POLITECNICO
DI TORINO

Honors thesis

COURSE OF ARCHITECTURE CONSTRUCTION CITY

Abstract

Testing of an Integrative Design Process in the preliminary design of an office building: energy and comfort.

Tutor

Marco Filippi

by

Carla Badagliacca
Elisa Cisotto

Advisors
Elisa Sirombo
Maria Ferrara

September 2016

Abstract

Nowadays the concept of architecture is changing radically since we are witnessing a transformation of building processes, becoming faster, flexible and with a careful control of building performance and comfort of users. Therefore, a rethinking of the processes of conventional design is necessary, in order to adapt to current new building industry targets, allowing to center more easily the energy goals set by European regulations which will also be reflected in the Italian panorama. The design of modern buildings, indeed, having to meet an increasing number of new requirements in order to fulfill the needs of the building industry, providing also the involvement of a growing number of professionals with more and more specialized skills, makes it essential to identify new organizational models that are more effective than in the past.

Accordingly, keeping in mind the fact that buildings are required to meet high energy and environmental performance goals, the theory of **Integrative Design Process (IDP)** is applied. The IDP was born in the 90s and has collected since then many successes in Europe and the United States. It consists in a drastic rethinking of the conventional design process through a more holistic approach to the building design, emphasizing, moreover, the importance of the early stages of the process referred to the entire project development. The strength of IDP lies in considering the building as an organism, whose systems must be managed with an synergic organizational approach between all participants involved in the process, starting from the early stages of the design process, in order to provide more aware and informed analysis.

IDP's further goal is to minimize the use of energy and environmental resources requested by a building in order to satisfy the functions for which it is built, as a valid approach to solving today's challenges of the building industry. Within this type of process, **energy modeling** plays a fundamental role from the preliminary stages of design.

These assumptions are the starting point of this thesis with which we intend to discuss energy and comfort issues in an IDP (using the dynamic energy simulation software DesignBuilder), identifying with the architect, as expert of building physics, acting also as an **energy modeler** and proposing an operative methodology in order to scan the modeling work to be used during the Pre-design and Schematic Design phases of an Integrative Design Process.

The proposed methodology, whose operating path consists of three different modeling cycles, is applicable to several design processes and at different scales of analysis. Although the intent was to focus on the preliminary stages of design, it is possible to develop, with the same kind of approach, even the planned successive phases of an IDP. The possible future scenarios suggest an in-depth analysis of the potential of an **Integrative Design**, which claims numerous successes in the European and American fields and which is still quite unknown in Italy.

La metodologia di analisi utilizzata

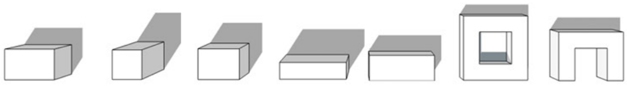
Definizione del ***Reference Building model***:

RB

Con riferimento all'**Appendice C - *Simple Box Modeling*** dello Standard ASHRAE 209P:

- Forma rettangolare
- Aspect Ratio: **1.62**
- Altezza d'interpiano: **3,81 m**,
- Copertura piana
- Window-to-Wall Ratio (WWR): **30%**

Definizione delle ***tipologie considerate***: torre/blocco **T**, linea **L**, corte **C**



Configurazione	RB	T1	T2	L1	L2	C1	C2
Aspect Ratio	**1,62 : 1**	**1:1**	**1,3:1**	**4:1**	**2,6:1**	**1 :1**	**1,3 :1**
Dimensione X [m]	48,6	28	40	64	64	64	64
Dimensione Y [m]	30	28	30	16	25	64	48
SLP totale [m²]	**19.302**	**19.898**	**19.344**	**20.024**	**20.008**	**19.506**	**19.886**
Altezza interpiano [m]	3,81	3,81	3,81	3,81	3,81	3,81	3,81
Numero di piano [n°]	**14**	**24**	**17**	**21**	**13**	**8**	**10**
Altezza totale [m]	53,34	91,44	64,77	80,01	49,53	30,48	38,10
Fattore di forma S/V	**0,15**	**0,16**	**0,15**	**0,18**	**0,15**	**0,22**	**0,21**
Area di lavoro piano [m² di SLP]	620	373	512	429	693	1.097	895
Area ancillari piano [m² di SLP]	69	41	57	48	77	122	99
Area di supporto piano [m² di SLP]	276	166	228	191	308	488	398
Percorsi principali piano [m² di SLP]	276	166	228	191	308	488	398
Nucleo piano tipo [m² di SLP]	133	80	110	92	149	236	192
Nucleo piano terra [m² di SLP]	199	154	276	166	215	302	258
Numero di piani [n°]	14	24	17	21	13	8	10
SLP piano tipo [m² di SLP]	1.374	826	1.134	950	1.534	2.430	1.982
SLP piano terra [m² di SLP]	1.440	900	1.200	1.029	1,600	2.496	2.048
Numero di occupanti [n°]	**924**	**953**	**926**	**858**	**958**	**934**	**952**

