

POLITECNICO DI MILANO



Laurea Magistrale (MSc)
in
Building and Architectural Engineering

CONSERVATION OF THE COURTHOUSE OF MILAN

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ABSTRACT

This thesis project focuses on the concepts of conservation projects and new additions to existing building in order to improve the quality of life, achieved through the upgrading of the interior environment in a room of the courthouse of Milan, considering this courthouse as a more public area with the art gallery, removing car parking in the courtyard in order to increase human accessibility more and use the area for staffs and visitors, then designing a modular platform for landscape, a roof and a secondary facade in order to improve environmental control of the building.

The government of Milan permitted the access and links to crucial areas, so as to enhance accessibility and attract more visitors. And the courthouse itself as a historical monument has a heritage of cultural responsibility. All the interventions and work should follow the five key words of conservation: reversibility, accessibility, recognition, compatibility, and energy efficiency.

The courthouse is now becoming to a important tourist site in Milan with abundant art and cultural heritage. But at the same while, the courthouse is still operating as hundred years ago, being a functional organization to serve the people living in this city or even more. Even though it has a big potential for being a public art gallery for visitors, most people and the courthouse seems like didn't prepare well for transforming from a solo-functional organization to a multi-functional organization.

During the work days, the courthouse is always full of people with staffs and visitors. Yet, the courthouse is not comfortable to visit. It is easy to notice that most people wait there for hours to get their job done, at the narrow corridors without less than enough seat to sit, and nowhere to go for fresh air. Considering these conditions, the aim of this thesis is to utilize the design to balance the functions in this building, and that is where the idea of focusing on the courtyard of the courthouse coming from, to improve the conditions of the courtyard, make these open spaces for people, not for car parking.

Therefore, first of all, this thesis introduces methods to attract more people to the building through urban and site approaches. Then, focuses on improving the quality of life inside for everyone. While the landscape platform provides an easy and reversible solution, the design of an intervention of the roof and facade system control the internal environment and energy saving. All of these approaches considered into three steps: concept, visualization and detail.

The design will base on simulation system combine with the building historic document investigation, sunlight analysis, material behaviors, local thermal comfort, natural and mechanical ventilation, and heating system.

ABSTRACT (Italian Version)

Questo progetto di tesi si concentra sui concetti di progetti di conservazione e nuove aggiunte all'edificio esistente al fine di migliorare la qualità della vita conseguita attraverso l'aggiornamento dell'ambiente interno in una stanza del tribunale di Milano, considerando questo palazzo di giustizia come area pubblica. Con la galleria d'arte, rimuovendo il parcheggio nel cortile per aumentare ulteriormente l'accessibilità umana e utilizzare l'area per personale e visitatori, quindi progettando una piattaforma modulare per il paesaggio, un tetto e una facciata secondaria al fine di migliorare il controllo ambientale dell'edificio.

Il governo di Milano ha permesso l'accesso e il collegamento a aree cruciali, in modo da migliorare l'accessibilità e attirare più visitatori. E il tribunale stesso, come monumento storico, ha un patrimonio di responsabilità culturale. Tutti gli interventi e il lavoro dovrebbero seguire le cinque parole chiave della conservazione: reversibilità, accessibilità, riconoscimento, compatibilità e efficienza energetica.

Il tribunale si sta trasformando in un importante sito turistico di Milano con abbondante patrimonio artistico e culturale. Ma al tempo stesso, il tribunale funziona ancora dopo cento anni, essendo un'organizzazione funzionale per servire la gente che vive in questa città. Anche se ha un grande potenziale per essere una galleria d'arte pubblica per i visitatori, la maggior parte delle persone e il tribunale stesso, sembra non siano preparati a trasformarsi da un'organizzazione monofunzionale in un'organizzazione multifunzionale.

Durante i giorni lavorativi, il tribunale è sempre pieno di persone con personale e visitatori. Eppure, non è comodo da visitare. È facile notare che la maggior parte delle persone aspetta lì per ore solo per ottenere lavoro, oltretutto i corridoi sono molto stretti con poche sedie sufficienti a sedersi e nessun posto per andare all'aria aperta. Tenendo conto di queste condizioni, l'obiettivo di questa tesi è quello di utilizzare il disegno per bilanciare le funzioni di questo edificio, ed è qui che nasce l'idea di concentrarsi sul cortile del tribunale, come zona da correggere, al fine di migliorarne le condizioni, e renderlo agibile come zona ad aria aperta per le persone e non da utilizzare solo ed esclusivamente come parcheggio..

Pertanto, prima di tutto, questa tesi introduce i metodi per attirare più persone all'edificio attraverso approcci urbani e siti. In secondo luogo, si concentra sul miglioramento della qualità della vita per tutti. Mentre la piattaforma paesaggistica fornisce una soluzione facile e reversibile, la progettazione di un intervento del tetto e del sistema di facciata controlla l'ambiente interno e il risparmio energetico. Tutti questi approcci sono considerati in tre fasi: concetto, visualizzazione e dettaglio.

Il progetto si baserà sul sistema di simulazione che si combina con la documentazione storica del documento edilizio, l'analisi del sole, i comportamenti dei materiali, il comfort termico locale, la ventilazione naturale e meccanica e il sistema di riscaldamento.

1. INTRODUCTION

1.1 - Information on Milan

1.1.1 - Geographical context

Milan is a city in Italy, capital of the Lombardy region, and the most populous metropolitan area and the second most populous comune in Italy. The population of the city proper is 1,369,000, and that of the Metropolitan City of Milan is 3,209,000. According to Eurostat, the commuting area has 4,252,000 inhabitants but its built-up-urban area (that stretches beyond the boundaries of the Metropolitan City of Milan), has a population estimated to be about 5,270,000 in 1,891 square kilometres (730 square miles), ranking 4th in the European Union. The wider Milan metropolitan area, known as Greater Milan, is a polycentric metropolitan region that comprehends almost all the provinces of Lombardy, the Piedmont province of Novara, and some parts of the province of Piacenza and contains a population of 8,123,020. It is the main industrial and financial centre of Italy and one of global significance.

Milan is located in the north-western section of the Po Valley, approximately halfway between the river Po to the south and the foothills of the Alps with the great lakes (Lake Como, Lake Maggiore, Lake Lugano) to the north, the Ticino river to the west and the Adda to the east. The city's land is flat, the highest point being at 122 m (400.26 ft) above sea level.

The population of Milan commune is 1,310,000 and its area of 2,370 km² (after Rome) is Italy's second largest populace. Milan is at the center of a very large urbanized metropolitan area. This metropolitan area is the largest in Italy. With regard to population, the population of Milan metropolitan area is about 7.400.000 people and it is Europe's largest metropolitan area.

The administrative commune covers an area of about 181 square kilometres (70 sq mi), with a population, in 2013, of 1,324,169 and a population density of 7,315 inhabitants per square kilometre (18,950/sq mi). The Metropolitan City of Milan covers 1,575 square kilometres (608 sq mi) and in 2015 had a population estimated at 3,196,825, with a resulting density of 2,029 inhabitants per square kilometre (5,260/sq mi). A larger urban area, comprising parts of the provinces of Milan, Monza e Brianza, Como, Lecco and Varese is 1,891 square kilometres (730 sq mi) wide and has a population of 5,270,000 with a density of 2,783 inhabitants per square kilometre (7,210/sq mi)

The concentric layout of the city centre reflects the Navigli, an ancient system of navigable and interconnected canals, now mostly covered. The suburbs of the city have expanded mainly to the north, swallowing up many communes to reach Varese, Como, Lecco and Bergamo.

1.1.1.1 - Climate

The city of Milano is located in the western-central part of the Upper Po River plain. Nearby points of participation of the Ticino Stream and Adda Stream descending from the nearby Po River Alps are also close to the city.

Milan can be cold and foggy in winter and very hot and humid in summer. Its climate is typically Mediterranean. Milan is lucky that the mountains to the north shield the city from the worst of the Arctic chills, but there are is the occasional cold weather. In summer Milan is troubled by heat waves. August drives many locals out of town because of the heat.

Metropolitan cities experience a 2-3 degree higher rise in temperature than in normality due to the urban heat island syndrome. A Milanese may experience an average temperature of +4 degree Celsius to +6 degree Celsius in January, which could heat up in between 15 to 28 degree Celsius in July. Snowfalls, a common happening in Milan, has decreased in the last 15-20 years due to the effects of Global Warming. The average snowfall during winter could pendulum between 30 to 40 cms. The greatest snowfall ever was recorded in January 1985 which was about 100 cms. The city’s climate which was mainly distinguished by its fog, due to the Po Basin effect has reduced considerably in the recent years due to lessened pollution and global warming.



Figure 1.1.1 - Average temperature per month in Milan.

Month	cm	Month	cm
January	05	July	06
February	06	August	08
March	08	September	06
April	12	October	08
May	12	November	10
June	08	December	05

Table 1.1.1 - Annual climate in Milan.

1.1.1.2 - Population

Milan is a global city in Italy, and it is the country’s most populated city. The “moral capital of Italy,” as it is known, is located in northern Italy and is the capital of the Lombardy region. This manufacturing and commercial city has seen recent declines over the years, however, the population is bouncing back in recent years. Milan’s urban area has an estimated population of 3.1 million in 2016.

The urban area of Milan has a population of 3.1 million in 2016, while the city proper is estimated to have a population of around 1.7 million. The metropolitan area has an even larger population, with some estimates placing it as high as 10 million people. Milan has become renowned around the world as a global city that leads the world in sectors including tourism, fashion, manufacturing, education and the arts.

Milan demographics

Industrialization during the post-war years led to a population boom that put the Milan city population at a record high of 1,743,427 in 1973, a number that is matched in 2016. The larger urban area boasts a population of over 3 million, while the metropolitan area has an estimated population of 7 to 10 million.

Milan has been plagued with decades of a declining population, in part due to the financial crisis and industry declines. However, the city is showing slow signs of growth, with city limits of 1.7 million matching the record-high from years ago. The urban population is expected to see slow but progressive growth over the years, with a 2020 estimated population of 3.124 million and a population of 3.16 million in 2030.

Year	Population	Growth Rate (%)	Growth
1950	1,883,000	0.00%	0
1955	2,099,000	11.50%	216,000
1960	2,395,000	14.10%	296,000
1965	2,695,000	12.50%	300,000
1970	3,017,000	11.90%	322,000
1975	3,133,000	3.80%	116,000
1980	3,168,000	1.10%	35,000
1985	3,128,000	-1.30%	40,000
1990	3,063,000	-2.10%	65,000
1995	3,020,000	-1.40%	-43,000
2000	2,985,000	-1.20%	-35,000
2005	3,010,000	0.80%	25,000
2010	3,056,000	1.50%	46,000
2015	3,099,000	1.40%	43,000
2017	3,109,000	0.30%	10,000
2020	3,124,000	0.50%	15,000
2025	3,142,000	0.60%	18,000
2030	3,162,000	0.60%	20,000

Table 1.1.2 - Population of previous and expected future years in Milan.

Area of the municipal territory:
 181.76 Km²
 Population at December 31, 2011:
 1341830
 Residents per Km²:
 7382.4
 M² of urban green per inhabitant:
 16.1
 M² of built-up area per inhabitant:
 23.8

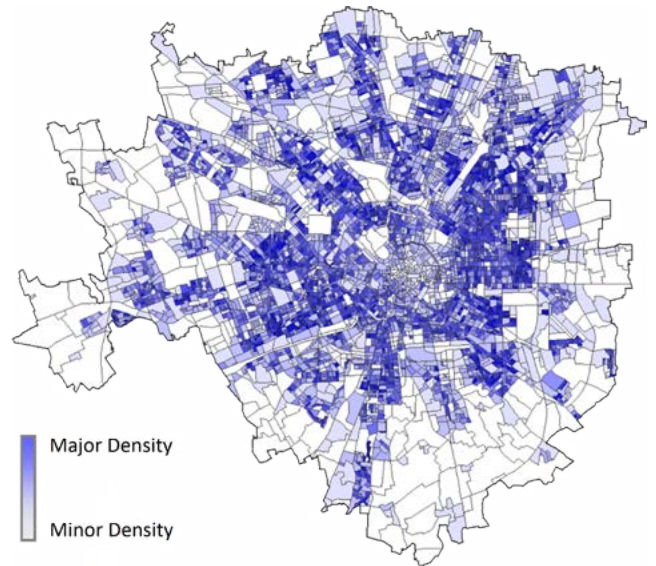


Figure 1.1.2 - Density of dwelling on the national territory (31/12/2011).

Men per every 100 women:
 90.9
 Average age of population:
 43.3 (men) - 47.5 (women)
 Average life expectancy (estimate):
 79.7 (men) - 84.8 (women)
 Percentage of young people (0-14 years):
 12.7%
 Percentage of elderly (65+ years):
 23.6%
 Elderly (65+) per every 100 young people (0-14):
 185.5

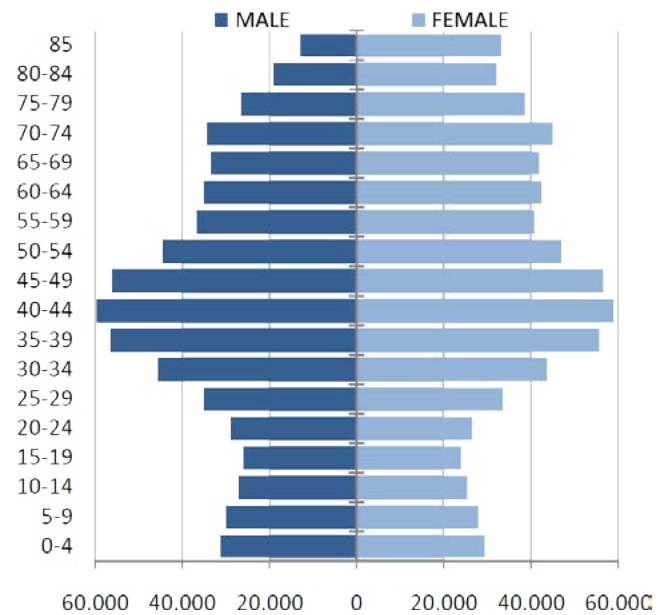


Figure 1.1.3 - Structure by age of resident population.

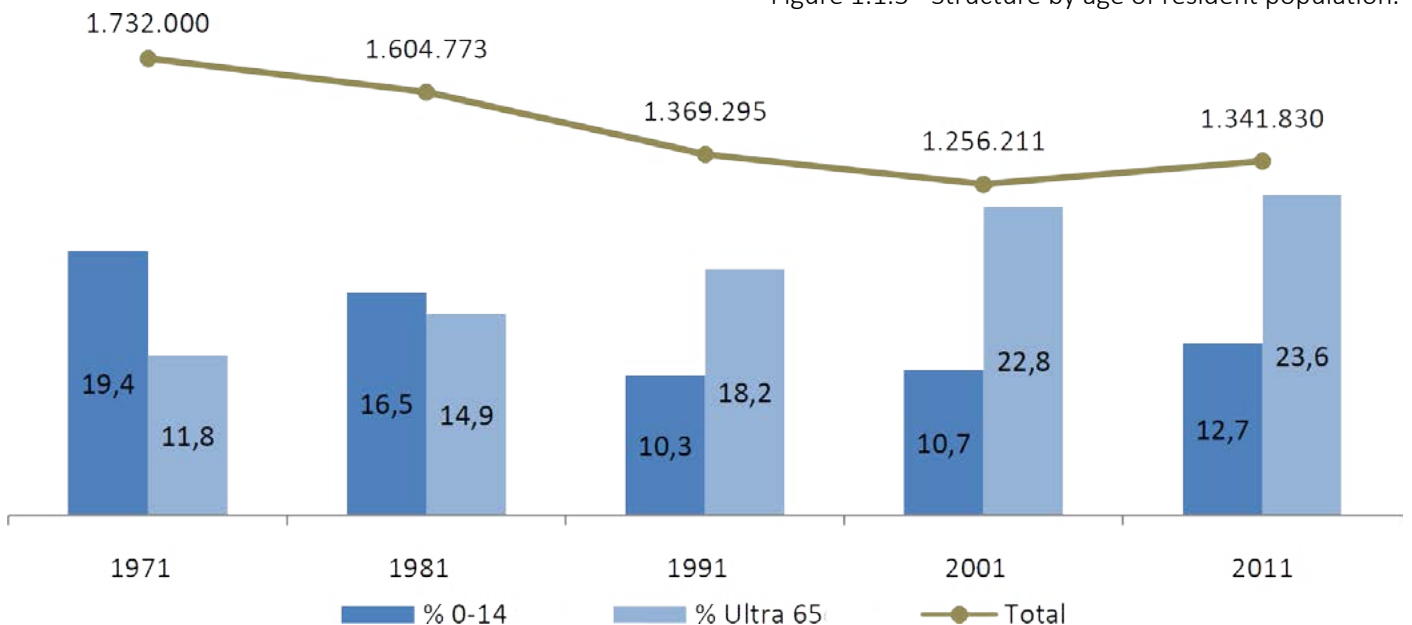


Figure 1.1.4 - Trend of the resident population (1971-2011).

1.1.1.3 - Education

Milan is home to some of Italy's most prominent educational institutions. Milan's higher education system includes 7 universities, 48 faculties and 142 departments, with 185,000 university students in 2011 (approximately 11 percent of the national total) and the largest number of university graduates and postgraduate students (34,000 and more than 5,000, respectively) in Italy.

Founded in 1863, the Politecnico di Milano is the oldest university in Milan. The Politecnico is organised in 16 departments and a network of 9 Schools of engineering, architecture and industrial design spread over 7 campuses in the Lombardy region. The number of students enrolled in all campuses is approximately 38,000, which makes Politecnico the largest technical university in Italy. The University of Milan, founded in 1923, is the largest public teaching and research university in the city, with 9 faculties, 58 departments, 48 institutes and a teaching staff of 2,500 professors. A leading institute in Italy and Europe in scientific publication, the University of Milan is the sixth largest university in Italy, with approximately 60,000 enrolled students.

Other prominent universities in Milan include: the Università Cattolica del Sacro Cuore, a private institute founded in 1921 and located in the Basilica of Sant'Ambrogio, famous for its law and economics teaching, currently the largest Catholic university in the world with 42,000 enrolled students; the Bocconi University, a private management and finance school established in 1902, ranking as the seventh best business school in Europe; the University of Milan Bicocca, a multidisciplinary public university with more than 30,000 enrolled students; the IULM University of Milan, specialising in marketing, information and communications technology, tourism and fashion; the Università Vita Salute San Raffaele, linked to the San Raffaele hospital, is home to research laboratories in neurology, neurosurgery, diabetology, molecular biology, AIDS studies and cognitive science.

Milan is also well known for its fine arts and music schools. The Milan Academy of Fine Arts (Brera Academy) is a public academic institution founded in 1776 by Empress Maria Theresa of Austria; the New Academy of Fine Arts is the largest private art and design university in Italy; the European Institute of Design is a private university specialised in fashion, industrial and interior design, audio/visual design including photography, advertising and marketing and business communication; the Marangoni Institute, is a fashion institute with campuses in Milan, London, and Paris; the Domus Academy is a private postgraduate institution of design, fashion, architecture, interior design and management; the Pontifical Ambrosian Institute of Sacred Music, a college of music founded in 1931 by the blessed cardinal A.I. Schuster, archbishop of Milan, and raised according to the rules by the Holy See in 1940, is – similarly to the Pontifical Institute of Sacred Music in Rome, which is consociated with – an Institute "ad instar facultatis" and is authorised to confer university qualifications with canonical validity and the Milan Conservatory, a college of music established in 1807, currently Italy's largest with more than 1,700 students and 240 music teachers.

