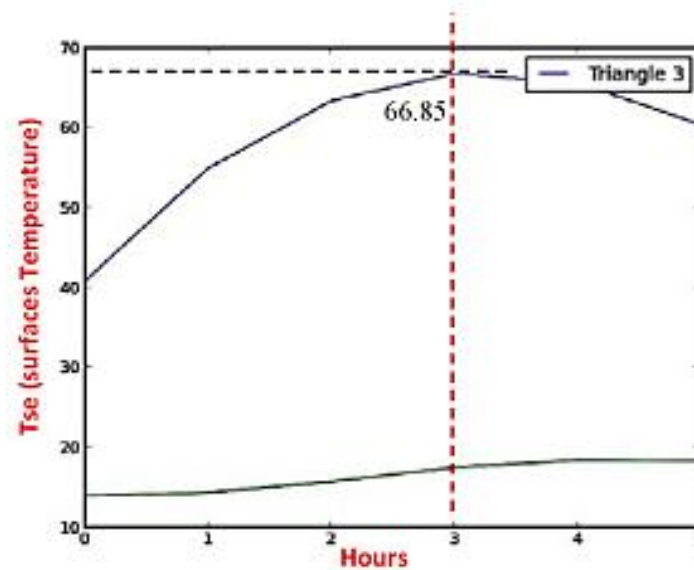


The result simulation for surface temperature for component of urban form at 15:00 h as a following