La scansione del processo in cicli di modellazione

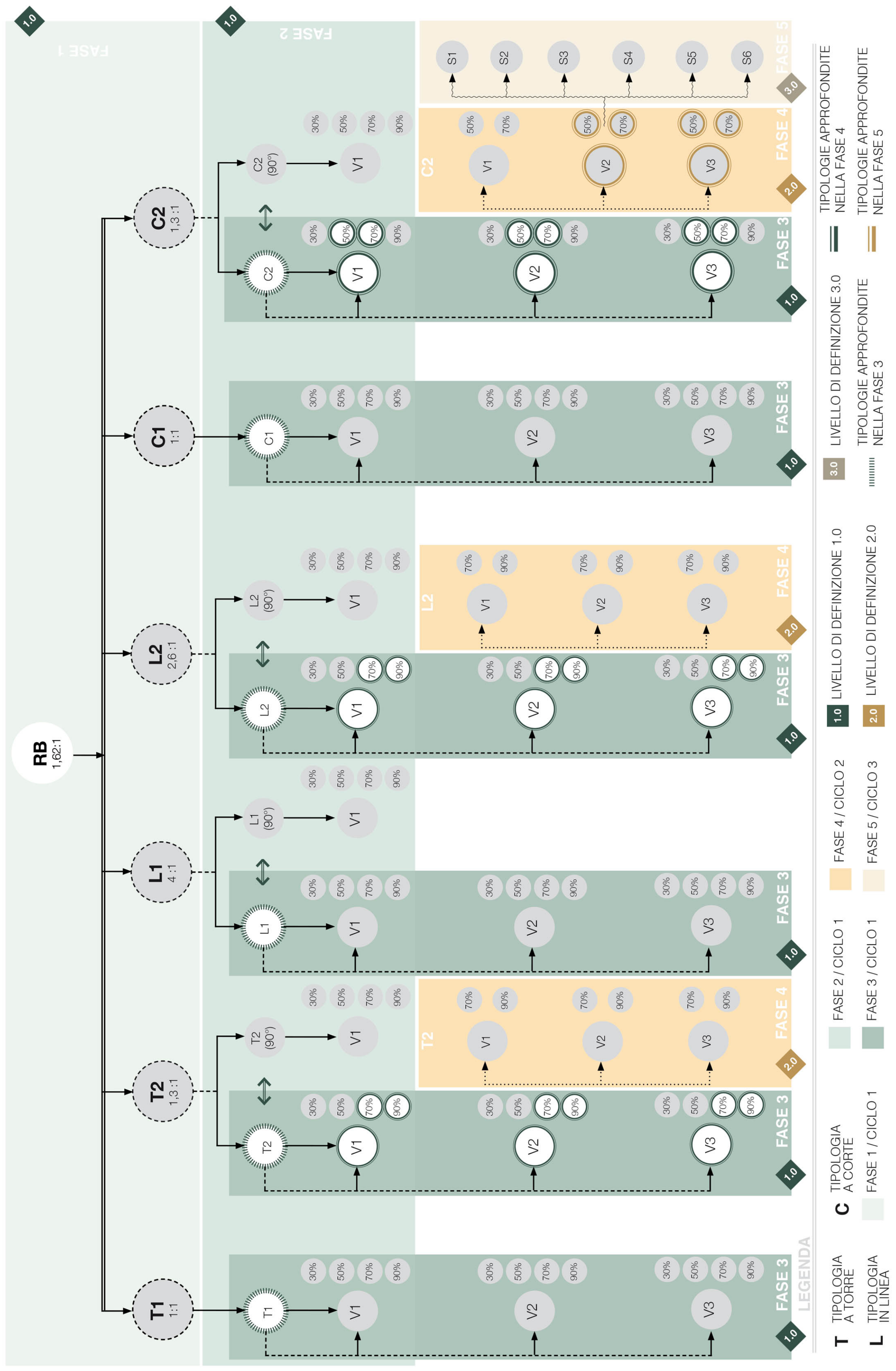
CICLO 1 — SIMPLE BOX MODEL (Liv. di definizione **1.0**)

CICLO 2 — CONCEPTUAL MODEL (Liv. di definizione **2.0**)

CICLO 3 — LOAD REDUCTION MODEL (Liv. di definizione **3.0**)

• FASE 1	• FASE 2	• FASE 3	• FASE 4	• FASE 5
RB T1- T2 L1 -L2 C1-C2	T1 - T2 - **T2_90°** L1-**L1_90°** L2 - **L2_90°** C1- C2- **C2_90°**	T1 - T2 L1-L2 C1- C2	T2 L2 C2	C2
VARIABILI			**VARIABILI**	**VARIABILI**
Aspect Ratio **S/V**	**Orientamento:** 0°-90° **WWR:** 30-50-70-90°	**VETRO:** V1-V2-V3 **WWR:** 30-50-70-90%	**VETRO:** V1-V2-V3 **WWR:** 50-70-90%	**VETRO:** V2-V3 **TIP. SCHERM. SOLARE e ANGOLO:** 15° S, 30° (E,O), 45° (S,E,O)

1.0 — 2.0 — 3.0



For further information please contact:
Carla Badagliacca, carlabadagliacca@gmail.com; Elisa Cisotto, elisacisotto@yahoo.it.