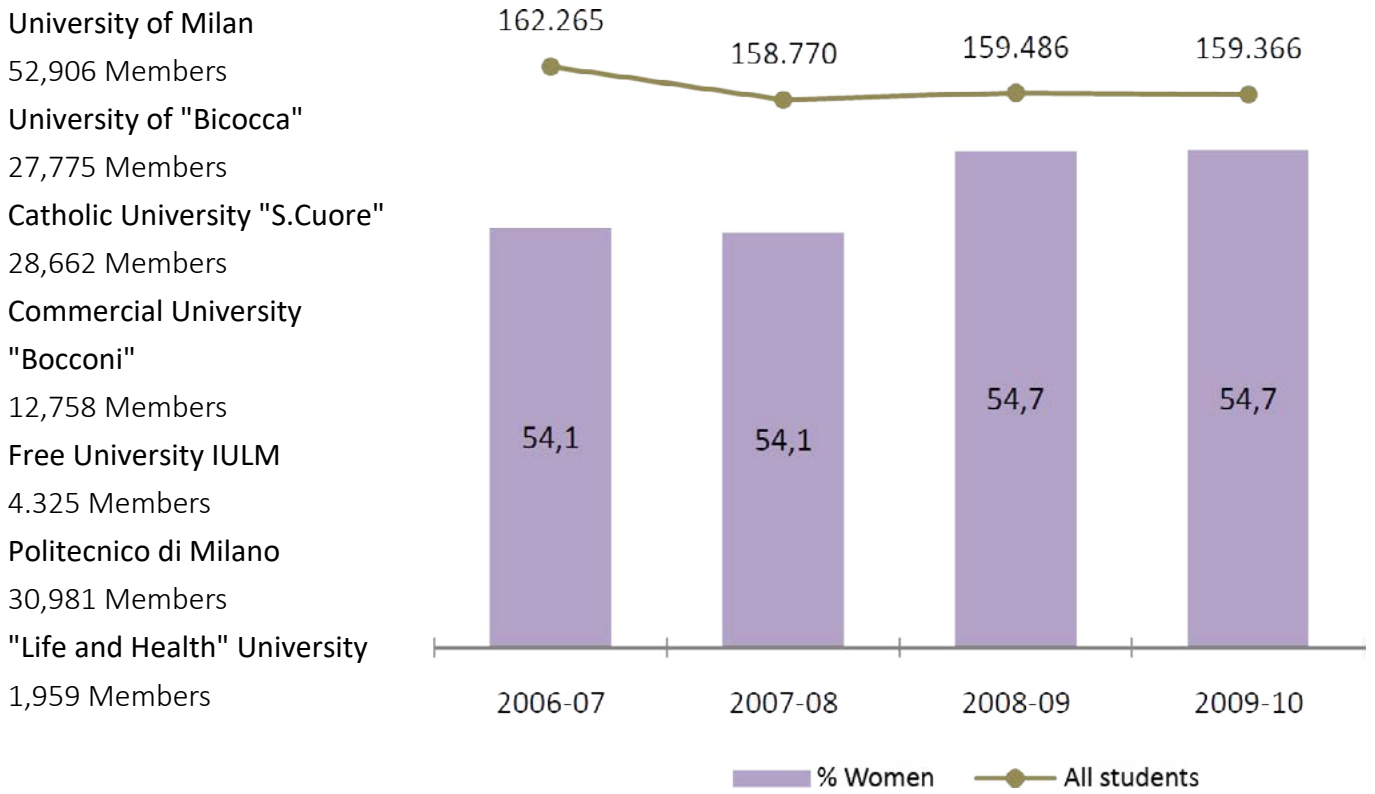


Figure 1.1.5 - Subscribers and percentage of women in the Milanese universities (A.A. from 2006-07 to 2009-10).

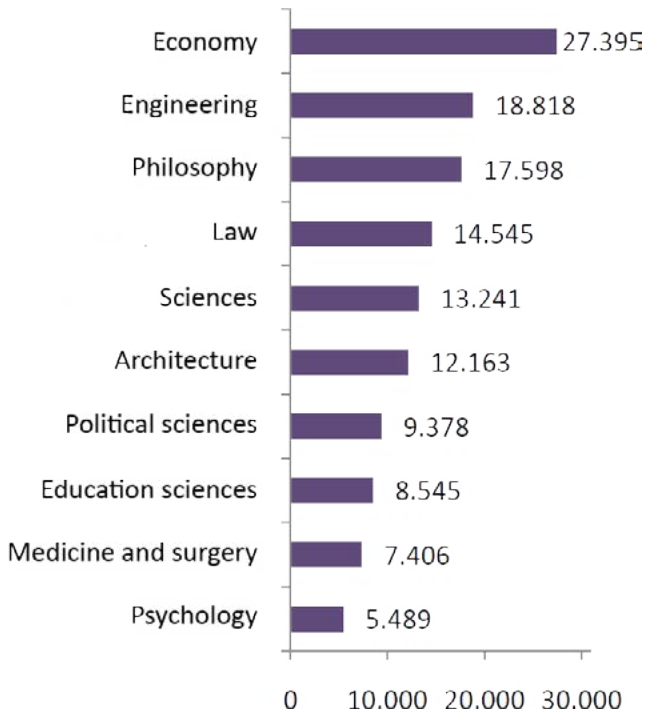


Figure 1.1.6 - Faculty with most registered students (A.A. 2009-2010).

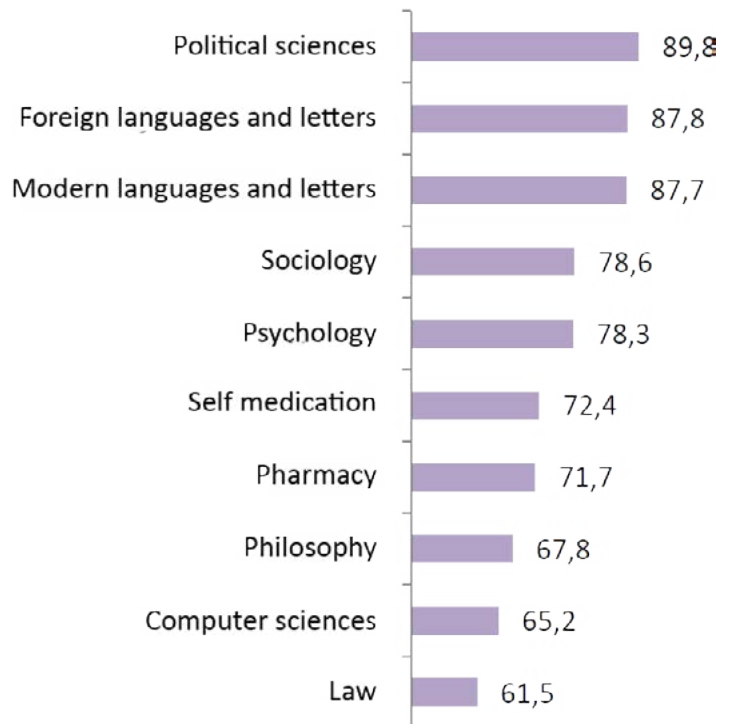


Figure 1.1.7 - Faculty with most % of women among them registered (A.A. 2009-2010).

1.1.1.4 - Art & culture

Milan has always been a rich and important city. It has always been a place full of various famous artists and offers a particular assortment of churches, buildings and monuments. There was a change of culture and art in the Renaissance with big a contribution in the period of the neoclassicism. Milan offers a big variety of buildings, monuments and museums. The most important church is the Cathedral which is the third largest church in the world.

It is overall made of marble, with immense statues, arches, pillars, pinnacles. From the roof you can experience a beautiful panorama of the city. Santa Maria delle Grazie was built between 1466 and 1490 and modified by Bramante. In the Refectory there is one of the most famous paintings of Leonardo da Vinci: the "Last Supper". Milan has many historic palazzos like the Palazzo Reale (Royal Palace) which is situated in the south side of Piazza Duomo. The Sforza Castle is one of the symbols of Milan together with the Madonnina and the Galleria Vittorio Emanuele II. All those sights together are just few reasons for a visit.

Change in leisure time spending and culture compared to 2009: +4,1%

Leisure and culture spending compared to total spending: 5,5%

Leisure and culture spending compared to non-food spending: 6,3%

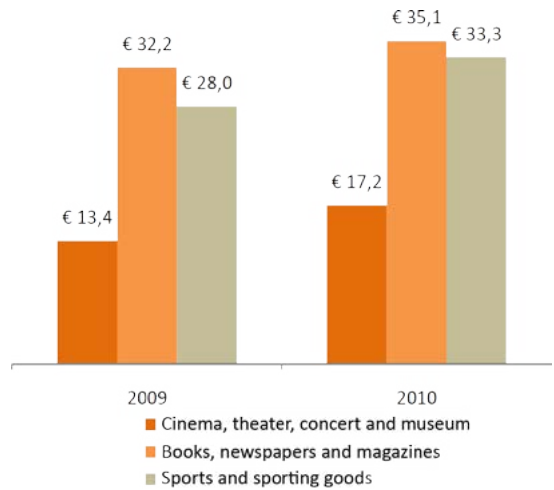


Figure 1.1.8 - Monthly monthly spending of a Milanese family for leisure and culture (2009-2010).



Figure 1.1.9 - Arrivals and average days of stay in Hotel shops per month (2010).

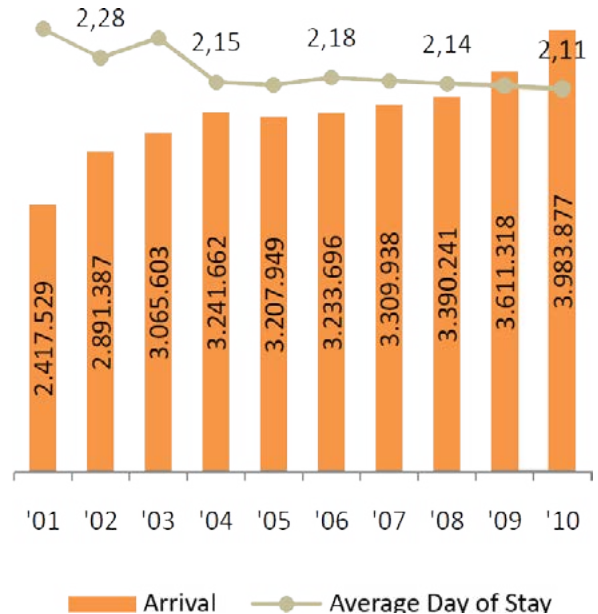


Figure 1.1.10 - Arrivals and average days of stay in Hotels by year (2001-2010).

1.1.1.5 - Economy

Today Milan is Italy's second largest city after Rome and its economic heart. It has the highest per capita income in Italy.

Milan is the centre of many financial businesses, and its so called 'hinterland' is an avant-garde industrial area.

It is the biggest industrial city of Italy with many different industrial sectors as manufacturing of garments, car manufactory, chemistry, mechanical tools and heavy machinery. Another important industry is tourism and of course fashion.

Milan leads Italian cities in the manufacture of chemicals and textiles. Other important products include aircraft, motorcars, foodstuffs, clothing, glass, leather and rubber goods, machinery, pharmaceuticals, and plastics. The city has a large book and music publishing industry, many banks, and the principal stock exchange of Italy. The city has a large construction industry, and it is one of the most important silk markets in Europe.

Fiera Milano, the city's Exhibition Center and Trade Fair complex is one of the most important in the world. The new fairground, in the north-western suburb of Pero and Rho (opened in April 2005) is Europe's largest open construction project and makes Fiera Milano the largest trade fair complex in the world.

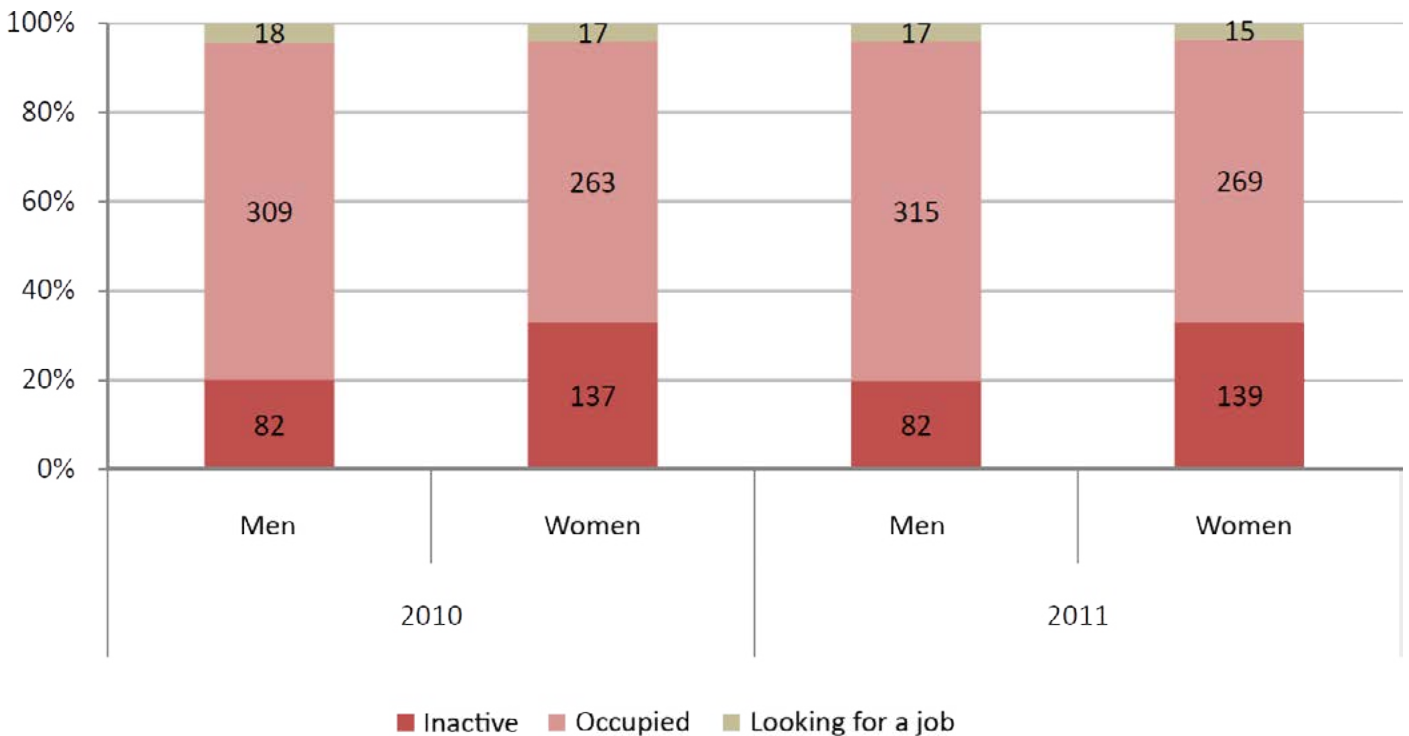


Figure 1.1.11 - Population (15-64 years) by occupational status estimation of occupational movements, provided by values in thousands (2010, 2011).

1.1.1.6 - Transportation

Milan is one of southern Europe's key transport nodes and one of Italy's most important railway hubs. Its five major railway stations, such as the Milan Central station, are among Italy's busiest. Since the end of 2009, two high speed train lines link Milan to Rome, Naples and Turin, considerably shortening travel times with other major cities in Italy.

The Azienda Trasporti Milanesi (ATM) operates within the metropolitan area, managing a public transport network consisting of an underground rapid transit network and tram, trolley-bus and bus lines. Overall the network covers nearly 1,400 km (870 mi) reaching 86 municipalities. Besides public transport, ATM manages the interchange parking lots and other transportation services including bike sharing and car sharing systems.

Milan Metro is the rapid transit system serving the city, that with 4 lines and a total length of more than 100 km (62 mi) is one of the largest in Europe. The recently opened M5 line is undergoing further expansion and the construction of the M4 line has been approved. The Milan suburban railway service comprises 12 lines and connects the metropolitan area with the city centre through the Milan Passerby underground railway. Commonly referred to as "Il Passante", it has a train running every 6 minutes (and in the city functions as a subway line with full transferability to the Milan Metro).

The city tram network consists of approximately 160 kilometres (99 mi) of track and 17 lines. Bus lines cover over 1,070 km (665 mi). Milan has also taxi services operated by private companies and licensed by the City council of Milan. The city is also a key node for the national road network, being served by all the major highways of Northern Italy. Numerous long-distance bus lines link Milan with many other cities and towns in Lombardy and throughout Italy.

There are 69 bus and 4 trolleybus lines in Milan. Most of the routes do not run during the night, however, bus services on demand are available in the weekend at night.

New night bus lines during weekends have been introduced since 24 September 2011, running from 2 am to 6 am on Fridays and Saturdays. The new network was considered a success, with more than 8,000 people using the lines every weekend.

Milan is served by three international airports. Linate, the oldest and the only airport lying within the city limits, is mainly used for domestic and short-haul international flights, and served 9 million passengers in 2014. Malpensa International Airport, the second busiest airport in Italy (about 19 million passengers in 2014), is 45 km (28 mi) from central Milan and connected to the city by the "Malpensa Express" railway service. The airport of Orio al Serio, near the city of Bergamo, serves the low-cost traffic of Milan (8.8 million passengers in 2014). Milano Bresso Airport, operated by Aero Club Milano, is a general aviation airport.

1.1.2 - The events leading to Courthouse of Milan

The question of a new Palace of Justice had passionate about Milanese souls around the years 1870-80. A precise report, which was presented to the City Council on 30 June 1880, clearly and unequivocally described the situation of the offices of justice, a situation that in those years had become increasingly aggravated until it became extremely unsustainable. For centuries, the surrender of the Milanese Justice was linked to the courthouse palace - as was used to call it once - that was in Piazza Beccaria, in the building where the Urban Watch is now located but which since 1605 had been official residence of Captain of justice.

The captain of justice - a character who was formerly chosen among the famous doctors of the College of Justice Consulates - was a prominent and prestigious figure of the Milanese judiciary, dating back to the Viscount period, instituted by Gian Galeazzo Visconti in the program of restructuring of the state institutions Milanese. It had predominantly criminal jurisdiction in Milan city and territory up to ten miles outside and, if it was a capital case, it was competent throughout the state, but - according to the New Constitutions of 1541, issued during Spanish domination - also exercised authority Civilian delegate for privileged people and indicated by the laws. It also had the function of judicial and security police, and therefore depended on the three city barges with thirty-six infants and the country bargello with twenty men on horseback, who were to safeguard the security of the Milanese state's communication channels. In the communal time, the captain of justice was headquartered in Mediolani, that is in the place occupied today by the archbishop's palace and, at the epoch, in the ducal palace built by Matteo and Azzone Visconti. It was only in the second half of the sixteenth century that the need for an autonomous residence had arisen, even to have new and more decent jails than the very ancient and now too narrow jail of Malastalla. The proposal for the construction of a new building was, in part, part of the Malastalla Protectors - the administrators of the work that had the task of protecting the prisoners - who, unable to take on themselves the burdensome expense, suggested to the Commune, a place in the center and suitable for the need

The justice building of Piazza Beccaria

The Cameretta Council - a kind of present City Council - gathered on July 20, 1569, examining the Protector's proposal and acknowledging that Archbishop Carlo Borromeo had contributed with three hundred gold shields in cash and the governor Albuquerque with six thousand shields, First decided to expropriate the land required and then to pay the sum of a thousand shields as a contribution. In 1570, the factory of the Captain of Justice's Palace was started, under the supervision of a commission specifically appointed to follow its course. The work was slow and although in the year 1593 there were 260,000 lire imperial expenses, the construction was completed only in 1605. At this time it was extended to the courtyard, so that it was easy and short the path from Justice to the clemency, from the judge to the governor, and it is first called Strada Nuova and then it is dedicated to the Jurisconsult Alciato; It disappeared after the bombings of 1943. The palace occupied the same space as it was today, but it had a sturdy wall surrounding it in the back to prevent escalation of the prison, a wall which, in 1784, was not

yet complete. On the southern side of it stood a small and low house, which housed the booth and beside it stood the sedan's chariot. The prisoners in the heart of the city did not have a few discomforts to the citizens, if in the Napoleonic period already there is documentation of complaints by the inhabitants of the area for the disturbance given by the prisoners at night by speaking with one prison to another. It was in this building - in which criminal justice was administered through a secret inquisition process, including torture - which in 1824 were imprisoned and heard condemnation by Federico Confalonieri and other compatriots who had been conspiring for italic indifference.

As for the architect who carried out the work of the austere lines, after some attributions, it was erroneous to the Seregni and the Bassi, according to the authoritative opinion of Moriggia (1602) and Bianconi (sec. Pietro Antonio Barca, a cameral and military engineer, well accepted by the Spanish governors, although it is not possible to exclude the intervention of others, particularly in his first phase. The seat of Justice was known by the people as the doer of the do-compann, playing The fact that the building was really equipped with two bells, but that there were also two others, that of the prosecution and that of the defense.

Transfer projects

Around the 1870s and 80s, as we have said, the situation of the palace has really become unsustainable, so much so that at first I think it is possible to carry all the pretensions in the fabricated form to the prisons; But then it was concluded that an accurate study made it persuasive that to give this stable a vast destination, it was indispensable to superimpose a second floor to the whole area. Although, for reasons of static as well as aesthetics, such a decision was not immediately adopted, it came about thirty years later. But the space problem had not yet been resolved. The Palace of Justice and its accommodation have been talking for years, many projects have been made and rejected, such as transporting offices in the Zecca area - where around 1880 the Court of Assise had its seat in the Senate Palace , In Vetra Square, etc., but nothing concrete was decided. Discussing and planning to arrive this way in 1932. At this time, as the necessities grew and the conditions of the buildings used for the administration of justice had become precarious, the seats had multiplied. They were scattered here and there, between the palace of Piazza Beccaria, Clerici Palace, S. Antonio Street, Missori Square, Montebello Street, S. Damiano Street, etc. so that the offices were broken and irrationally divided. The problem was now urgent and immediately addressed. The municipal administration, this time, made a commitment, explored various logistic possibilities, discarding some of them, such as the area of the Garibaldi barracks of the 7th and 8th infantry regiments in Piazza S. Ambrogio - too narrow -; That of the old slaughterhouse, not far from the prisons of via Filangieri - too peripheral -; and finally, I will dwell on the area of the former barracks of S. Prassede, later called Prince Eugene, in the gateway to Vittoria. The latter was waiting to be transported to an area near Baggio, where he was already building new buildings. In this way the Vittoria gateway area would remain free. And the choice was made.