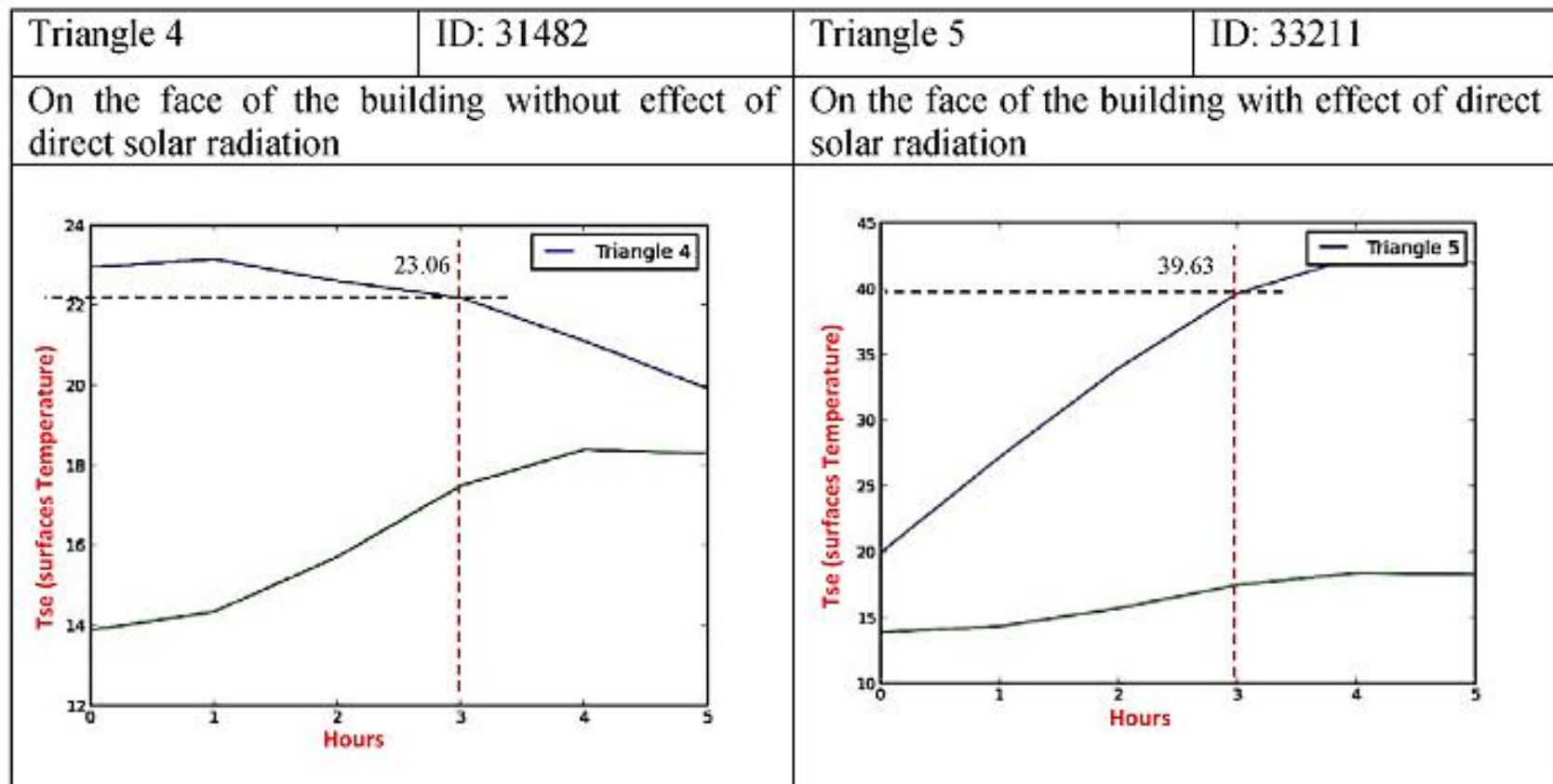
Triangle 3

ID: 38398

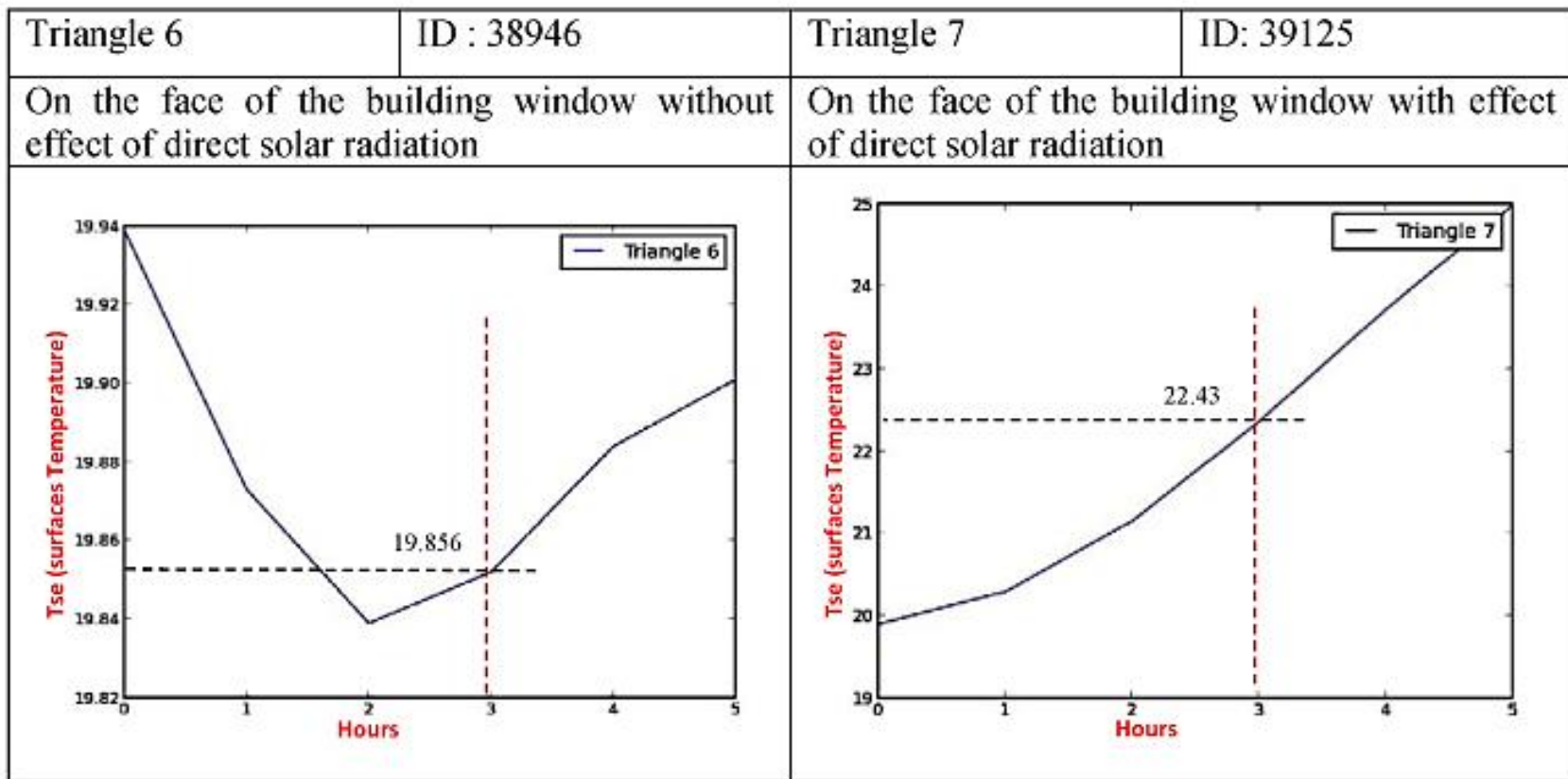
On the roof of building