Public competition for the new Palace of Justice

Waiting for the clearance of the Commune, to gain time, in the April 1929 band). A public competition for the project of the Palace of Justice, which, according to the announcement, should have been inspired by a simple and severe idea and must respond to the purpose for which the palace is destined and worthy of the city of Milan. The result of the banned competition from the podesta Giuseppe de Capitani d'Arzago gave only an interlocutory result, also because the area did not show a geometric shape suitable for the prepositions purpose. Of the eleven projects submitted, three were found worthy of a prize, but none of them offered the requisite requirements for being put into operation. The podcast Marcello Visconti of Modrone - successful in the meantime at the Capitani - finds itself in the necessity of making a difficult decision, but above all urgent, as the problem became irreparably aggravated and a viable solution was needed.

The roads that could be followed could be three: to ban a new competition, call the three selected in the previous one to a second degree, entrust a trusted architect with the task of preparing the project. The first two offered the advantages, but also the unknowns, of public competitions, including the one to go empty a second Volta; So that the podesta, urged by the urgency, took the decision - for him the heavy responsibility, but also the quickest and the most infallible - to entrust the mandate to set up a project for the Palazzo della Giustizia di Milano, to be placed In the port of Vittoria, to the architect Marcello Piacentini, with the act of October 3, 1931. In the meantime, the work of the barracks of Baggio - where at the beginning of 1932 took over the artillery regiment - was hastened and lepratic solicitations were sought for the clearance of the 'Vittoria door area. Lastly, a new control plan for the Vittoria Gate Course area was approved, as in addition to the barracks, it was also necessary to expropriate some adjacent land and houses. In these urgent procedures, on February 5, 1932, the podesta, the two vice podesta and the architect Piacentini were able to present to the Head of State the final project for the Justice House, which was immediately approved Grandiose and rational at one time, worthy of justice and Milan. In fact, it came to impose itself on the city's plan, such as the Castle and the Major Hospital.

The podcast Marcello Visconti of Modrone had chosen Parchitetto who at that moment went for the Major. Marcello Piacentini (1881-1960), born in Rome, was a professor of urban planning at the University of Rome and an academic in Italy and had devoted himself both to the urban field and to the construction field. Inspired by a monumental not rhetoric, in a mediation, even spilling between modern architecture and suggestion from the ancient, especially in the period 1923-43, he had numerous assignments, among which the accommodation of the centers of Bergamo and Brescia and , In Rome, in the Borghi and in today's Via Bissolati. In these, Piacentini is concerned with the scenic aspects of the buildings, which made it remarkable and representative, such as the setting up of the university town, the design of the EUR, the Palace of Industry and Commerce, and still in the construction of cinemas, theaters, churches, Public buildings, etc.

The new impressive work was therefore launched, but it needed to be contained in a particular urban space, by means of which it was possible to access, through roads capable of enduring greater traffic, at the offices of Justice, all of which were concentrated there. The difficulty of communications between the chosen area and the center, due to narrow and winding streets, was in fact to be overcome, so that the Vittoria gateway - one of the city's widest, thirty meters wide - to carry out its function in relation to traffic and, at the same time, to facilitate the circulation of the district. The Via S. Pietro in Gessate - now Cesare Battisti - was sacrificed, sacrificing the palace of Luogo Pio Trivulzio, which obstructed the passage between the course and the Verziere, widened the street of the Archbishopric with demolitions between Piazza Fontana and 11 Verziere, thus offering convenient access to the courthouse of Palazzo Giustizia, and completely transforming the intersection between Naviglio - now covered -, Verziere and via Durini. In order to be in harmony with the new construction, the surrounding buildings, such as the house of the mutilate, were erected on the design of Luigi Secchi, a municipal technical engineer, or the two buildings on the sides of the palace, Architect Cesare Donini and architect Giovanni Muzio. It was to insert the new work into a zone of particular urban design, which were subsequently approved the 1932 Regulatory Plan and its variant in 1939.

The new Palace of Justice, which was built at the center of a large area of forty thousand square meters - occupying only thirty thousand - was made up of 25,900 square meters of the Prassede barracks, out of the 4,200 results from the expropriation of fourteen private houses placed on West side of Via Luciano Manara and the remains of the Augustinian Sisters complex at the barracks of S. Filippo, towards Via Fregaglia. At this point, a special committee was appointed, chaired by Senator Piero Alberici, first president of the Court of Appeal of Milan, and corneted by magistrates and lawyers, who were in charge of flanking the designer with practical and immediate suggestions on the needs of the service and on the Resulting in distribution of premises. It is of great use in providing those indispensable information to make the work of art also a functional work and practical use.

According to the information of the time, we can follow the details of the Piacentini project for the new Justice Palace, for which the Municipality had allocated the expenditure burden, calculated in 120 million, of which 85 for construction, 5 for The furniture, 30 for the expropriated. The works, begun in 1932, ended only in 1940, I wish the podest Marcello Visconti of Modrone, Guido Pesenti and Giacomo Gallarati Scotti. The architect Piacentini had as a good collaborator the architect Ernesto Rapisardi, who followed for the long eight years during which the construction of the building was hard, all the structural works and, moreover, the municipal technical office led by the engineer Giuseppe Baselli , Assisted by engineer Beniamino Carnisio. The great and complex work of building was entrusted to the Garbarino-Sciaccaluga-Mezzacane company, which scrupulously fulfilled its heavy task. Let's see how the building was building at the time of construction.

1.2 - Information on the Courthouse

1.2.1 - Historical synopsis

After Mussolini formed a dictatorship in 1925, he aggressively employed established instruments of state control — the police, army, and legislature — to reinforce and secure his command. Force and punishment served as a method to control and direct the population, even if the kinds of terror unleashed in Italy never reached the extremes of Nazi Germany or Stalinist Russia. In the same years that Mussolini approved a series of new legal codes authored by a conservative fascist theorist, Minister of Justice Alfredo Rocco (1925-32), the municipal government began construction of a massive new Palace of Justice (Palazzo di Giustizia, 1932-40) in central Milan.



Figure 1.1.12 - Old photograph of the Courthouse.

Designed by the politically powerful Roman architect Marcello Piacentini (1881-1961), this building was not only the largest building constructed in Milan in the inter-war period but also the most important of a number of law courts built during the fascist era. The project provided the regime with an unparalleled opportunity to demonstrate the strength of the central government in Milan, which, with its great wealth and influence, threatened the authority of Rome. Indeed the stark and physically overwhelming building remains the most forceful architectural demonstration of state power in that city, where it serves as an imposing setting for legal dramas. Preliminary planning for the new Palace of Justice began in 1923 with identifying an appropriate site for the project, a task that Mayor Luigi Mangiagalli (1922-26) assigned to the planning commission, which was headed by liberal engineer and city planner Cesare Chiodi. The municipal government was responsible by law for providing adequate accommodations for the judiciary.

Crowded conditions and outdated facilities in the late-sixteenth-century Palazzo del Capitano di Giustizia, the traditional home of the Milan judiciary located behind the cathedral, justified new construction. However, little had come of the city's efforts since officials had begun to discuss the need for new law courts a decade earlier. In keeping with Milan's commitment to the rational reorganization of major civic institutions, Mangiagalli hoped to consolidate all the law courts and offices distributed throughout the city's centre in a single building.

For Chiodi, the new building presented an opportunity to relieve congestion there and to revitalize an underutilized area of the city. After the state withdrew its offer to sell a promising site on Via Parini, the commission proposed the site of the former slaughterhouse along Bastione di Porta Magenta (now Viale Papiniano) on the southwestern edge of the city. Chiodi favoured this site because it met several important criteria: it moved the courts away from the dense

area around the cathedral; it was one of the few sites within the Spanish Walls large enough to house the law courts; and it was publicly owned, which gave the city a purchasing advantage. In addition, Chiodi the rapid and efficient circulation of people who worked in the building and to underscore the modernity of the endeavour, Piacentini made the ground level accessible to automobiles and provided parking for the members of the court near the "numerous elevators." These elevators carried members swill ly to their offices, which lined the extensive system of hallways that circulated throughout the building, without "passing through other offices or travelling a great distance by foot." Following the traditional hierarchy in Italian buildings, Piacentini reserved the second storey for the most prestigious functions of the palazzo. Here he located the offices for the head of the Milan judiciary and the Civil Court of Appeals. By adjusting the size, material richness, and ornamentation of the entrance, vestibule, and ambulatory of each of the courts, he further articulated the relative position of each within the Italian legal system. The emphasis on order, hierarchy, and clarity echoed the rhetoric surrounding the contemporary redevelopment of central Milan, suggesting that the Palace of Justice could be understood as an abstract, idealized representation of a fascist city.

Despite the regime's desire to erect a building uniquely appropriate for its legal structure, the most important conceptual model for this project was Calderini's Palace of Justice in Rome. Piacentini's studio and residence (1929-31) along the Tiber River in Rome provided views of Hadrian's Tomb, his War Veterans headquarters (Casa Madre dei Mutilati, 1925-28, 1936), and Calderini's Palace of Justice. Piacentini criticized Calderini's "mania for sumptuous, rich, and exuberant" decoration. However, he appreciated the older architect's effort to draw from Italian building types. Calderini's horizontal neo-cinquecento façade, heavy rustication, prominent quadriga, and use of the term ambulatorio for the main waiting hall (rather than the French *sal des pas perdus*) all suggested a distinctively Italian interpretation of this building type. For the exterior of Milan's Palace of Justice, Piacentini maintained Calderini's low horizontal mass and anticipated including a central sculptural element. He also carefully studied Calderini's "very simple and clear" plan. Borrowing directly from the Roman example, he exploited the dramatic potential of a central courtyard and placed the courtrooms at the end of the transverse axis. The similarities between these two projects caught the attention of contemporary commentators, who found Piacentini's Milan building to be little more than a reworking of nineteenth-century examples. In 1936 the periodical *L'Italia Letteraria*, directed by the leading cultural critic and author Massimo Bontempelli and an influential supporter of avant-garde modernism, Pier Maria Bardi, published a simple line drawing of Piacentini's Palace of Justice. A caption emphasized the connection: "The architecture of the Palace of Justice in Rome rehabilitated by the architecture of the Palace of Justice In Milan." Like Mussolini's government, Piacentini's design drew from the established iconography of state power and adjusted this imagery to suit fascist rhetoric.

However, Ugo Ojetti, the outspoken conservative architecture critic for the Milan-based newspaper *Corriere della Sera* and editor of the art journal *Pegaso*, objected to the ways in which the building broke from Italian anticipated that the new construction would rehabilitate the

quarter by spurring residential and commercial growth there. This would not only improve the economic and social composition of the surrounding community but also increase the value of city-owned property nearby. Mussolini and Rocco (president of the Milan Chamber of Deputies, soon to be appointed minister of justice) reviewed the proposal and approved the city's initiative in August 1924. Despite consensus on this project at the highest levels, local lawyers and magistracy were outraged when they learned of the city's plan.

The law community vigorously attacked the proposal in the press, arguing that there was little about the site that made it a suitable location for one of the most important courts in the nation. To begin with, although it was located along a major ring road, the site was not well connected to the city's centre or to major transportation hubs. Perhaps more important, it was surrounded by residential buildings of modest size, a prison stood in the immediate vicinity, and it was isolated from leading business, cultural, and government centres — in short, there was little about the location that conveyed the courts' significance as a prestigious civic institution. The head of the Court of Appeals in Milan, Piero Alberici, captured the spirit of their objections when he declared that the proposal would effectively send "justice to the slaughterhouse." It soon became apparent that the project would not go forward, and hopeful architects sent alternative proposals directly to the mayor and to Mussolini. Some of the architects suggested adapting large-scale structures of historical importance, such as the medieval Castello Sforzesco and the Ospedale Maggiore. Others advocated new construction. All of them proposed sites within the centre of the city, and most endeavoured to make a clear link between the new Palace of Justice and the existing urban hierarchy. Mussolini, either persuaded by their arguments or concerned about gaining their political support, intervened on behalf of the lawyers and magistracy and urged the city to find another location for the Palace of Justice, one that was within the symbolic centre of the city.

In 1926, Mangiagalli (a member of the Italian Liberal Party) was replaced by Ernesto Belloni, the city's first fascist mayor (podesta). Soon after being appointed to that position, Belloni solicited new ideas for the site of the Palace of Justice as part of the 1926-27 master plan competition. In response to Mussolini's recent directive, the city had already begun to consider the former Infantry Barracks (Caserme di Fanteria Garibaldi) on the Piazza San Ambrogio as a possible location for the judiciary, but no specific plans had been drawn up. Piero Portaluppi and Marco Semenza, the team that was awarded first prize, argued that the site was too cramped. Instead, they made the Palace of Justice the centrepiece of a monumental complex of gigantic proportions behind the Renaissance Ospedale Maggiore (established in 1456). The hospital had already begun to expand into this area and a few years later would begin to construct a vast new complex in the Niguardia (Giulio Marcovigi, Giulio Ulisse Arata, and Alessandro Tibaldi, 1932-39), one of the municipalities absorbed into greater Milan in 1923. Rendered with an architectural uniformity and sense of civic grandeur that was reminiscent of the American City Beautiful movement, the complex envisioned by Portaluppi and Semenza comprised various public buildings and featured an open lawn lined by "grand palaces linked by porticos to the Palace

of Justice." The winners of the second-place prize, the Club of Urbanists (Club dei Urbanisti), proposed a similar urban arrangement. The report issued by the artistic subcommittee, the body charged with evaluating the aesthetic merits of the proposals, clarified the perceived strengths and weaknesses of each proposal.

The subcommittee, which included Piacentini, the politically powerful and influential future architect of the Palace of Justice, paid particular attention to the formal and symbolic objectives of each proposal. Although it criticized Portaluppi and Semenza for their intent to radically restructure central Milan, the group praised the team's "monumental nucleus" behind the Ospedale Maggiore. This feature of the plan, like Giovanni Antolini's project for the Foro Bonaparte and Giuseppe Mengoni's Piazza del Duomo, proposed a unified and grand architectural and urban ensemble for the centre of the city. The subcommittee judged the Club of Urbanists' submission to be less successful because of its elongated form, its inclusion of buildings intended for private use, and its prominent placement of a concert hall. Neither proposal appears to have been seriously considered by municipal authorities. However, the idea of redefining an entire section of the city anticipated the scale and reach of the final project and established the city's preference for plans in which important government buildings, rather than cultural institutions, were the focal point of large urban and architectural compositions.

In 1927, Belloni signed an agreement — which became a law the following year — that committed the city to spend more than 250 million lire on the construction of new buildings for the state in exchange for the transfer of a substantial portion of state-owned property. The property listed in the accord included the Artillery Barracks on Corso di P. Vittoria, a site that the city had often considered as a possible home for the Palace of Justice. The parcel was strategically positioned along one of Milan's principal thoroughfares just beyond the city's innermost ring. Major institutions already established in the quarter included the city's main synagogue (Luca Beltrami and Luigi Tenenti, 1890-192), the Humanitarian Society (Societa Umanitaria), and the Ospedale Maggiore. Corso di P. Vittoria, a principal east-west artery, led from the city's centre beyond the Spanish Walls to residential neighbourhoods developed in the 1920s and out to the future home of the airport in Linate (designed by Gianluigi Giordani in the mid-1930s). The site of the former barracks, approximately one-quarter of a mile (four hundred metres) from the Piazza del Duomo and the Palazzo del Capitano di Giustizia (the traditional centre of the city and home of the law courts, respectively), met the judiciary's expectations and Mussolini's demands for a centrally located building and provided a sufficiently large plot of land on which the city could construct a massive new building.

The sprawling site included private residences, a synagogue, and a convent, and the city planned not only to use it for new construction but also to reconfigure it for redevelopment. In the first plan drawn up by the city, the original block — bound by Corso di P. Vittoria, Via Manara, Via Guastalla, and Via S. Barnaba — was divided into four relatively equal units by introducing two new streets, Via Freguglia and Via Zaccaria, thus imposing a geometric regularity onto what

had been a large block accommodating a range of functions. The city designated two blocks for the Palace of Justice, one facing Corso di P. Vittoria and the other behind it. The National Fascist Syndicate of Architects (Sindacato Nazionale Fascista degli Architetti), which was led by Alberto Calza-Bini and included Piacentini as one of its members, criticized the city's decision to house the Palace of Justice in two separate buildings and asked the agency to revise its plan. In response, the city conceded and created a large trapezoidal site slightly set back from Corso di P. Vittoria for a single free-standing new building. The resulting footprint competed in size with the largest buildings in central Milan: the Ospedale Maggiore, the Castello Sforzesco, and the Duomo. As in the initial version, the plan left the synagogue and residential buildings along Via Guastalla largely untouched but marked for demolition the barracks, numerous residential buildings elsewhere within the block, and a convent, despite the protests of local church officials. At the same time, the city proposed reworking the area that had housed the city's open-air Verziere Market until it was moved in 1911 to an indoor facility further from the city's centre. The redevelopment of this area with broad new roads lined by office and residential buildings was intended to effectively extend the symbolic centre of the city along Corso di P. Vittoria.

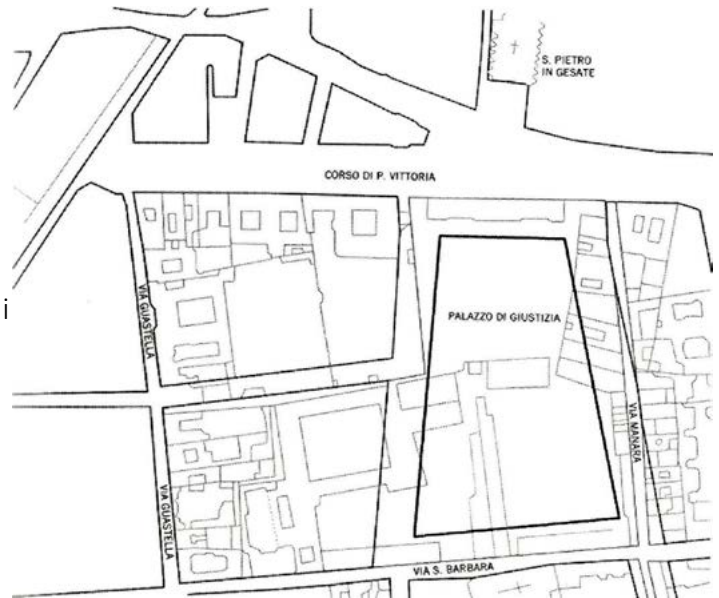


Figure 1.1.13 - Site plan of the Courthouse from construction period.

The new street pattern signalled the city's intent to use the project as a catalyst for change throughout the district. The broad streets framing the Palace of Justice made it possible for new buildings to reach a height of seventy-eight feet (twenty-four metres), approximately twice the height of existing ones, resulting in a 150 per cent increase in the site's building volume, from about 26,500 to 3,980,000 square feet (about 75,000 to 112,680 cubic metres). The city planned to sell lots to private developers and anticipated that a wealthy residential quarter with spacious modern palazzi would surround the Palace of Justice. New construction along Corso di P. Vittoria was to take the place of the modest brick and stucco structures that defined the street edge. Plans were already under way for the construction of the Fascist Syndicate of Industry Headquarters (Casa dei Sindacati Fascisti dell'Industria, and now Camera del Lavoro), a symbol of fascism's new economic model, along Corso di P. Vittoria, a short distance from the new Palace of Justice; and in 1938 work started on a new police headquarters building opposite the Palace of Justice. The arrangement of these buildings resembles that of finance minister Quintino Stella's bureaucratic centre established on Via XX Settembre in Rome after the unification of Italy and of Piacentini's more recent proposals to position government institutions along the major arteries extending out of the national capital. Like the Roman examples, the transformation of Corso di P. Vittoria offered an expedient solution to the

persistent problem of reconciling the modern needs of large government institutions with the constraints imposed by the compact centre of the historic city.