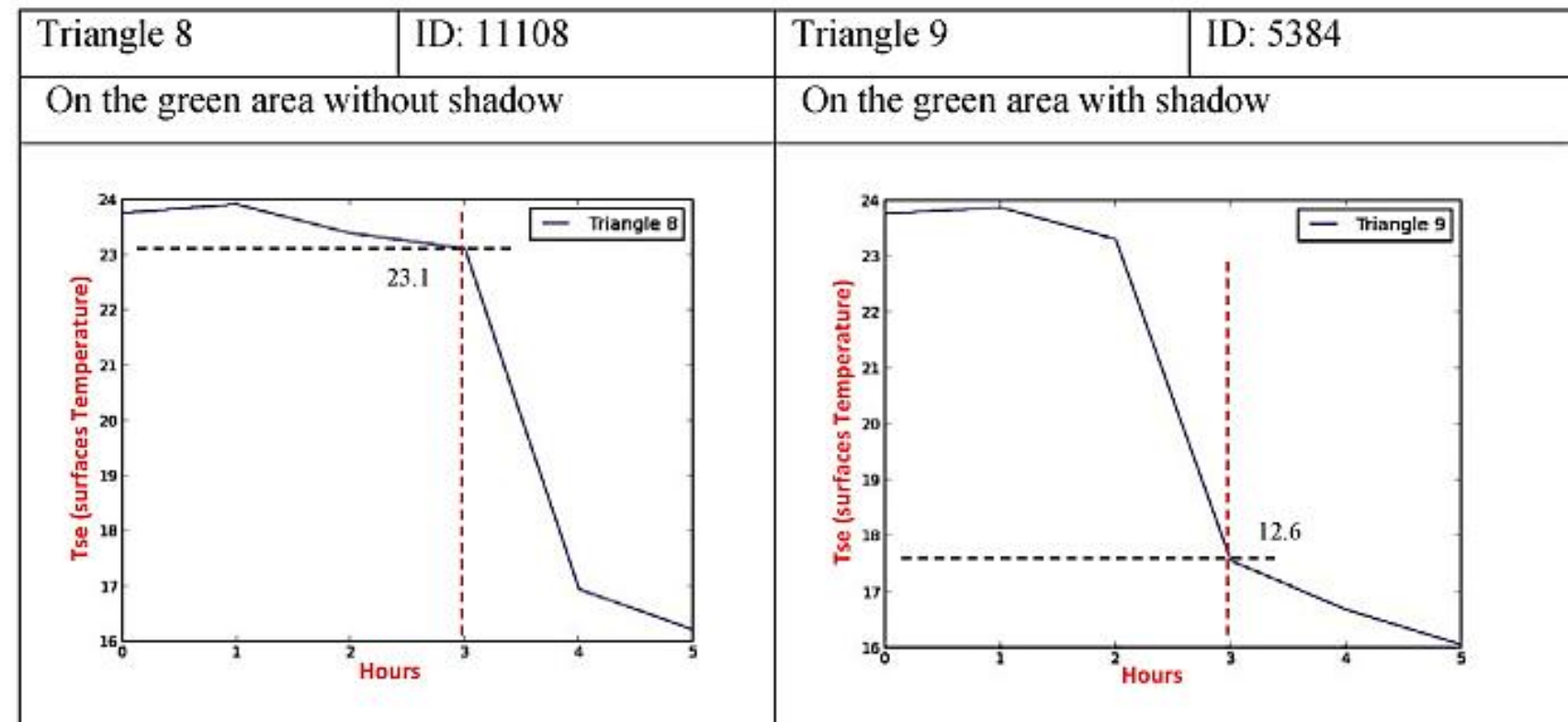
The result simulation for surface temperature for component of urban form at 15:00 h as a following



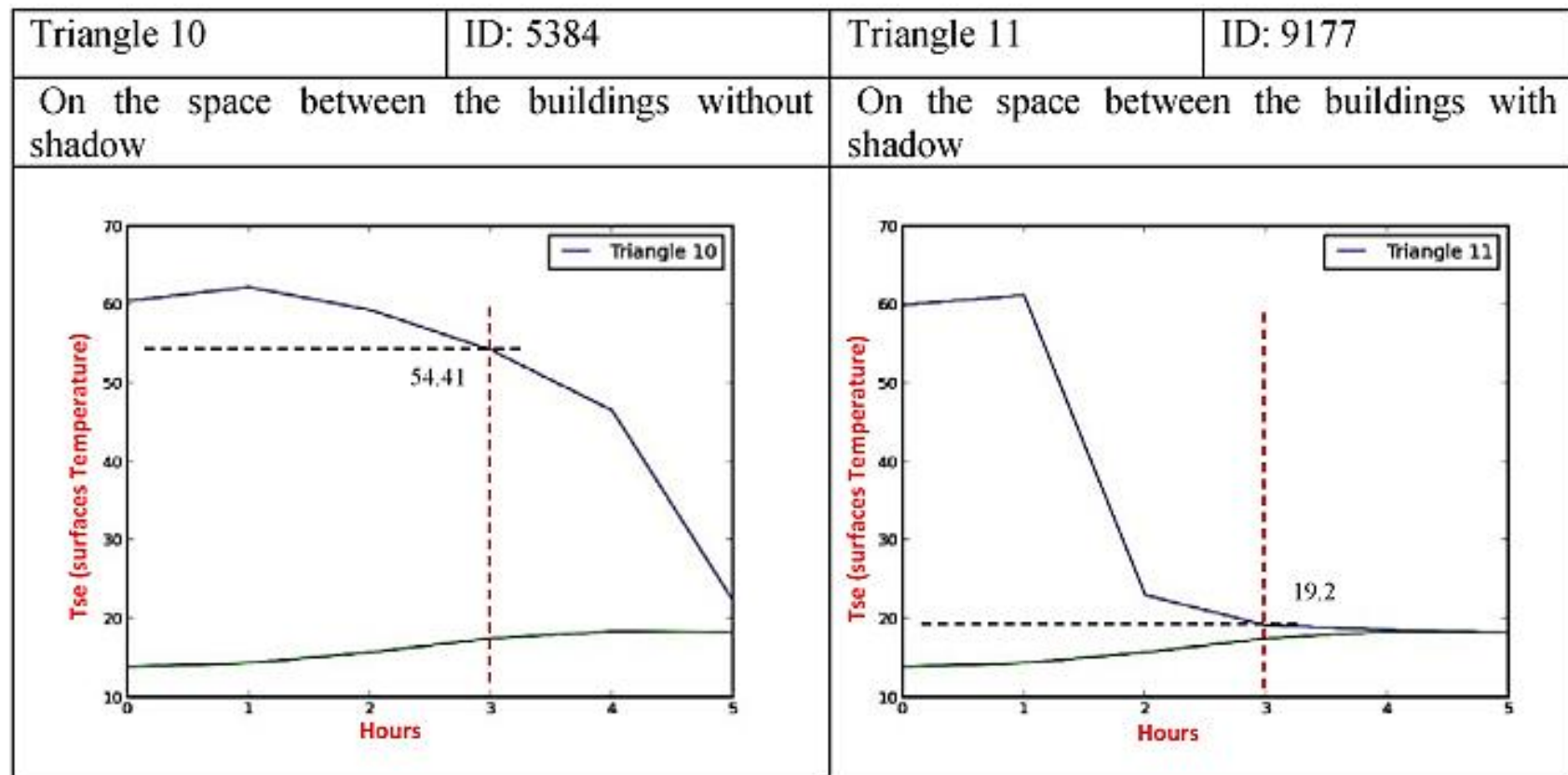
The result simulation for surface temperature for component of urban form at 15:00 h as a following