On 22 April 1929, the podesta of Milan, Giuseppe de Capitani D'Arzago, announced that the city would hold a competition for the Palace of Justice. The competition brief stressed that the new building was to be "simple and severe" and that the architectural design should be worthy not only of justice but also "of Milan and the Fascist age." The terms "simple" and "severe" encouraged architects to reject the lavish ornament of the most important and symbolic court in Italy, Guglielmo Calderini's Palace of Justice (1888-1910) in Rome, and other monuments associated with the bourgeois excess of liberal Italy. Instead, they encouraged participants to adopt an architectural vocabulary appropriate to the militaristic and populist rhetoric of fascism. Competitions, a regular feature of interwar Italian architecture, helped generate public support, provided an illusion of broad involvement, and enabled bureaucrats to generate ideas for projects without being obliged to commit to the results. It was no different. One Milanese architect and city planner, Ferdinando Reggiori, alluded to its exploratory nature when he complained that it was "poorly organized ..., lacked guarantees for the participants," offered only "modest prizes," and did not reveal "the names of the judges in advance."

Capitani D'Arzago's successor as podesta, Duke Marcello Visconti di Modrone (1929-35), appointed the jury, which was composed primarily of city officials and representatives of the law courts. The only designers on the jury were Mario Sironi, a prominent artist and the principal illustrator for Mussolini's journal *il Popolo d'Italia*, and two architects, Ulisse Stacchini and Piacentini. Stacchini, a pupil of Calderini, brought his understanding of Roman monumentality and Beaux Arts planning to the jury discussion; at that time, he was overseeing the completion of his massive Central Station in Milan, which opened with great fanfare in 1931. Piacentini (the son of Roman architect Pio Piacentini) had maintained his contacts in Milan since acting as a juror on the 1926-27 master plan competition; he served as an adviser to the city planning office and designed, with Ernesto Rapisardi, the National Bank for Social Insurance (*Cassa Nazionale per le Assicurazione Sociali*, 1928-31) in Milan. He had also recently completed the Palace of Justice in Messina, Sicily (1923-29), again with Rapisardi. His working relationship with the Milan planning office and recent work in Messina suggests that he may have participated in the formulation of the site plan and the writing of the competition brief for the new building. Although the jury's deliberations have not been located, the competition results provide a window into the decision-making process of which Piacentini was an integral part and help clarify official expectations for the project.

Not surprisingly, Italy's leading practitioners did not waste their time developing proposals for the project, and the city received only eleven entries, all by relatively unknown architects. After deliberating for nearly six months, the jury announced that none of the projects merited first prize. Second prize went to the most unconventional design in both plan and elevation, Angelo Bordoni, Luigi Maria Caneva, and Antonio Carminati's "White, red, black" ("Bianco, rosso, nero")

That team proposed a dramatic projecting curved entrance along the Corso di P. Vittoria, with protruding brick bays reinforced by colossal stone columns capped by statues, an arrangement that recalled Mezzanotte's Exchange in Milan as well as Carlo Broggi's entry in the League of Nations competition of 1927. The jury expressed concern that the project was "perhaps excessively simple" and that the semicircular entrance served to "diminish rather than to augment the impression of grandeur." The jury similarly faulted the other entries for their failure "to achieve the impression of a public building that was desired." The city and the judiciary agreed that the new building needed to be visually arresting and physically imposing in order to convey the authority of the legal system.

A month after announcing the results of the failed competition, Podesta Visconti di Modrone formed a commission to determine the best procedure for finding an architect who could carry the project to completion. The commission included members of the Milan judiciary and the city government, several of whom had participated as jurors in the competition. Some members of the commission proposed asking the winners of the second-place prize to revise their project. However, the influential city councilor Cesare Dorici noted that those architects had limited experience and were already engaged in building the nearby Fascist Syndicate of Industry Headquarters (1930-32). He also effectively dissuaded members of the commission who thought the city should hold another competition, on the grounds that this would be costly and time consuming and could not guarantee satisfactory results. Guided by Dorici, the commission determined that the podesta should have exclusive authority to appoint an "illustrious" architect. The commission stipulated only that the architect take into consideration the results of the competition and work closely with the city's Office of Technical Services, a move intended to give the city some control over the project, for which they had financial responsibility.

The worldwide depression triggered by the collapse of the American stock market, together with the failure of the housing sector in Milan, created an environment in which the city could not fulfill its obligations to provide new buildings for the state. While the municipal administration stalled, Minister of Justice Alfredo Rocco, the head of the Milan judiciary Piero Alberici, and members of the law community in Milan sent letters to public officials, published essays in the city's leading papers, and otherwise pressured the city to take action. In June 1931, Podesta Visconti di Modrone and Dorici, who had served briefly as deputy podesta, travelled to Rome to renegotiate the city's financial obligations. Crafted with Rocco, Alberici, and party secretary Giovanni Giurati, the new arrangement included the transfer of the Corso di P. Vittoria site to the city, with the express intent that the site be used for the Palace of Justice and that the building be completed within five years. In August 1931 the podesta and the deputy podesta met once again with Mussolini and other officials in Rome to discuss construction projects underway in, and planned for, Milan. In early November 1931 the podesta of Milan publicly announced that Piacentini would design the new Palace of Justice. The announcement made clear the city's commitment to the new building and placed at the helm the man who had long directed the project from behind closed doors.

Correspondence indicates that Piacentini had been working on plans for the new building since at least the end of 1930. Given Dorici's efforts to place control of the project in the podesta's hands, it seems likely that by the spring of 1930 the decision to appoint Piacentini had already been brokered. Although Piacentini never held an official position within the government, he remains the architect most intimately associated with Mussolini's government. The same year that Piacentini received the Palace of Justice project, Mussolini chose him to design the University City (Citta Universitaria, 1932-35) in Rome, and he later directed the massive E'42 Exhibition (later known as EUR, Esposizione Universale di Roma, 1937-43) just south of the capital. Piacentini's stature was enhanced by the friendships and contacts he inherited from his father, facilitated by his ability to manoeuvre within powerful circles, and maintained by his numerous professional appointments. In the case of the Palace of Justice, Piacentini had been involved with the project at nearly every stage of its progress through local and national bureaucratic channels. He served as a juror for both the master plan and the law courts competitions, experiences that afforded him a unique opportunity to shape the contours of the project. His position as a leading member of the National Fascist Syndicate of Architects and his connection to Dorici enabled him to persuade the city to set aside a massive site for the new building. He understood that the judiciary wanted a building that occupied a central position in the city, for practical and symbolic reasons. He also recognized that the planning office, headed by Albertini, favoured efficiency over aesthetics when it came to planning decisions. Finally, his awareness of the project's symbolic value was shaped by Rocco, who as minister of justice pushed the project forward in its initial stages and then as rector of the "La Sapienza" University of Rome (1932-35) oversaw the completion of Piacentini's new campus there. Piacentini comprehended that the new Palace of Justice should not only be a monument to the authority of the state — a pointed message in a city that was more oriented to commercial than political concerns and had long resisted the influence of Rome — but should also symbolize the unique historical position of the fascist regime.

In Rome on 5 February 1932, approximately six months after having been officially handed the commission, Piacentini presented his design for the Palace of Justice to Mussolini for approval. After reviewing the project, Mussolini pronounced it to be "at once grandiose and rational, and thus worthy of Justice, the Regime, and Milan." Modifications made during the building's lengthy construction — for example, sanctions imposed on Italy after the invasion of Ethiopia in 1936 probably forced Piacentini to restrict the use of glass — had the effect of reinforcing its monumental character. Piacentini concentrated the visual and spatial intensity of the project in the vestibule behind the principal entrance on Corso di P. Vittoria; none of the other entrances arc as grand. After passing through an imposing tripartite portal reached by low-rising granite stairs, the visitor stands within a rectangular entrance hall or atrium that fills two levels of the palazzo and extends to the spacious exterior Court of Honour (Cortile d'Onore). Diffuse light filters through windows overlooking the court and down from corridors on the second storey. Not unlike the portals on the exterior, gigantic piers contribute to the exaggerated sense of

scale, and opulent materials augment the sense of grandeur. At the time of its completion, the building's total area (about 323,000 square feet [30,000 square metres]) was as large as that of the largest building in central Milan, and its height of almost 125 feet (38 metres) overwhelmed surrounding buildings, most dramatically the modest fifteenth-century brick church of S. Pietro in Gessate on the opposite side of Corso di P. Vittoria. Suggesting that scale was a



Figure 1.1.14 - Interior view of the Courthouse.

metaphor for progress, some critics viewed its great size as one of its principal accomplishments and noted that its sixty courtrooms and enormous total area would surpass those of the Palace of Justice in Rome, implying both that Milan had outdone Rome and that the fascist state had superseded the preceding liberal government. The horizontal extension of Piacentini's building can also be understood as the Italian response to the American, German, and Russian use of steel (a material in short supply in Italy) to construct buildings of tremendous height. A few urban gestures — such as the tower located at the rear of the building on the corner of Via S. Barnaba and Via Freguglia further augmented the building's visual prominence and did little to improve its relationship to its surroundings. Perhaps in part because it made so few references to its context, the building served as a model for other law courts built during this period, most notably the Palace of Justice in Palermo (Gaetano and Ernesto Rapisardi, 1938-57), which was intended to function as the symbolic and logistical headquarters of fascism's campaign against the Sicilian Mafia.

The compositional logic and rational organization of the various courts located within the building drew on Beaux-Arts planning models. Each side of the building provides an entrance to one of the courts: the front entrance on Corso di P. Vittoria leads to the Court of Appeals, the highest court in Milan; the side entrances along Via Freguglia and Via Manara lead to the Tribunal Court (Tribunale); and the rear entrance facing Via San Barbara leads to the Magistrate's Court (Preture). The tower held a library and legal archives (Archivio Notarile). Piacentini organized the various functions of the complex — accommodated largely in offices and courtrooms of varying dimensions — according to a grid broken by eight courtyards, which brought necessary light and air into the block. He situated courtrooms adjacent to major entrances and at the end of the three major circulation halls or ambulatories. These halls extend across the width of the building to facilitate the movement of and provide space for the general public. To encourage tradition. In 1933, Ojetti published a scathing letter to Piacentini in Pegaso in which he criticized Piacentini's recent buildings and projects, including the Milan Palace of Justice. He complained that Piacentini rejected the arch, vault, and column, "elements that have been for twenty or twenty-five centuries the signs of Rome," and embraced modernism with his "respect for

the right angle, for naked and plain walls." In Italy, the controversy over modernism in Italian architecture began when the Gruppo Sette, a group of seven young Milan-based architects, published the first of a series of articles in the architecture periodical *Rassegna Italiana* in 1927. Influenced by avant-garde European architects such as Le Corbusier, the group argued for a new rational approach to architecture that celebrated modern life and conditions. Interwar advocates of modernism as well as post-war scholars have often viewed Piacentini as the great enemy of Italian Rationalism. However, he was not entirely opposed to the architectural reform advocated by the rationalists.

Piacentini's response to Ojetti helps clarify his uncertain relationship to modernist architecture in the early 1930s. Piacentini acknowledged his peculiar status and opined: "Mine is a strange situation. On the one hand, I am categorized with the old, with those who have been replaced by the culturalists... and on the other hand, my ears are still being pulled reproaching my harmful avant-gardism." To defend his work and his turn away from the iconic forms of Italian architecture, Piacentini argued that "each building period ... has had one or more constructive principles, elements which have constituted the base of every architectonic composition." For Piacentini, concrete, the building material of the modern era, demanded the use of posts and beams. However, he was careful to qualify his support of modern forms. He added: "We will not construct bald façades, consisting of only glass and steel, or of gray and monotonous cement as is used today in northern Europe, in horizontal strips without any symmetry, without porticos and with 'thermometer towers' on the corners." Instead, he urged architects to remain faithful to the principles of Roman building. In the Palace of Justice, for example, the posts and beams expressed the building's concrete frame, while the marble cladding alluded to traditional Italian monumental architecture. To further locate his architecture within Italian history, he pointed to countless examples from Renaissance and Baroque Rome where arches were not used and where columns served a minor role. Piacentini rejected the superficial use of classical and modernist forms and argued for a modern style that respected the architectural principles that had defined the great moments of Italian history. At the same time, plain, classically derived architecture comported with official taste on both sides of the Atlantic during the interwar period.

Piacentini intended for the interior decorative program to convey, in ways that architecture could not, the unique character of fascist law, particularly after disappointing competition results and a limited budget undermined plans for the major decorative element, a seated statue of justice, twenty-three feet (seven metres) tall, above the main entrance. It was initiated under the direction of Podestà Guido Pesenti (1935-8), who saw the project as a means to strengthen associations between Milan and Imperial Rome after Mussolini's declaration of Empire in 1936. Indeed, the podestà hoped that the building and the recently restored San Lorenzo would stand as "two exceptional temples, that of Roman Justice and that of Imperial Religion" during a visit by Hitler scheduled for 1938, which never transpired. The ambulatory of the Civil Court of Appeals contained the most important feature of this program: three low-relief sculpted

panels. Commissioned by Piacentini in 1936, the sculptures are visible from the entrance vestibule. They depict "Roman Justice" (Giustizia Romana), "Biblical Justice" (Giustizia Biblica), and "Fascist Justice" (Giustizia Fascista), by Romano Romanelli, Arturo Dazzi, and Arturo Martini, respectively. Influenced by contemporary currents in fascist thought, Piacentini presented fascist justice as the inheritor of two great traditions in Italian history: ancient Rome and Christianity.



Figure 1.1.15 - Interior view of the Courthouse.

The dedication of a panel to biblical themes made reference not only to the legacy of Christian thought in Italian legal traditions and codes, but also to the Lateran Accords of 1929, one of the most significant and popular accomplishments of the fascist state. The accords helped to repair the rift between the Italian state and the Catholic Church that had developed in the wake of Italian unification. Minister of Justice Rocco assisted in crafting this agreement, which included among its precepts the legitimacy of marriage rites performed according to canon law. As architectural historian Terry Kirk shows, one of the principal aims of the architectural and iconographic program for the earlier Palace of Justice in Rome was to distance the legal authority of the Italian Republic from that of the Catholic Church. Piacentini's decision to include biblical themes in this triptych and elsewhere in the building communicated the rapprochement between church and state, even as the fascist regime sought to curtail the church's influence in Italian society and culture.

Piacentini viewed the decorative program as a necessary feature of the building's historical relevance and architectural success, and he commissioned sixty artists to execute more than 140 works of art for the interior. In a letter to Milanese art critic Raffaele Calzini, he explained, "I have always thought that the Town Hall [Palazzo Comunale] in Siena would not look as good if Simone Martini had not painted it, and all of the palaces of the Renaissance from the Schifanoia to the Farnesina would be cold, without feeling, and would not sufficiently speak of their age, if they were stripped of the frescos that cover their walls." For the most prominent works of art decorating the building, Piacentini favoured successful artists with whom he had collaborated on past projects, such as Mario Sironi and Arturo Martini." He also invited a few younger artists, including Lucio Fontana and Fausto Melloti, to participate, in a gesture to avant-garde practitioners and local talent. He instructed these artists to develop subjects that were "closely tied to the theme of Justice," and he suggested, reiterating the topic of the central hall, that their work "could be inspired by biblical or historical subjects." The only restriction that Piacentini placed on the artists was that their work be figurative. Just as Piacentini tied his architectural program to a recognizable architectural tradition, he sought to orient the decorative program to established artistic practices.

As the building neared completion in 1939, the decorative program became the subject of considerable controversy. The head of the Court of Appeals, Tito Preda, sent a letter to the podesta of Milan at that time, Giacomo Gallarati Scotti (1938-43), that was scathing in its condemnation of the paintings and sculptures planned for the interior. Preda criticized the art in terms of style and content and demanded that the city remove or cover images that he thought inappropriate or anti-fascist. For example, he thought that all works representing scenes from the Old Testament were Jewish and, in light of the 1938 racial laws, anti-fascist. In contrast to Nazi Germany, fascist Italy never adopted an official policy that controlled artistic freedom. In principle, the state supported all art that embodied the ideals of fascism — from the abstraction of futurism to the realism of the Novecento. This undefined cultural policy became increasingly problematic in the later years of the regime. Piacentini defended the integrity of his project and argued against Preda's naïve and excessive conservatism. It was undoubtedly Piacentini who, in 1942, appealed to Giuseppe Bottai, the minister of education (1936-43) and one of the most influential figures in the formation of official culture during the fascist years, who had long supported artistic pluralism and the use of modern art to advance fascism. In autumn 1940 Bottai intervened, writing a letter to the minister of justice, Dino Grandi, the official who was best able to overturn the decision by the head of the Court of Appeals. Like Bottai, Grandi was also a moderate and had supported fascism from the beginning. In his letter, Bottai appealed to Grandi's "open" and "modern" intelligence and longstanding commitment to the ideals of fascism. Echoing many of Piacentini's earlier concerns, Bottai asserted that Preda's effort to extend the racial laws to the decorative program of the Palace of Justice was a mere pretext and represented an attack on the kind of Italian art that fascism had long promoted. In addition, he proposed that it was a mistake for the state to reject works of art made in its honour. No doubt influenced by Bottai, Grandi ordered all the frescos to be displayed for public view. The involvement of the project architect, artists, magistracy, and local and national government officials shows the often confused and arbitrary process by which important decisions were made. Piacentini's reputation and political clout did not protect him from accusations of departing from fascist orthodoxy. However, his access to powerful and influential figures within the government helped rescue the project.

From the start, the municipal government had envisioned the Palace of Justice as the catalyst for change along Corso di P. Vittoria. As described above, the street was previously defined by modest residential buildings, religious institutions, military barracks, and an orphanage, and was now to accommodate numerous government institutions, of which the law courts were the most visible and the most important. Piacentini played a critical role in this process as architect of two buildings in the immediate vicinity and as adviser to the city planning office." He had in 1935 designed a mixed-use building for the insurance agency and joint-stock company north of the Palace of Justice along Corso di P. Vittoria (Assicurazione Generali di Venezia e Trieste, Anonima Infortuni di Milano). A nearly identical building, though not credited to Piacentini, stands along the southern side of the law courts. In 1938 the provincial government commissioned him to design a new police headquarters (Questura) on a site diagonally opposite the Palace of Justice

along Corso di P. Vittoria. Giuseppe De Finetti, a Milanese critic, architect, and urban planner, later noted that "the choice of the location for the construction of the new building was not rational but accidental, and was influenced by interests of the moment, direct and indirect" an allusion to Piacentini's behind-the-scenes influence. For both projects, Piacentini repeated the scale, materials, and visual vocabulary of the Palace of Justice but adjusted the architectural details to serve the programmatic requirements of each building — for example, the mixed-use building included balconies on the upper



Figure 1.1.16 - Exterior view of the Courthouse.

stories and floor-to-ceiling windows at street level. As a consultant to the city planning office, Piacentini reviewed the design for the other major institution adjacent to the Palace of Justice, the War Veteran's Centre (Casa del Mutilato, Luigi Lorenzo Secchi, 1937-42) on the corner of Via S. Barnaba and Via Freguglia. As completed, this building's stone base and square central tower echoed the scale and formal language of the Palace of Justice, while its lower profile, brick, and arches related to the brick medieval church of Santa Maria della Pace, part of the complex of buildings that made up the Humanitarian Society on the far side of the street. In each instance, Piacentini made sure that new construction created a plausible context for the law courts but deferred to the Palace of Justice, the symbolic locus of the administrative district.

The nearly twenty-year process of completing the Palace of Justice points to the difficulty the fascist government had in carrying major architectural and urban projects to completion in urban centres. Indeed, the project would probably have taken longer without Piacentini's considerable ability to direct and innage the process: he played a role in determining the site plan, shaped the horn petition and its results, used his connections to secure the commission, and drew on his relationship with the city planning office and other local centres of power to effect the development of the surrounding urban fabric. Situated within the city walls but on the edge of the ancient urban core, the Palace of Justice presented an austere and unrelenting vision of state control with its grey battered base, blank stone walls, and deeply set ceremonial entrance. In contrast to the Trading Exchange designed by Paolo Mezzanotte, which maintained some continuity with the existing urban fabric, the Palace of Justice stood completely apart from the disorder of the traditional city and would preside over a district of dramatically new proportions configured to accommodate the speed and efficiency of modern mechanized transportation. Piacentini's building not only sought to embody the authority of the central state manifest in Minister of Justice Rocco's legal reforms, but also expressed fascism's desire to alter the character, habits, and mentality of its subjects through the creation of a substantially new kind of Italian city during the second half of the 1930s. In this period, the regime manifested its confidence and optimism in increasingly large-scale urban and architectural projects, and Milan, with its limited cultural patrimony and progressive spirit, presented an ideal testing ground for these ideas.

1.2.2 - Architectural information

1.2.2.1 - Design

Starting from the concept of the centrality of the Court Building, located in the heart of the city, the "Citadel of Justice" can in fact expand towards the surrounding buildings and spaces, some already existing (the Anmig building and the lounge Valente), others being about to be built (like the building on the corner of Via S. Barnaba) and others to be acquired by the City.

In this way, the common roots among the places where justice was administered would be strengthened, thus creating a tight connection between the economic and social fabric of Milan on one side, and the history of the city and its citizens on the other.

The most monumental and solemn architecture of the Ventennio Fascista is the Palazzo di Giustizia di Martello Piacentini, the one that is most significant not only for the grandeur and the mole, but also for the stylistic affirmation and the unique beauty of the constructional structure.

The mole, which in size can race with famous buildings such as the Vatican and the Royal Palace of Caserta, the Valentine or the Escuriale, squared with your straight edges, with its rushing and bare rhythms on a surface that once and a half bigger than that occupied in Rome by the Palace of Justice. It came up in the years of Fascist ascent on the eve of the cyclone contrasts that move the world today. An affirmation of Latin wisdom and balance, of tradition and of Italian conclusion, which seems to be called admonition and example on the brink of chaos; But, at the same time, seems to add the ideal point of reference for the coming future. If its architectural character is, in a sense, abstract and universal, and no stylistic cultural appeal refers directly to Roman architectures, its inspiration can not be ours, its unitarity is revealing its task and its function.

While on the shores of Lake Geneva, the so-called "Nations" Palace, which was almost simultaneously erected at the Palazzo della Giustizia in Milan, is heterogeneous and amorphous and seems destined to do not know that idols or priests disputing under the frescoes frescoed by Sert, Of Piacentini can not accommodate that Justice itself, understood as the supreme intellectual and executive function of men. The lack in the same facade of the symbolic and truncated statues that adorn the palaces of justice, such as those of Rome and Brussels, away the idea that the administration of justice can be a vanity and rhetoric academy of contrasting eloquences. The austere epitaph of Justin, which is the only decorative element carved on the crowning of the Palace, defines the tasks of human and divine justice according to the spirit of the Romans. The "verb" inserted in the compartment of architecture is like a spiritualization of matter; And I still remember the emotion I felt when, from the sandy burial of the excavations of Leptis Magna, mysterious inscriptions of Septimus Severus appeared in my eyes and for the first time in the light.

While designing the building Piacentini paid attention to all the details, including the furnishing of rooms and offices. Even today, the office of the President of the Court of Milan contains the original furnishings in fine woods, veneers and finishes in leather with the typical twentieth-century style. As regards the arrangement of the courtrooms, it follows a pre-defined scheme that refers to some of the recurring patterns found in European courthouses throughout centuries. The doors are made solid walnut, partly covered with bronze plates, the floor is linoleum except for the part occupied by the raised wooden bench of magistrates.

The aesthetic concept of the Palace has obviously departed from the solution that should be offered to the operation of the services by means of an adequate internal distribution of the environments. The basic services to be performed were those of the Court of Appeal, the Court of First Instance and the Pretura; The three major branches of the judiciary, each of which, in turn, is subdivided into a criminal section and a civil section. It is well known that, while a close network of relationships links the functioning of the two sections, both criminal and civil, of each of the three branches, an even tighter network of links binds to the functioning of the three branches (Court of Appeal, Court and Pretura) Of each of the two sections.

The fundamental core of the distribution solution was to confer a horizontal seat, in the sense of the different areas of each floor of the palace, to the flow of relations between the three branches, and instead a vertical seat in the sense of the different plans of the ' Building, to the flow of relations between the criminal and civil sections of each branch.

If seen from its longitudinal side, the building is divided into three sections: the Court of Appeal, the Magistrates Court and the Court, perfectly independent of one another with their own entrances from the outside, but closely connected at the same time through two large parallel halls, crossing lengthwise the whole building. The creation of spaces both easily accessible by the users and easily connected between them at the same time, had been one of the fundamental conditions required by the competition committee.

As for the side façades on via Freguglia and via Manara, the partitions of the portals are decorated with bas-reliefs bearing the symbols of justice made by Fausto Melotti (Rovereto 1901 - Milan 1986). While the rear façade on Via San Barnaba features a triple entrance portal surmounted by the inscription of "Justitia" and is flanked by two basreliefs made by Corrado Vigni (Florence 1888 - ivi 1950): the left one depicts two archangels holding a balance with the following words below "Let there be justice so that the world will not perish" by G.W. Friedrich Hengel, while on the right, the two archangels respectively brandish a sword and the scroll of the Law with the following inscription by Cicero below "Justice is the basis of the kingdoms".

1.2.2.2 - Distribution of the spaces

In the sense of height, the building body is divided into two main layers: the lower for all criminal services, the superior for civilians.

Here is a list of the Palace's plans:

A basement floor at 4.0 m below the road level;

A ground floor at 50 cm above the road level;

A raised floor area of 5,50 m above the road level;

A mezzanine floor which extends only partially on the surface of the raised floor;

A noble first floor at 14.10 meters above sea level;

A second mezzanine limited to a few premises extending to a limited portion of the noble first floor.

A final floor.

There are, therefore, four floors occupying the whole length of the palace and two mezzanine floors of limited size; Finally, a plan of sight obtained at the large penthouse overlooking the main facade.

Here is a brief description of the distribution of environments on different floors.

Basement floor: It includes all heating, air conditioning and ventilation systems; Cells and tunnels for the transfer of detainees from cells to classrooms; The armored archive of the Tribunal's civil status; Warehouses for the bodies of the offense of the Court of Appeal, the Court of First Instance and the Pretura; Large rooms for charcoal storage and for groups, air conditioners in hearing rooms: electric cabin for power transformers; Workshop for electricians; Various storehouses for the maintenance of the Palace; Storage room for telephone switchboard, etc.

Ground floor: is partly intended for judicial administration and partly for ancillary services: from the rear view of the palace, located on S. barnaba Street, it enters the Criminal Criminal Chamber, surrounded by six classrooms plus five other available classrooms.

From Via Luciano Manara you enter the Offices of the Conciliazione, which is composed of five classrooms.

On the Via C. Freguglia the carriages are opened for prisoners' vans, which give access to the guard's body. The numerous cells are divided into two groups and are communicated directly with the different criminal chambers through particular ladders and corridors.

Via C. Freguglia also has access to the Notary Archives. In the lateral bodies of the ground floor are located: the Detention Bureau, the Court Officials of the Court, the Legalization and

Vetting Office of Commercial Books. In the central body, you find the Civil Status Archive of the Court, the Judicial Officers of the Court of Appeal and the Building Maintenance Offices.

On the main prospect of the Palace, on the right and left, open for the cars of the First President of the Court of Appeal and the Attorney General of the King, Such accesses lead to private escalators for these magistrates and have their own garage with annexes Local drivers.

Raised floor: It has a height of m 8.60 in Ambulatories and Classrooms and m 4.30 in Offices. According to what has already been reported, the 4.30 m module, just the height of the service plans, has an impact on the height of the building, doubling at the Penitentiary Department and tripling at the Ambulatory Hospital Civil section.

The elevated floor essentially contains, in addition to the monumental vestibule, the three outpatient offices of the Criminal Court, the Tribunal and the Pretura Civile, around which the three levels of judicial administration are concentrated. Of each of the three areas where, as mentioned before, the palace is subdivided, the outpatient clinic is the representative and functional center.

Around the Criminal Court's Abuse, they have two large classrooms, the Magna Hall and the Court of Assise Court, and four other Criminal Courts. Each of these is of course equipped with all the accessory environments, ie premises for prosecution and defense witnesses, local councils, carabinieri premises, and so on.

Around the Observatory of the Criminal Court there are ten classrooms; Around the Pretura Bureau there are six classrooms.

All other offices and premises of this plan are dependent on the aforesaid services except the premises located in the corner of Via S. Barnaba and Via Carlo Freguglia, which are reserved for the Notary Archives. This, in addition to the consulting rooms, is equipped with a tall tower divided into sixteen floors of height 2.50 m each, fully occupied by the storage shelves.

On the main front there are the Offices of the Large Library of Lawyers and Pro-curators. There is also a bar-restaurant in the corner between Via Freguglia and the Porta Vittoria Course.

First Mezzanine floor: is 4.30 m high, extends only above a part of the surface occupied by the underlying raised floor and does not contain hearings; It welcomes additional offices and services which are: the Offices of the Directors of the Civil Court of the Court of Appeal; The Criminal Procedure Office with the Commercial and Bankruptcy Section of the Court; The Cabinets of Judges and Chancellors: the Cabinets of the Pretori and Vice Pretori; The Office of the Register with annexes salt for the public and salt for the archives; Judicial Doppler with

various meeting rooms, reading, games and various services. All of these Offices are connected to both the underlying services and those of the upper floor.

First Floor - Like the raised floor, it has different heights, m 12.90 in the ambulatory, m 8.60 at the classrooms, m 6.50 in the offices, and, as in the elevated floor, here is the triple scheme of the Three large ambulances surrounded by numerous classrooms: here, large staircases crowd around and crowds circulate. The Court of Appeal's outpatient clinic disengages eight attached halls; That of the Tribunale Civile ten classrooms; A second outpatient of the same Civil Court, six classrooms. A wide range of offices are located around the President of the Tribunal, the First President of the Court of Appeal and the Attorney General.

There are also Offices and Cabinets for the Deputy Prosecutors of the King, the Press Office, the Library, the Cabinets of the Section Presidents, the Work Chancellery, the Office for the Protection of Minors and Large Attorneys.

Second mezzanine floor: Offices in this plan are attached to the Civil Court of Appeal and to the Civil Tribunal.

Top floor: In this plan, 4.30 m high above the offices of the King's Attorney, other Offices are connected with the Judicial Offices.

The Prosecutor's Office, in addition to the Attorney's Office, includes the Cabinets of Deputy Prosecutors, the Judicial Police, the Execution Office, the Medical Examination Office, the Judicial Case, the Library for Judicial Works, the Library for Collecting The Laws, the Press Office, the Certified Office, and so on.

District Attorney includes: Heads of State Attorney's Office, State Attorney's Office, Attorney's Office, Copier Office, and Library. In addition, the Royal Carabinieri Offices and Housing have been flooded in this plan, with attached kitchen services, meeting rooms, the Telephone Office and other services; There are still some rooms available to the judiciary and some available to the Royal Civilian Tribunal Commissioner for Settlement.

Addition floor: The rooms here are used for the use of the Economics Offices, service and cleaning staff; Some others are available for future enlargement.

To summing up, in the Halls of Audience, in total, the Palace houses 62, of which 5 for the Conciliazione, 11 for the Criminal Court, 6 for the Pretura Civile, 6 for the Criminal Court of Appeals, Aula Magna and the Hall of Assisi, 8 for the Civilian Court of Appeal, 10 for the Criminal Court and 16 for the Civil Tribunal.

1.2.2.3 - Circulation in the environment

Tribunale di Milano is on the main street of Corso di Porta Vittoria, which has easy transportation via tram or bus. Tribunale di Milano is located on the street Via S. Barnaba at south, Via Carlo Freguglia at west and Via Luciano Manara street at east. Via S. Barnaba is also a long street which connects to a park at west. The other two, Via Carlo Freguglia and Via Luciano Manara are smaller side streets.

Closest stations to Tribunale di Milano are:

Palazzo Di Giustizia is 130 meters away, 2 min walk.

C.So P.Ta Vittoria (Camera Del Lavoro) is 206 meters away, 3 min walk.

C.So P.Ta Vittoria L.Go Augusto is 215 meters away, 3 min walk.

Via Besana Via Podgora is 253 meters away, 4 min walk.

L.Go Augusto is 373 meters away, 5 min walk.

The orderly and orderly arrangement of the services contributes, in addition to the well-studied distribution scheme of the environments, the wise solution offered to the circulation inside the palace.

It has already been noted in this regard that the three major ambulatory units constitute the main ganglia of this circulation and their function is comparable to that which is attributed to the squares in the city circulation: to them are the ramps of the stairs, galleries, The corridors, in which the public currents are directed at the offices and can easily accommodate those who intend to attend the hearings.

On the four sides of the palace, the four main entrances to the public are opened, and the smaller entrances reserved to employees and services; Six staircases join the Ambulators of the elevated floor with those of the first floor; In addition to these, there are other twenty-six secondary, reserved and service stairs in the Palace. This remarkable staircase is equipped with nine elevators.

The natural ventilation and interior lighting of the interior is ensured by eight large courtyards, almost internal squares, providing plenty of light and air to the classrooms, the galleries, and the offices opening windows.

Public galleries are 5 m large, office corridors are 4 m wide, measures to ensure the easiest contact between Ambulatories, Classrooms and Offices on various floors.

1.2.2.4 - Metric data

The building has a trapezoidal plan with the main front facade. The main facade of the Palace is 120.00 m long and 33.00 m high; It consists of two lateral corpses of 2.80 m, enclosing the triple monumental architraved portal: this gives access to the large vestibule of the raised floor and constitutes the largest entrance of the Palace. The building's main characteristic is its main façade, which features a triple gateway leading to an imposing hall 25 m high. As a decoration, the front bears only a few Latin inscriptions in the centre under the word "Justitia", that read: "The rules of the Law are these: live honestly, do no harm others, give everyone what one lawfully owns". On the side façades instead, the inscriptions read respectively, on the left: "The Law is the knowledge of divine and human things, the science of what is right and what is wrong" by Oeneus Domitius Ulpian and, on the right: "We were born for Justice and the Law is not established by the human thought, but by the nature" by Marcus Tullius Cicero.

The façade is crowned by a flat floor and smooth. The rear facade, facing at Via S. Barnaba, 167.36 m long and 28.50 m high, is made up of three bodies: a 93.36 m and two side 37.00 m each with 0.80 m and slightly bent inwards.

The sides of the Palace, facing at via Manara and via Freguglia, 203.70 m long and 28.50 m tall, are made up of a completely smooth surface. The tower of the Notary Archives, with sides of 17X19 m, is 61.00 m high.

The internal plan is divided into three floors and two mezzanines, the lower part having to deal with criminal while the upper with civil cases. Currently, however, the fifty rooms are not being used according to the original project.

Each section of the building features a large space called "hall" which leads to all the rooms of the same section. The two major halls -Court of Appeal and the Magistrates Court- are 70 m by 24 m. The project also features eight courtyards of different sizes that allow the rooms to be lit by natural light through the windows, which do not look out on the outer perimeter of the building, as required by the commission. The records offices are placed at each end in order to make them more accessible by the users.

The Archive, originally intended to occupy the 61 m high tower facing via Freguglia, was then moved, for management purposes. Six great stairways connect the halls of the upper floor with those on the first floor, twenty-six secondary minor flights of stairs and nine elevators complete the internal connection network. The number of rooms is well over one thousand (1300) given that the 1929 competition requirements demanded there be 1032.

1.2.2.5 - Architectural drawings

1.2.2.5.1 - Plans

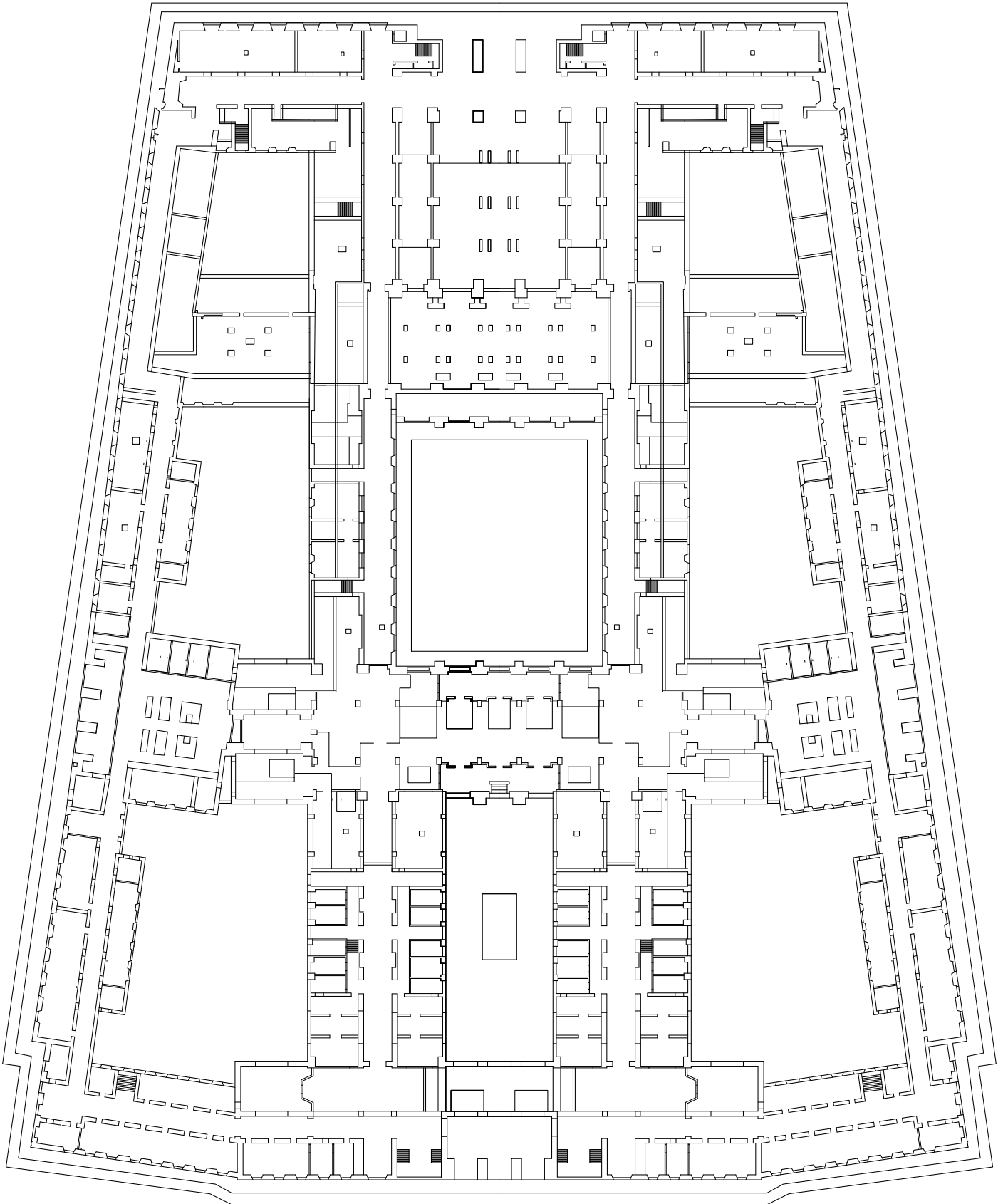


Figure 1.2.1 - Basement Floor Plan, 4 m below the road level.

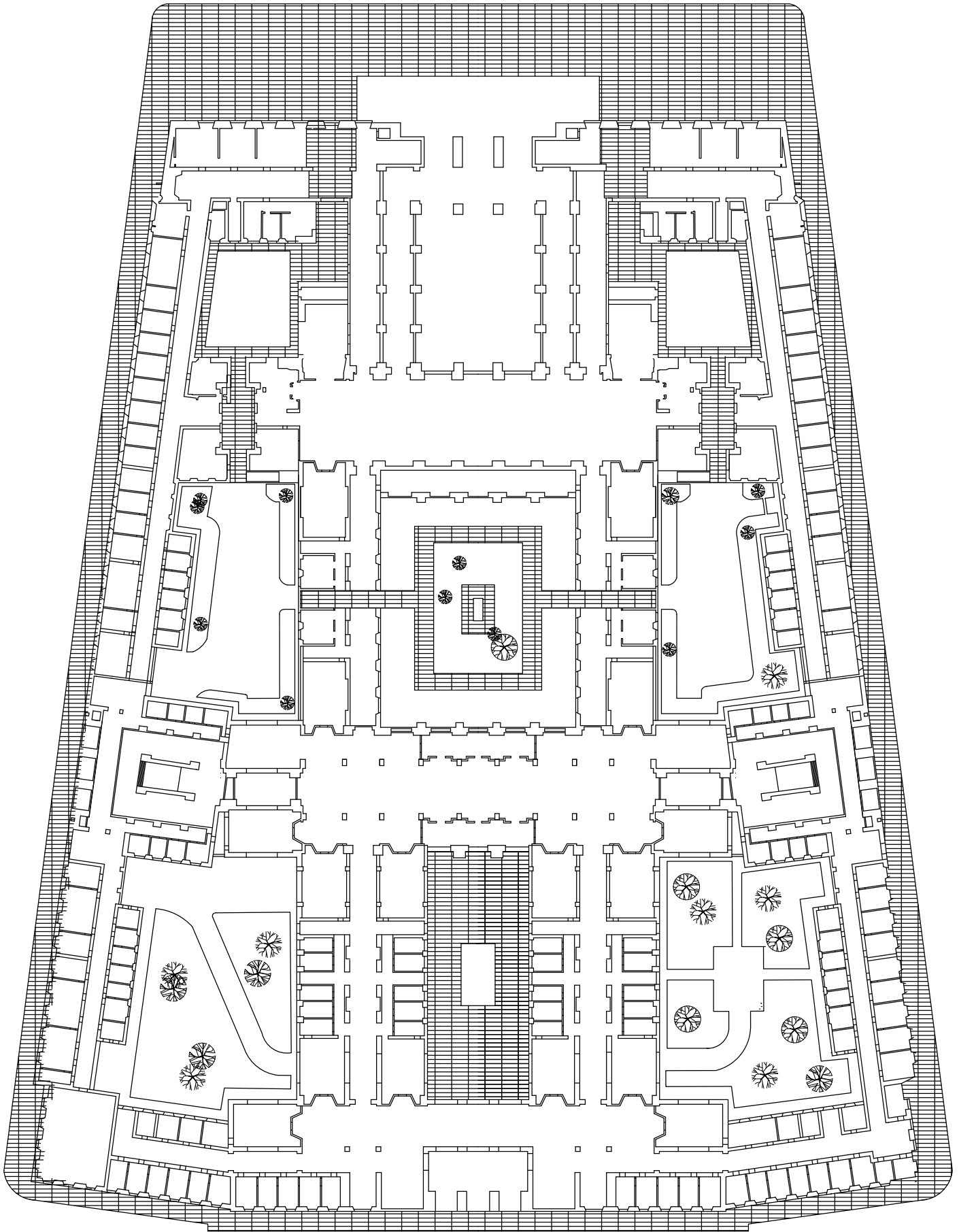


Figure 1.2.2 - Ground Floor Plan, 50 cm above the road level.