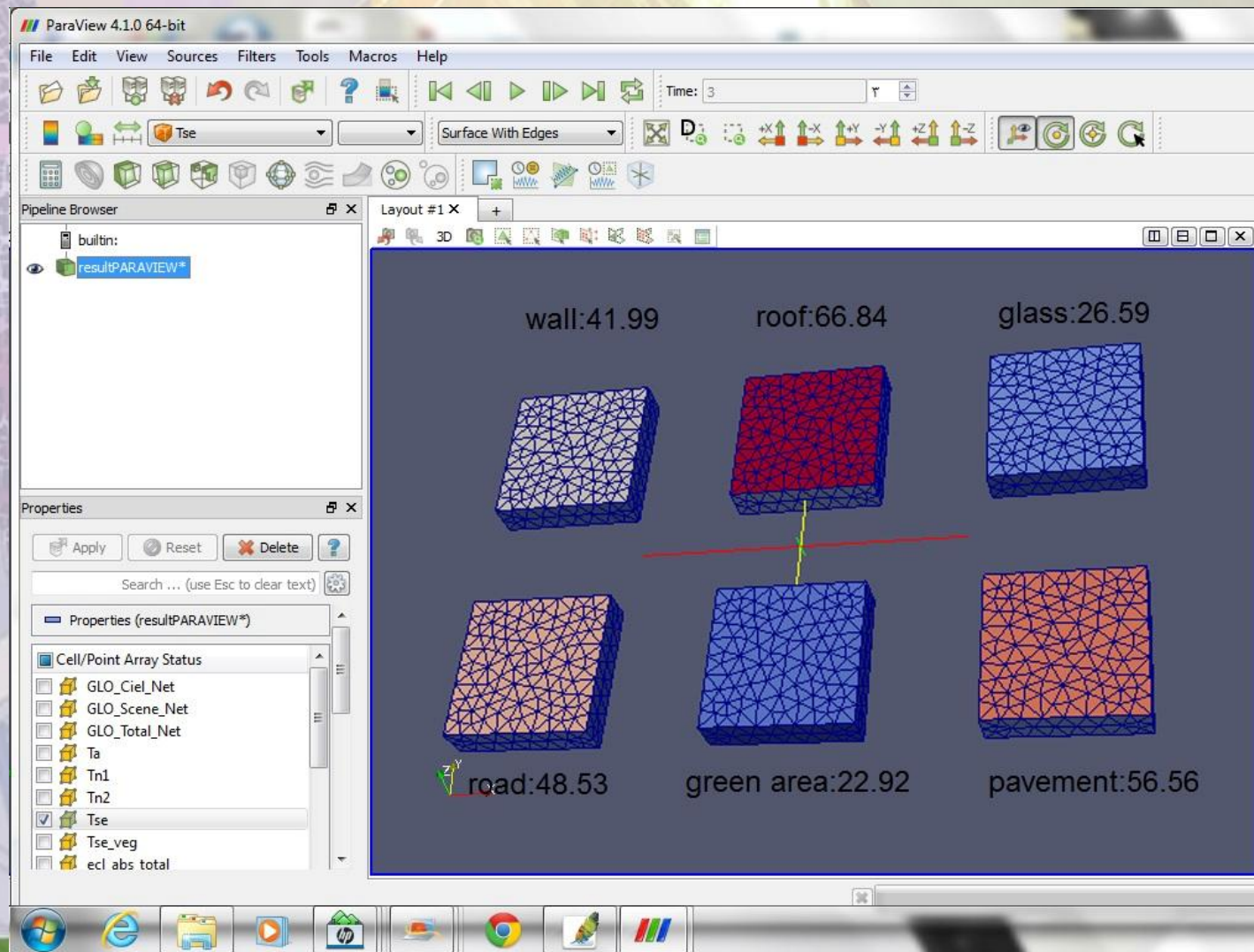
The result simulation for surface temperature for component of urban form at 15:00 h as a following