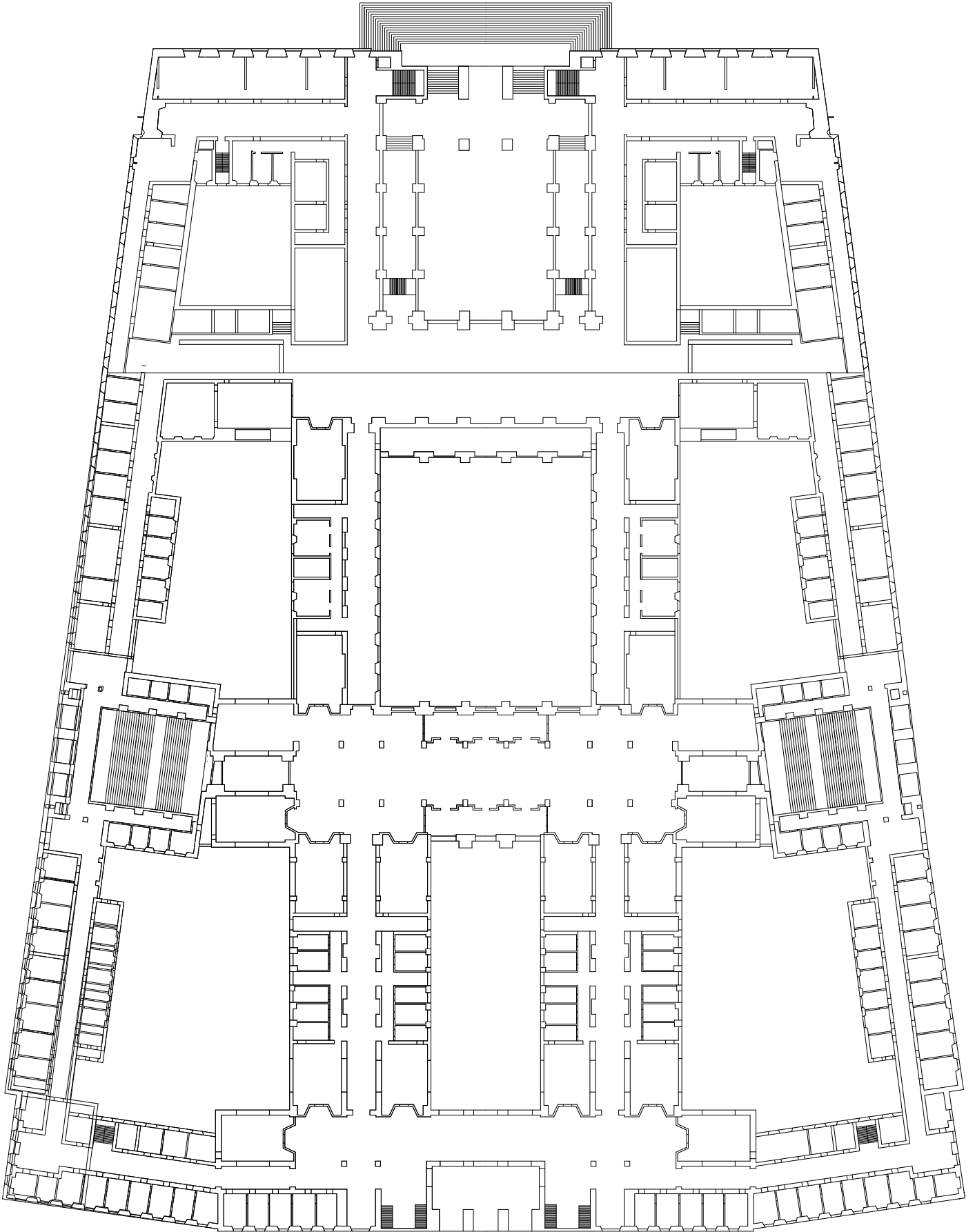


Figure 1.2.3 - Raised Floor Plan, 5.50 m above the road level.

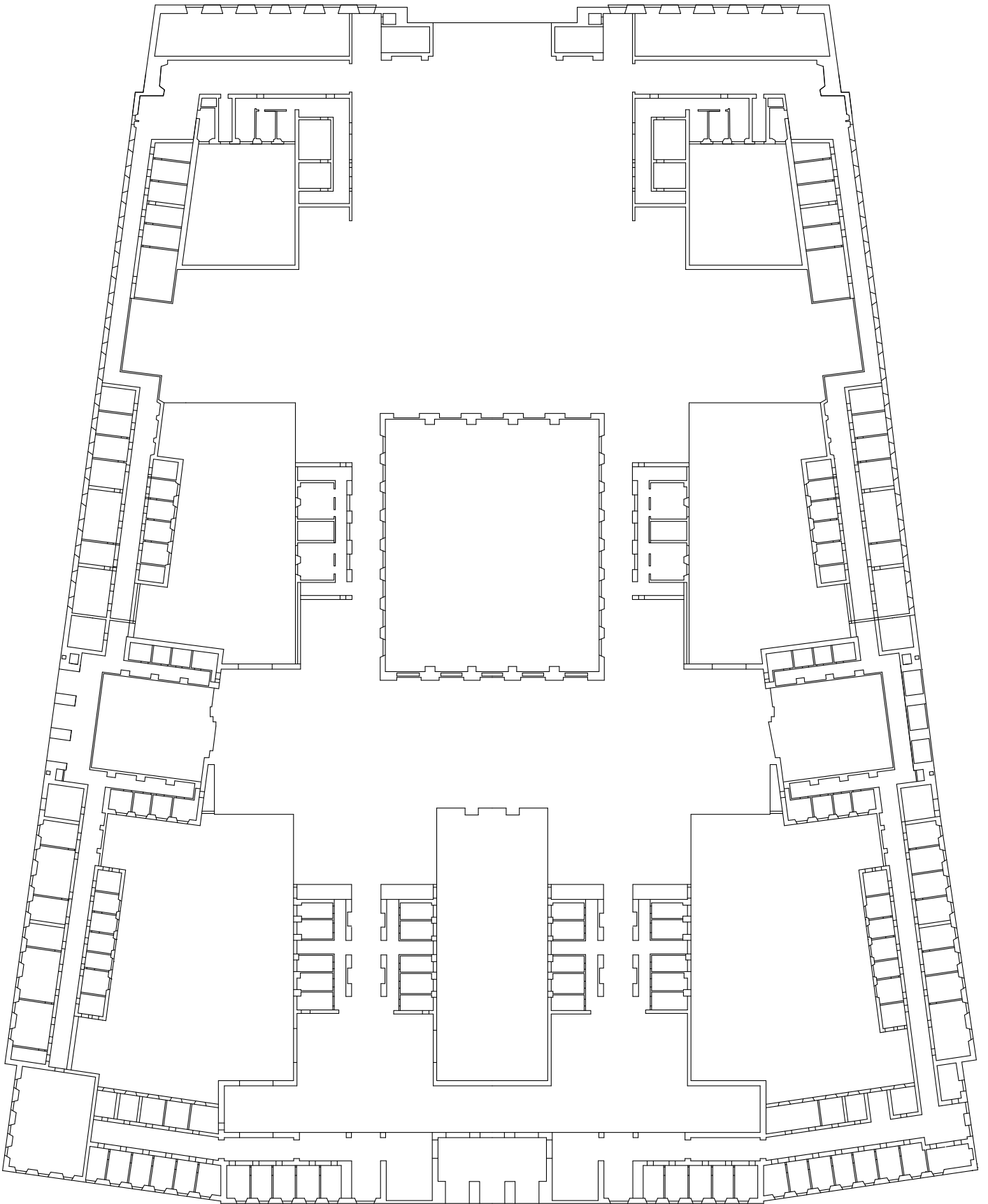


Figure 1.2.4 - First Floor Mezzanine Plan, extending only partially on the surface of the raised floor.

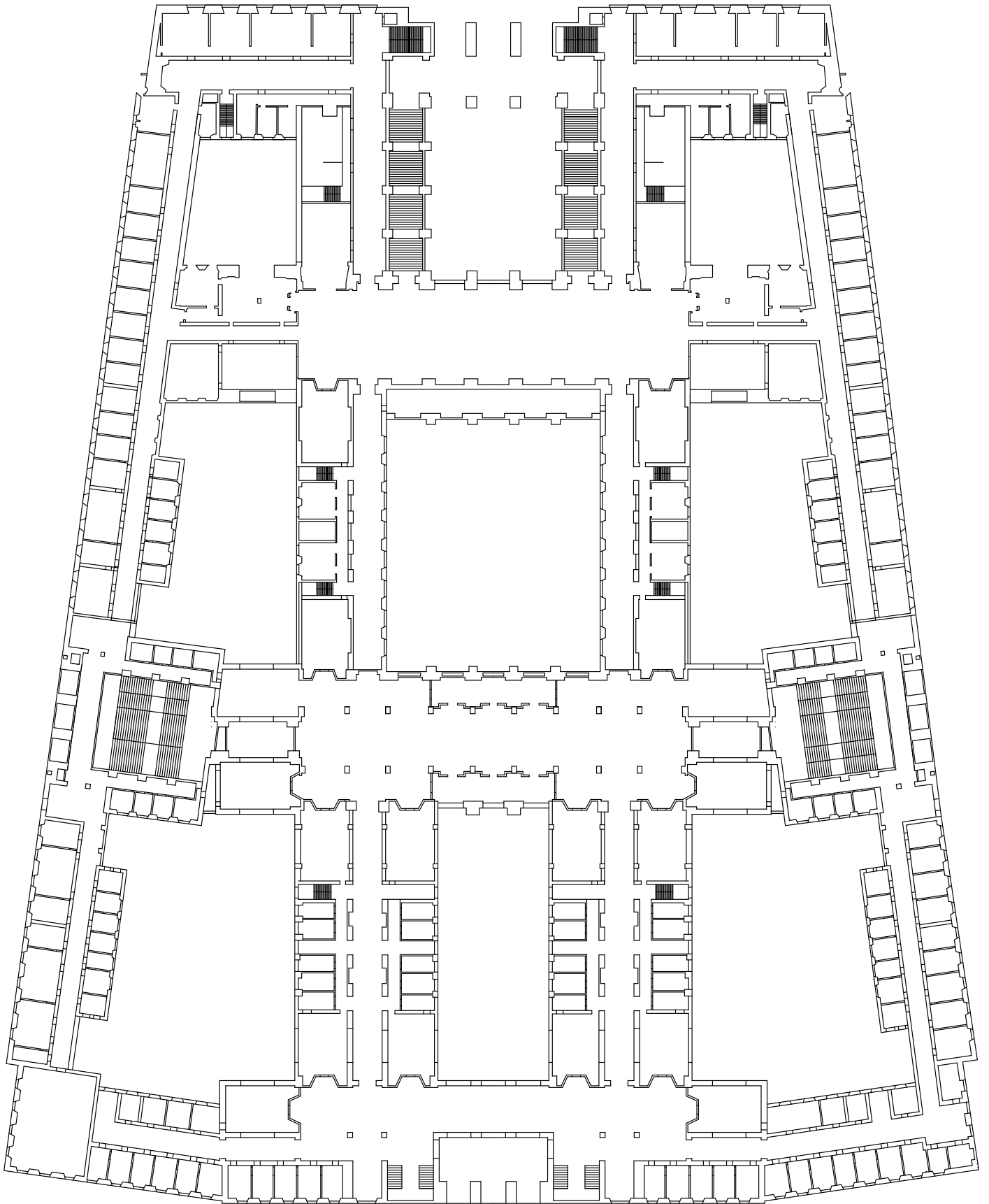


Figure 1.2.5 - Noble First Floor Plan, 14.10 m above sea level.

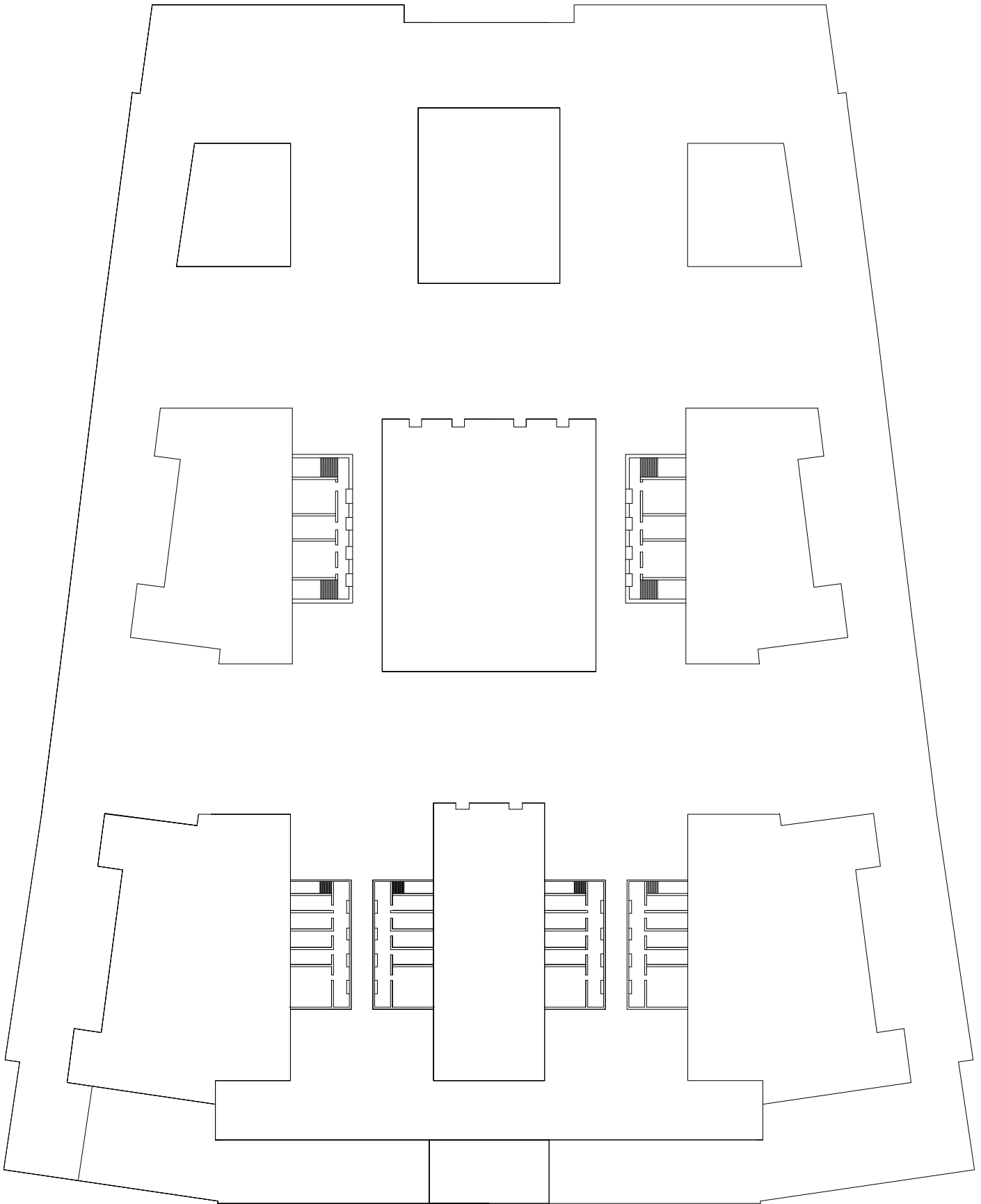


Figure 1.2.6 - Second Floor Mezzanine Plan, limited to a few premises extending to a limited portion of the noble first floor.

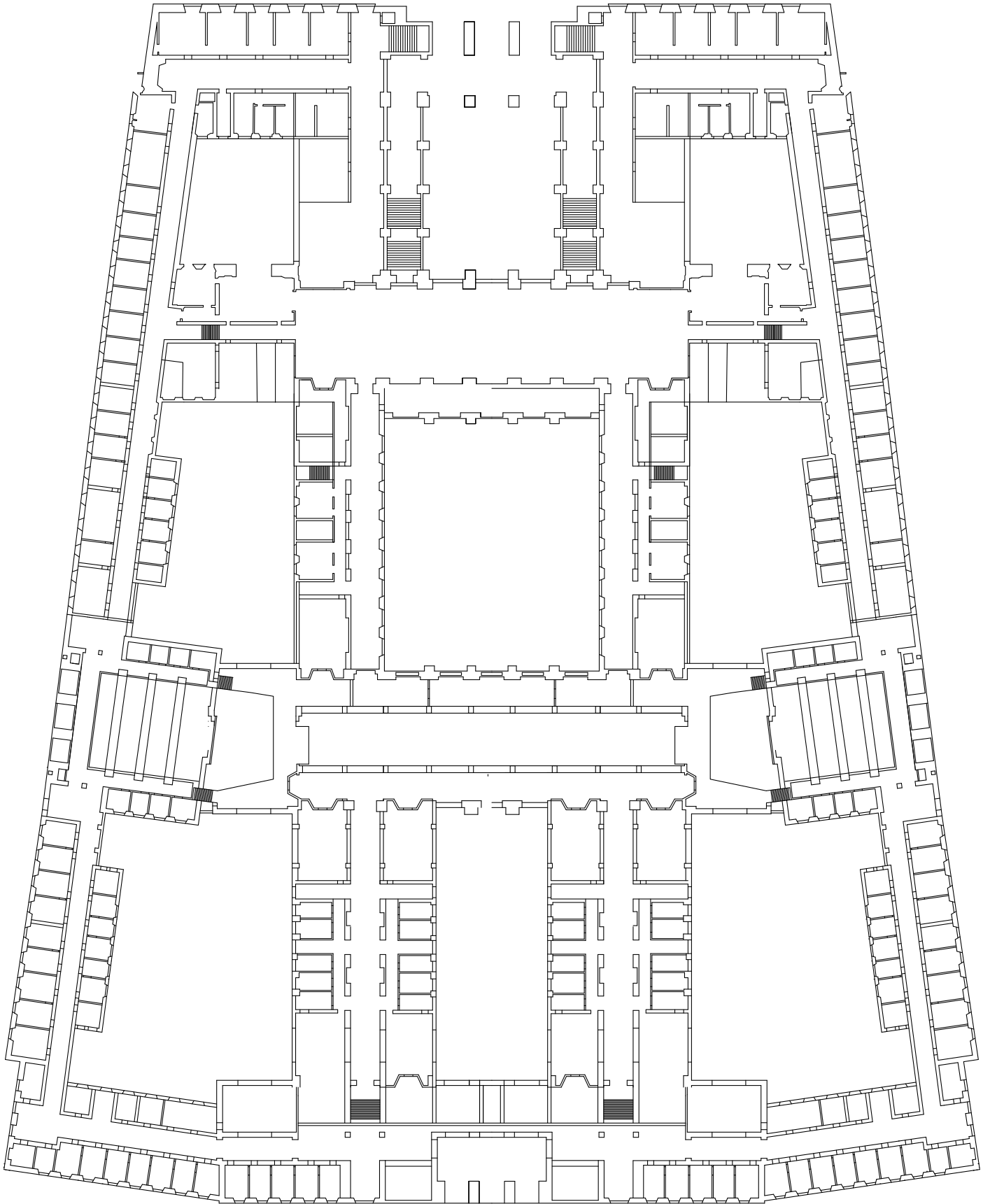


Figure 1.2.7 - Top Floor Plan.

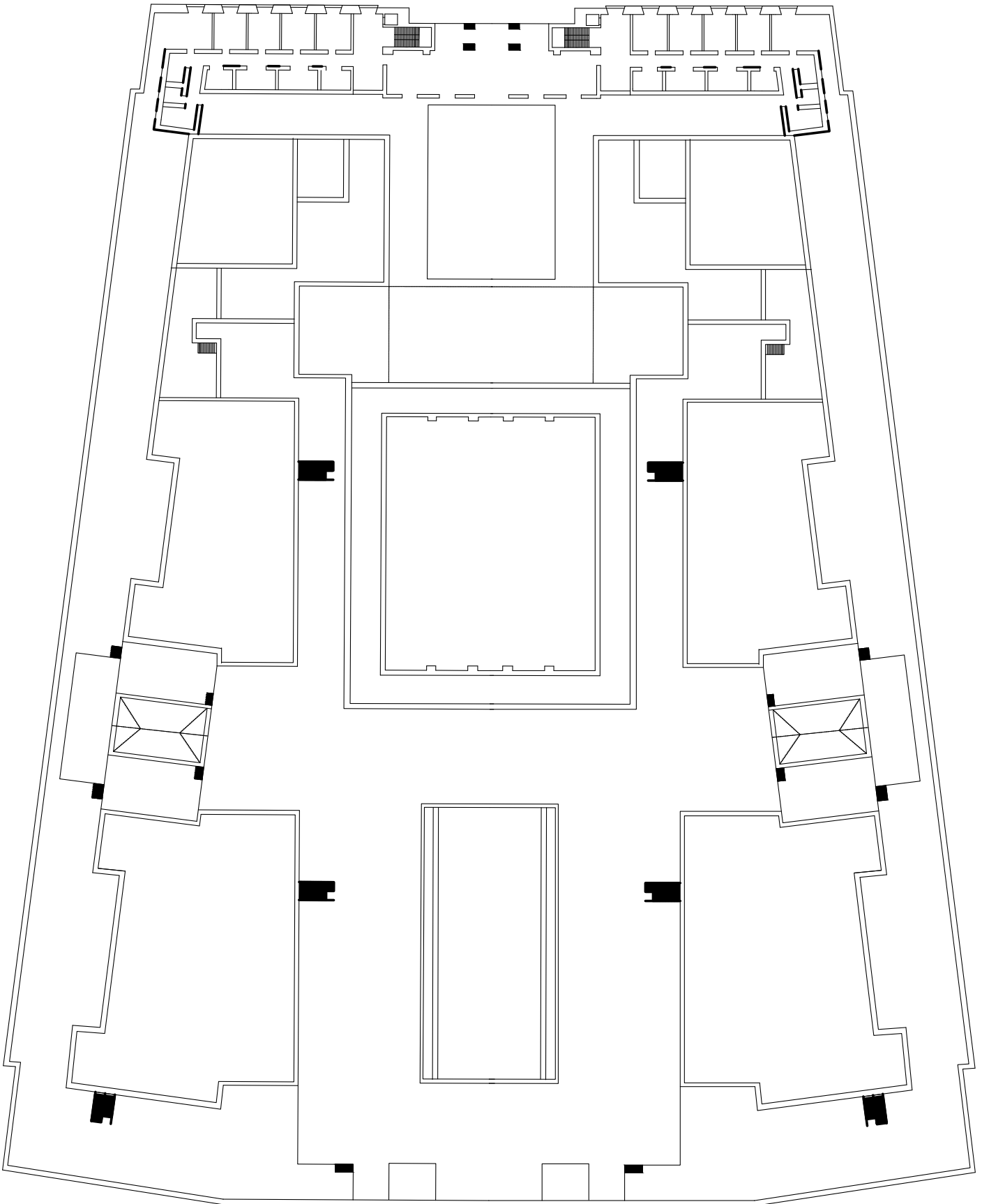


Figure 1.2.8 - Additional Level Plan, showing the new offices.

1.2.2.5.2 - Elevations

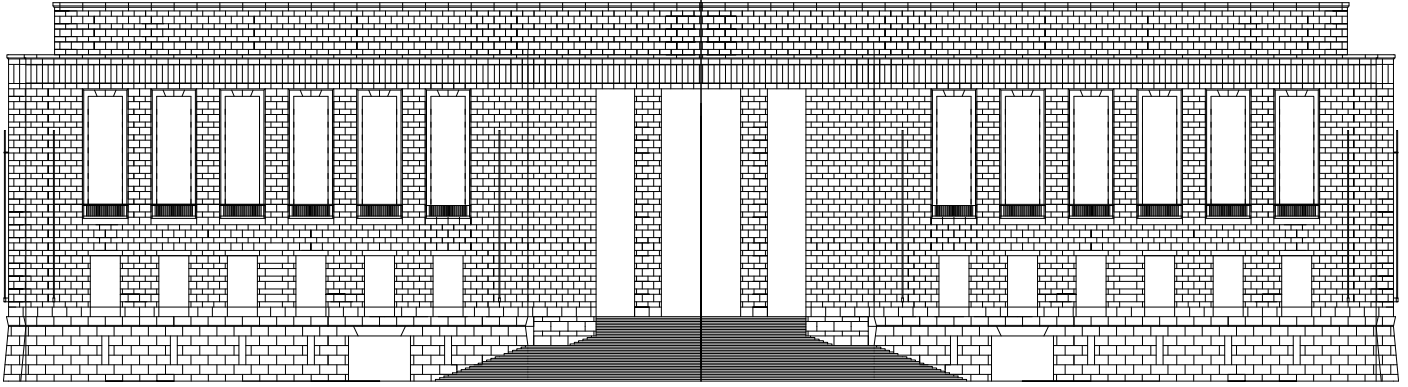


Figure 1.2.9 - North / Main Facade.

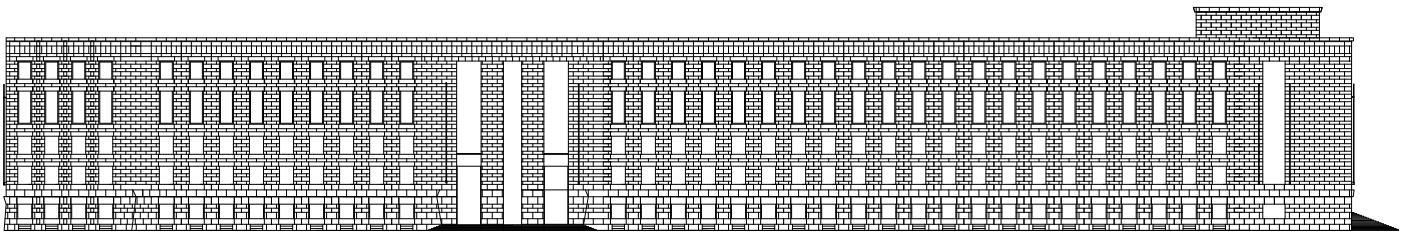


Figure 1.2.10 - East Facade.

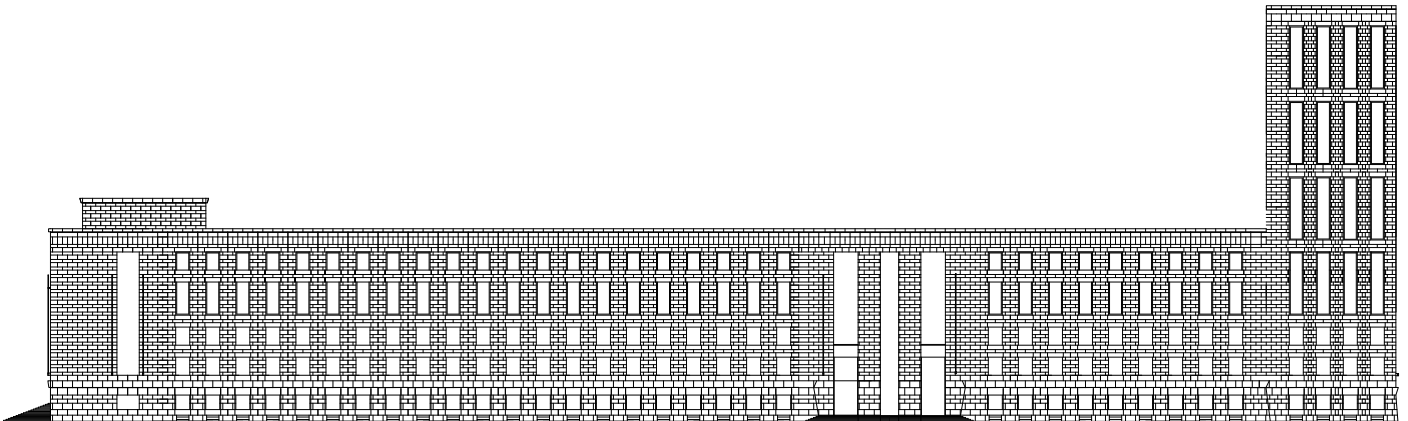


Figure 1.2.11 - West Facade.

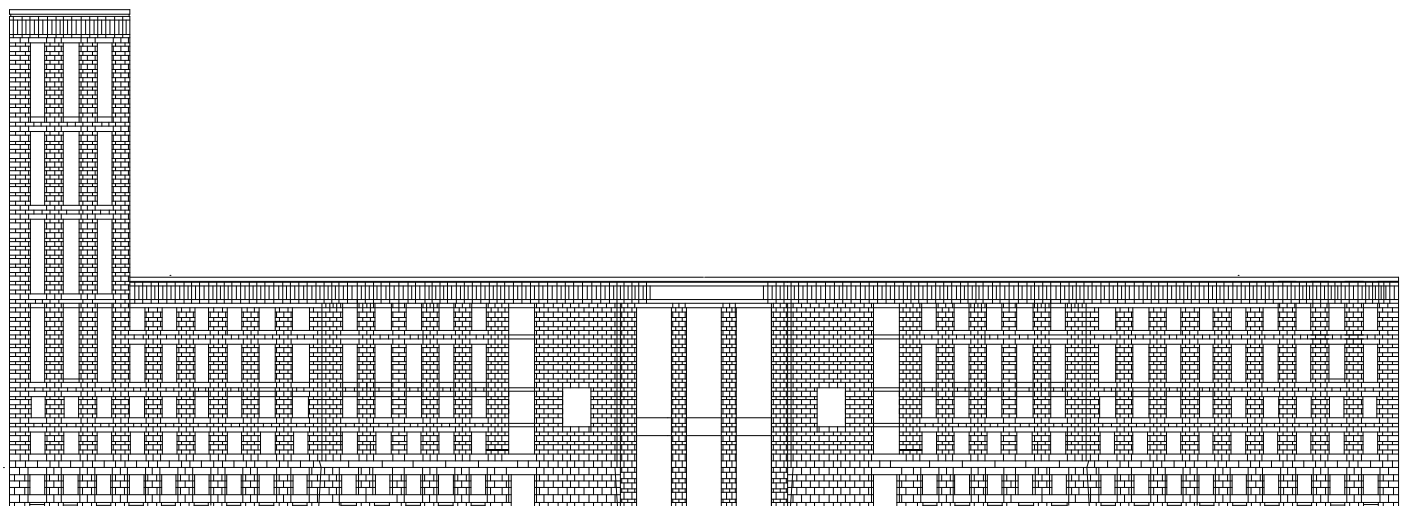


Figure 1.2.12 - South Facade.

1.2.2.5.3 - Partial sections and elevations

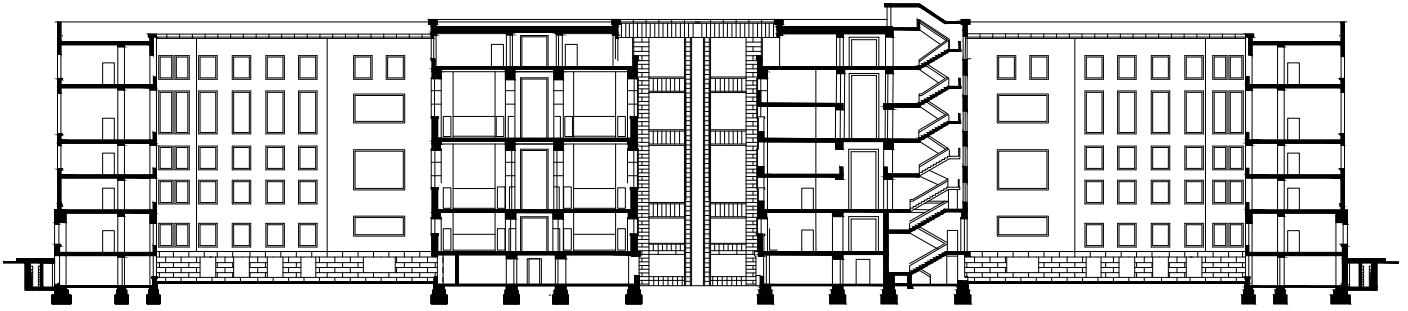


Figure 1.2.13 - Transversal section.

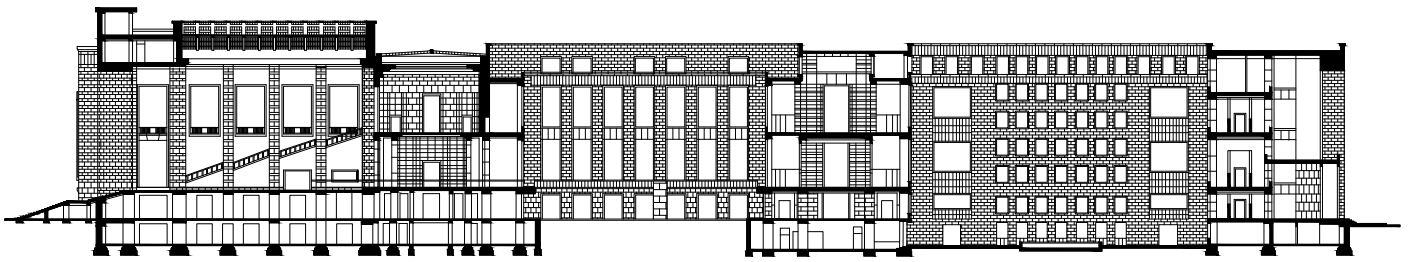


Figure 1.2.14 - Longitudinal section.

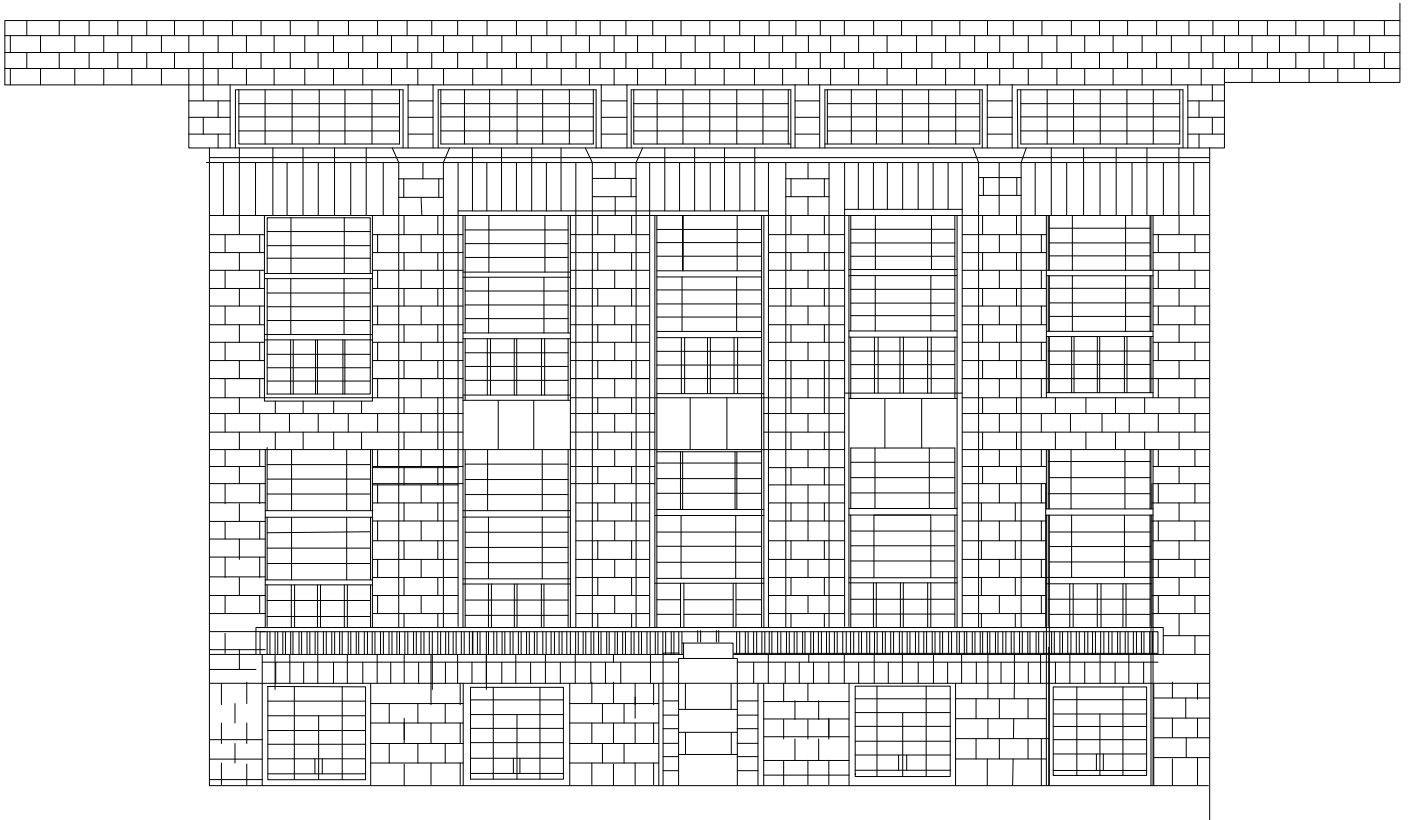


Figure 1.2.15 - Cross-section of the yard.

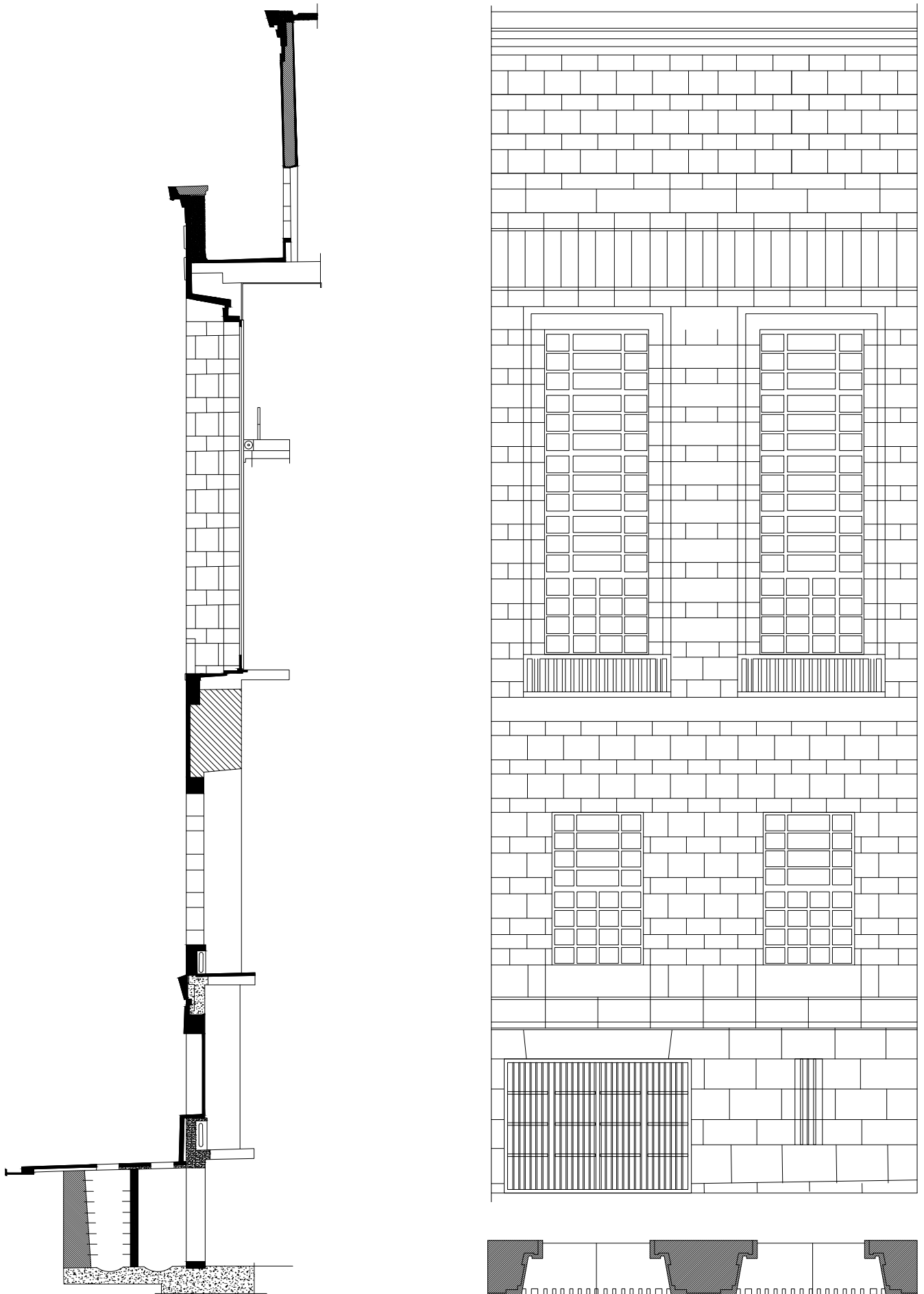


Figure 1.2.16 - Detail of the main facade, section and elevation.