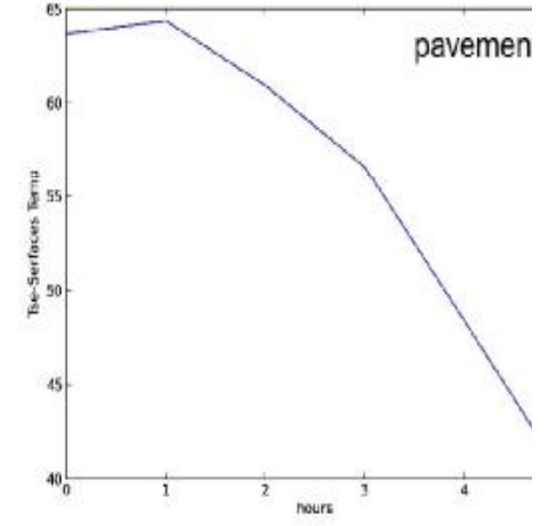
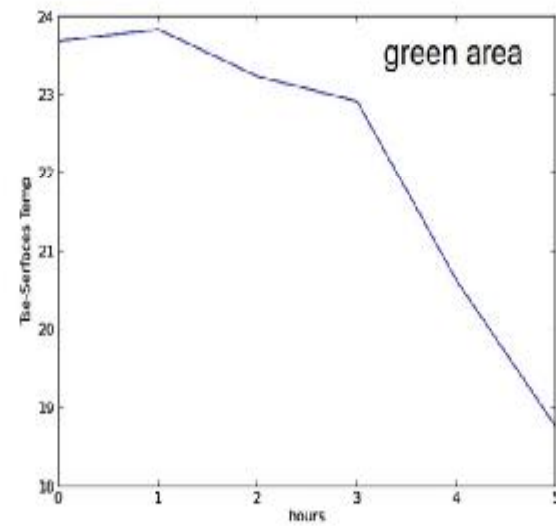
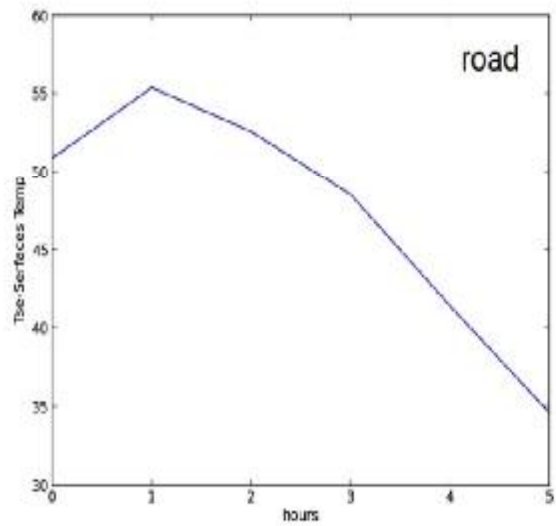
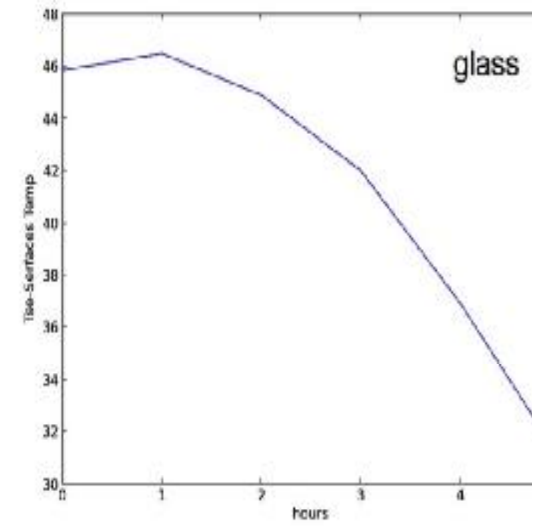
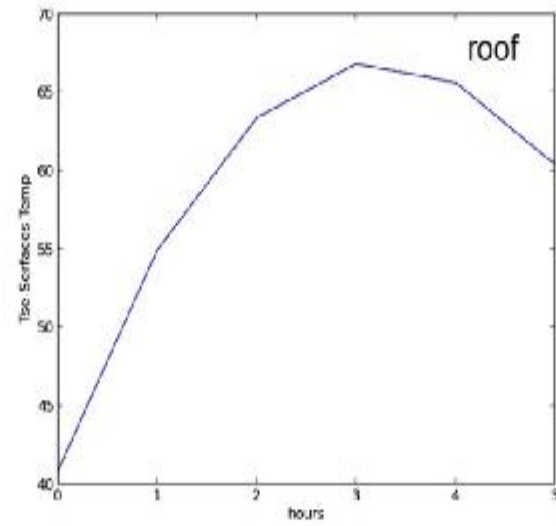
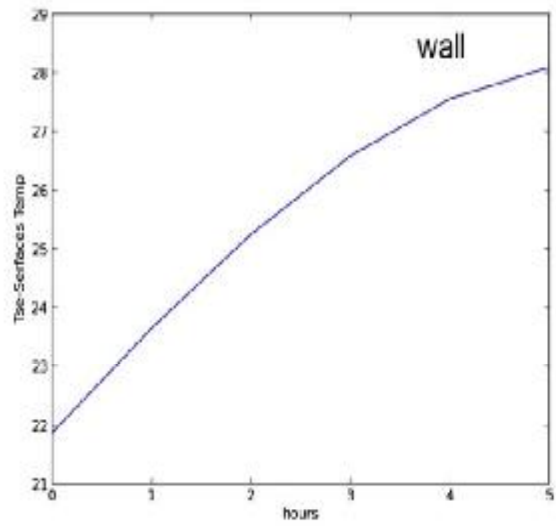


The result simulation for surface temperature for component of urban form at 15:00 h as a following



The result simulation for surface temperature for component of urban form at 15:00 h as a following







— **Create the geometry:**

- I create my geometry by using Autocad and Salome, as a following :
- 1. Autocad : completed the 3D geometry
- 2. Export the file as .igs file
- 3. Salome: import the .igs file , Reconstruct the geometry and finally change the geometry to mesh .
- 4. Export the file as .med file

Summary of analysis software tool features

Study of Olof Granlund Oy, Matti Korhonen, Tuomas Laine

	IES 5.8.1	Ecotect 5.6	E-Quest 3-6	EnergyPlus v2.1	IDA ICE 3.0	RIUSKA 4.4
User interface	comfortable	adequate, manual needed	a bit illogical		requires understanding	easy to use
based import (other formats)	gbXML (DXF; GEM; MIT)	IFC, gbXML (+lots more)	gbXML	(IFC), gbXML	IFC (IDM; IDA; IDS; DWG; DXF)	IFC
based export (other formats)	none	IFC, gbXML	none	none	none	IFC
3D geometry modelling	via CAD	via CAD	simple	no, only external	via CAD or in the program	via CAD
Input parameters	-	-	not tested	not tested	X	X
Possibility to make a comparison case	no	no	no	no	yes	yes
Benefits	Lots of additional simulation possibilities	comprehensive solar and lighting simulation	HVAC systems definable	advanced engine	single space simulation program	Suitable for large office buildings and large projects, practical in use
manuals	Quite comprehensive, but a bit shallow	Good	Very limited	Limited	Extensive	User manual available

The background features a stylized cityscape with various buildings in shades of blue, green, and yellow. On the left side, there is a vertical strip with a grid pattern in purple and blue. The overall style is modern and abstract.

Thank you for attention