1.2.3 - Technical information

1.2.3.1 - Construction

The problem of gathering in one large palace all Milan's judicial offices was taken into account by the first fascist administrations. Even though Milan was a legal place of primary importance, the Administration of Justice was in disadvantaged conditions and in some undesirable aspects.

It was divided into seven buildings located not far from each other, as the Preturas were partially in S. Antonio Street and partly in the Via della Signora; The Conciliazione in Via Uberto Visconti di Modrone, the Court in Piazza Beccaria, the Assisi in via Francesco Sforza, the Procura and Education in Piazza Missori and finally the Court of Appeal in the Clerici Palace, which was the only truly worthy place.

All the other buildings were old, falling, with low-lighted classrooms and offices, poorly distributed and inadequate; Moreover some buildings did not even guarantee stability.

To solve this great problem, several solutions were considered. At first, around 1925, the area of the old slaughterhouse was considered a short distance away from the judicial prisons in via Filangieri. Afterwards, in 1927, attention was focused on the Ark of the Caserges of the 7th and 8th Infantry Regiment in Place S Ambrose and finally in 1929 the Marquis Podestà Giuseppe De Capitani D'Arzago and the Vice Podestà Giuseppe Gorla, now Minister of Public Works, destined to build the Palace of Justice the area occupied by the Horse Artillery Barracks "Prince Eugene of Savoy" located in Porta Vittoria, a barracks to be moved to the new grandiose buildings of Via Baggio.

In April 1929 a public competition was banned for the project, the conception of which, saying the ban, "simple and severe, will have to respond to the purpose for which the palace is destined and worthy of the city of Milan and the fascist era Where it rises." The competition did not give a definitive result, since the 11 projects presented 3 were recognized as worthy of a prize, but no one seemed to possess the requisites needed to be translated into work.

The next Administration, with the Duke Podcast, Marcello Visconti di Modrone, instead of banishing a new competition that would have led to the execution of the work, which appeared urgent, having aggravated the situation of the Judicial Offices, entrusted it with the Academician Arch. Marcello Piacentini, by Act of October 3, 1931, concluding with the State Administration the regulatory convention for the execution and operation of the Palace.

Transferred at the end of 1931 to the Artillery Barracks in the new large Baggio headquarters, the abandonment and dismantling of the old Barracks were carried out, so on 5 February the Podestà with the Vice Podestà and the Arch. Piacentini could present the definitive project to

the Head of Government, who approved him, feeling great and rational at the time, worthy of justice, the regime and Milan.

Because the new great work was then contained in an environment of particular urban design, a regulatory plan of the adjacent area with R. D. L., February 25, 1932, No. 95, and with a subsequent variant contemplated in R. D., May 12, 1939, No. 875, was approved.

As a result of agreements between the State Administration and the Municipal Administration, Podestà avv. Guido Pesenti, and Vice Podestà gr. Uff. Rag. Franco Marinotti and Dr. Vincenzo Vella, agreements approved by RDL on September 5, 1938, No. 1469, the Palazzo di Giustizia, executed by the Municipality of Milan, was transferred to the State Administration, while the City of Milan continues its management according to law.

According to the plan adopted in 1932, the area destined for the Palace of Justice had a trapezium with fronts on the Porta Vittoria course, (main front 120 m long) and via S. Barnaba (long side 168) and sides Length of 204m on Via Luciano Manara, which by 8m was enlarged to 20 m and on the new Wide Freguglia street 20m.

A large part of the area forming the seat of the new Palace for 25900 sqm was made up of the old barracks, the remaining part for 4200 sqm was due to the expropriation of the houses on the west side of Luciano Manara street as well as from the relics of the Convent of Sisters Existing Agostinian during Porta Vittoria between the Caserma and Palazzo Durini, at the entrance of Via Freguglia. Overall, for the construction of the palace and for the opening of the streets, they had to expropriate no. 14 private houses, in addition to the riddled Convent, and occupy an area of 39,600 square meters.

Opposingly, the plan provided for Porta Vittoria a significant backwardness of the palace front to form a sufficiently deep square. On the other side of the Palace of Justice and according to the alignment of the Palace itself, buildings were perfectly sounded to the architecture of the Palace, which was one of them designed by Piacentini Architect.

Likewise along the path of the new Via Freguglia, which looks to the Palace of Justice, there were very decorative buildings with heights and architectural parties that are in harmony with those of the Palace and finally at the end of that street on the corner of Via S. Barnaba, Now completing the House of the Mutilate according to the design of the Ing. Luigi Secchi of the Municipal Technical Office.

It can be said that the construction of this palace has given the opportunity to renew the entire surrounding area.

INTRODUCTION

Here are some information about the works of the yard that to see what is needed to carry out a work of such size.

The shipyard, of enormous proportions, was organized with the most modern systems. In addition to the installation of powerful machining and manipulating machinery for cement mortars and conglomerates, various wooden shacks and masonry partitions (including a large dressing room for workers) were constructed, large and large hygienic premises equipped with drinking water current. A 200-Q.li bridge deck was also installed, a repair workshop in general, a carpentry and local locks for storage of materials, a truck lorry and one for passenger cars, a warehouse storage facility, a Vast dormitory for guardians.

A transformer cabin was also built for 8500 times voltage current and transformed to 160 volt voltage. This current went through a ring line all around the yard. From this ring, by means of intermediate outlets (one every ten meters) and two auxiliary lines, it was brought to the engines that operated the various machines (cranes, kneading machines, etc.). There were no 25 electric motors with a total power of 180 HP.

The yard was equipped with a water distribution system with grips every 25 meters, and, given its enormous extension, was equipped with a complete telephone system with switchboard in the office of the company, three appliances distributed on the yard and One at the headquarters of the job department, so you can quickly communicate orders and arrangements.

An electric bending machine was also installed for the bending and preparation of homogeneous iron for reinforced concrete.

The gravel material from the foundation excavation and special grooves was brought through a Decauville plant into a hopper from which, through a feeder and a lift, a washing machine was placed on a Wood stacking at height of approx. 6 from the ground. The material, washed and screened, continued to the concrete reinforced silos and, by means of a dosing cart, to the mixer. The so prepared concrete was also carried by Decauville to the elevators and distributors in the machining areas.

The plant described above produced 250 sheets of concrete daily.

The elevator system insisted on a 1150m long line network consisting of a ring around the building with four revolving platforms, so that external elevators could travel the entire perimeter; and two internal longitudinal lines are each lift.

In addition to the numerous and important companies that provided and worked the stones and the marbles, the Construction Worker Company provided the yard of a complete equipment

for the production of marble, and for this purpose were installed: no. 4 jigsaws for sawing blocks with helical wire; A chisel saw with 20 blades for the production of the slabs; Two sharpening machines and disk saws, two fixed sanding machines and polishing machines; A grinding wheel for scrapers; Three polishing and polishing machines.

In addition to the numerous cabins and dressing rooms, bureaux for bicycle storage were built, and were made up of special rooms for food shops, for the kitchen and canteen of workers.

SOME METRIC DATA GENERAL

Covered surface - 21,700 mq
Interior courtyards (n.8) - mq 8.400
Total Area - 30.100 mq
Cubatura - mc 617.500
Current height of facades - ml 28.50
Height of the front face - ml 33
Notary Notary Tower Height - ml 61
Perimeter of the Palace - ml 710
Exterior facades - 23,000 square meters
Facade courtyard of honor - sqm 5.300

NUMERICAL DATA ABOUT THE MAIN AND SECONDARY ENVIRONMENTS

Audience Classes - No. 60
Courses of Court of Assise - N. 1
Aula Magna - N. 1
Rooms in general - N. 950
Ambulatories - No. 8
Scale - No. 32
Elevators - N. 9

CURRENT METHODS OF CONSTRUCTION

Excavations - mc 150,000
Masonry foundation and underground - mc 45,000
Masonry, elevation structures - mc 70,000
Solai - 90,000 mq
Tables (trusses) - 30,000 square meters
Horizontal seams - ml 3,500
Intonaches and coatings - 250,000 square meters
Floors - 90,000 square meters
Ironing serrations - 22,000 square meters
Glasses - 25,000 square meters

1.2.3.2 - Structure data and conditions

The building's skeleton is constituted, except for special cases, of load-bearing masonry, of which part is made of bricks and concrete part, and in reinforced concrete floors and bricks. Moreover, the covering floors of the Pretura's classrooms and ambulatories are reinforced with soles and ribs in sight.

Foundations, excluding those in the archive tower, consist of a simple continuous reinforced concrete plate, which divides on the ground a rather high load of 2.3 / 2.5 Kg per cm³; Which was allowed by the excellent consistency and homogeneity of the soil.

There are some special structures in the building, and particularly the following:

A) Main entrance vestibule cover: It consists of two orders of structures: the inner, the lower, which has the function of wearing the veil, and the outer, upper, which carries the cover properly said. The first consists of a series of reinforced concrete portholes of 22.50 ml and with a distance of 7.50 meters. These portals have been calculated for overload, in addition to their own weight and weight of Kg 100 / m². They are 25 m high from the floor of the vestibule. The section of the struts has been calculated and shaped so that the secondary beams bearing the velvet can rest on the same.

The second structure, superior to the anisidured, consists of a series of 22.50 m light concrete bridged trusses with a distance of 2.50 m, suitable to support, in addition to its own weight and that of the covering material, consisting of panels Of armed glass, the overload due to snow and the wind thrust.

Both portals and trusses have been constructed with high strength cement, so as to minimize the sections of the various structures, so lighten the complex and make them aesthetically slim.

B) Archive Tower: The archive tower consists of seven floors, four of which are high above each 11.00 m. It was built entirely in reinforced concrete.

It had been foreseen at first, given the loaded pie, to make the foundations of the plasterboard on reinforced concrete poles; But then, having found the great compactness and homogeneity of the ground, came to the determination to build a general reinforced concrete hall, consisting of a solette with overlapping crossed nerves under the pillars. Given the stack of the plate and its subdivision, in the form of blacks, in square-shaped panels, the solette was calculated as so many plates engraved on the contour of the ribs and therefore armed with two cross series of irons.

Also all tower soles, calculated for a useful overload of 1000 Kg / m², are considered as compounds of many plates supported by beams crossing on the pillars, so that in addition to having better loads on the vertical structures, An excellent horizontal connection of the pillars was obtained, very useful given the efforts that the various structures have to support under the action of the horizontal thrust of the wind. In fact, the various tower members have been calculated considering its overall body as consisting of A series of highly-trained multiple-frame frames, as well as over-loads and weights, even with a horizontal thrust of the wind, 150 Kg per m².

To save space and iron, not only the real pillars, but also the shoulders of the large windows that were built in reinforced concrete, were used as resistant structures; The concrete was all done with cement to the resistance.

In order to allow the tower some relative movement that could occur, it was completely isolated from the rest of the building by means of a expansion joint on the two sides of the building itself.

C) Roof cover: The roof covering of the building, which in some areas has a distance between the support and support of over 12.00m, has been executed all with mixed slab in reinforced concrete and brickwork, using taverns of the type Bidelta-terrazzo. As is known, said table tops, in addition to having a capable air chamber, given their height, offer the possibility, by means of varying height, to extract the extruded floor plan of the sloping floor, with the saving of filling materials, for the drainage of rainwater. Among the advantages of this type of slab, it is also possible that it allows the circulation of external air into the empty spaces inside, with a healthy cooling effect.

In the interior of the building, in order to ensure greater acoustic insulation, the partitions, the training of the offices at the auditorium (rooms of deliberation, etc.), were constructed with "Cellulite" material, applied to tablets Cooked.

In the basement, outside and inside the building (courtyards), large spaces have been constructed to ensure better illumination and ventilation of the rooms and the perfect isolation of the structures. The outer perimeter cavity is twofold: the first, in contact with the building, is for the uses of the Palace; The second, running parallel to the first, is for public utilities and has direct inputs from the road.

1.2.3.3 - Materials

Outdoor outfits are completely covered in Strona Valley marble and have a dark skirt in Scrizzo della Val Masino, materials all supplied by Vallestrona. The facade windows are bronze, those of the other painted iron facades.

The central courtyard and courtyard no. 2, located on the longitudinal axis of the building, are coated in Botticino and have a polychrome base. All the other courtyards are intencati and have a plinth in polychrome and Botticino contours at the windows. All the windows and windows in the courtyards are painted iron. The supplies of marble Botticino and Mazzano were carried out by F.lli Lombardi.

The office doors are in oak and those in the classrooms with polished walnut and wooden part covered with glossy bronze slabs. The office and corridor floors are in mosaic with metal bins and panels. The floors of the large longitudinal tunnels, the gates, the stairs, and so on the secondary stairs are in marble or granite. The Ambulatory floors are all marble, the auditorium halls are in linoleum with cellulite and cork background.

The classrooms have a marble basin of about 3.00 m above sea level, the walls above the plinth are in plank-cut plaster, the ceilings are all reinforced concrete and martellined in the Criminal Hearing Classrooms, while those of Civil Hearing are plastered.

Particular care has been taken in the study of wall finishes in general and especially where the audience is admitted or stopped. When the function of the premises was carried out, marble coatings were applied, but the entire building complex (tunnels, stairs, passageways, corridors, etc.) were made of specially worked granite or hammered or pinned plaster.

All common offices have a wooden skirting and painted wall tiles. The gutters of the windows are completely covered with varnished wood and are designed with special arrangements to receive the thermosifone elements and the rolling shutter maneuvering devices.

The Linoleum floors have been applied in the most important premises, such as the Offices of the Section Presidents, the President of the Court, the Procurator of the King, the Hall of Attorneys, the Libraries; The wooden ones in the group of offices of the First President of the Court and of the Attorney General of the King. In these groups of offices, which are of the utmost importance, special coatings on the walls, decorative paintings and special decorations have been made.

The floor is in Diorite with large strips in Vallestrona; The staircase in Diorite; The lining of the pillars and outlines of the red granite openings Pantheon; The frames of the bronzed bridges; The coated reinforced concrete cover with special procedures similar; The secondary texture of the bronze cover; Glass in White Termolux; Bronze chandeliers and shaped glass.

1.2.3.4 - Technical equipments

1.2.3.4.1 - Doors and windows

THE OUTSIDE FACES - COMPOSITE FACTORY: CURTISA OF BOLOGNA AND MALUGANS AND BOMBLES OF MILAN

The external exterior facades are divided into three groups, namely: 1) those of the main facade, coated in similar metal; 2) those with normal doors for the offices of the three facades and interiors (courtyards); 3) the windows are shuttled to shutter doors for the galleries heads. The Archives Tower and the Cabinets.

The main façade fixtures are made up of U-shaped flat sections and quadrats held by electric arc welding. The opening of the opening doors is made of bronze hinges of the type of steel-retained rings, applied to metal screws. The central closure is carried out with a lever arm with a vertical linkage hinged arm in the chamber of the central meeting flaps. The exterior facade of the fixtures is covered with similar plates and has, as a decorative motif, a bulging profile protruding all around the glass lights. Another twisted filament is applied internally, but removable, with a flocculent function. At the lower exterior wing, a shaped contour in the like has the function of a drip tray. The windows of the noble floor have the lower opening door-to-door for access to the terraces; The upper doors open to horizontal overrun for the ventilation of the compartments on the second floor. The opening is carried out with direct control by means of massive handlebars in the same way.

The doors to normal doors, the offices of the other three facades and the interiors (courtyards), have two normal openable doors and one over-the-top with a lowered armchair with a lowered armrest. They were made with special profiles for the base section window of mm 40 series SV / G of national production Ilva, which has been soldered after milling, held by electric welding at the arc voltage. The joint of the doors is made on hinges of massive alpaca of the type with rings clamped by steel plugs, the central locking with vertical clasps forged between the meeting doors. The overrun with horizontal internal tilting doors is operated by a horizontal-type remote-controlled maneuvering device with scissor-jointed arms, with special connecting rods on the self-locking and tilt-foldable, retractable, anti-clockwise, 45-degree. Each wing is fitted with the upper arms that are held for maximum opening, and at the bottom the double-jointed hooks for fixing the doors.

FIXTURES FOR CLASSROOMS - BUILDING COMPANY: CURTISA, BOLOGNA

The classroom fixtures, both on the exterior courtyards and on the inner corridors, are made of iron, constructed with the opening of the hinged shafts on a horizontal central axis, all open at 90 or with a special mechanism returned to reach the crank handle.

The construction - is made using special profiles for double-sided double-sided window, of the section of mm 50 in combination with normal profiles for the counter-frame, and for the intermediate stiffening columns. All of Ilva's national production in special series SV / M, U / NP, etc.

The hinged hinges are twisted on steel pins working in special bronze-coated bushes, and the double hinging of the hinges is guaranteed by the special consecutive inversion of the profiles, both inside and outside at the bottom of each bush rotation axis.

Each fixture is divided into three vertical elements of anchors, of which the central one is larger than the lateral sides, all vertically connected with appropriate rods for the synchronous opening and closing action. The maneuver consists of a horizontal transmission concealed in the base of each infinity which, with special conical assemblies, operates the vertical helical screws hidden in the intermediate columns and lateral uprights, from which, by means of special bronze envelopes, the thrust arms 'Opening and closing of corresponding matching array groups.

The said transmission is then maneuvered with a hammer consisting of an inverted conical assembly and a crank handle mechanism concealed in the masonry of the underframe and can be inspected by disassembling the marble slab of the inner lining.

The composition of the frames is realized by engagement of the welded sections electrically, after milling, with the removable parts for the correct connection and the inspection of the mechanical parts, which are exactly worked, turned and milled and bear all the parts Rotating wheels mounted on ball bearings.

The sealing of the glass is made with the application of U-shaped fixing screw applicator applied to metal screws.

In conjunction with the exterior joists, there is another concealed mechanism for operating the interior curtains. Each mechanism consists of a Mannesmann tube winding shaft rotating on ball bearings, with compensating side assembly made of blue steel springs, with a toothed pinion applied thereto which returns the handle to the bottom by means of chain drive, concealed in the shoulder From the marble slab tiles. A hoist, similar to the one above, makes the crank handle.

GATES IN CLOSING OF THE INGREDIENT PORT FORKS - Manufacturers: A Bombelli and Biraghi Arturo of Milan.

The gates of m 5.70 and m 3.60 are free climbs between the pillars with brackets in the iron underlying in lateral guides placed in the underground: they are balanced balances by counterweights, electromechanical maneuvers. They are made of tubular iron profiles made

of sheet metal of 4.00 mm thick. The frames are of rectangular section; the trapezoidal section posts. The top crossbar of the gate is brass-coated and shaped, with lowered gate, overflow of the gate passage at the threshold.

The staff is made of normal beaded truss beams with side spurs bearing the turned rollers mounted on steel pins with sliding balls.

The balancing mechanism of each gate is composed of a shaft mounted on constant lubrication supports, toothed wheels, gang chains and counterweights. The galley chains attach to one end of the beam carrying counterweights: at the opposite end of the bracket.

The uphill and downhill movement is imprinted on the gate by an electromechanical maneuvering mechanism composed of a gearmotor assembly mounted on a cast iron base plate made up of a power engine of Cav. 2 connected to the reducer by elastic joint with electromagnetic brake.

The reducer consists of a cliché wheel made of bronze phosphor bronze and worm screw made of turned steel, all enclosed in an unsuitable oil seal housing.

The gearbox's slow gear shaft is fitted with adjustable end-of-stroke mechanical device and galvanized sprocket sprocket gear knob mounted on the shaft of the balancing mechanism.

The electric control is achieved by means of a three-button push-button for downhill and stop by means of a contactor.

In the event of a power failure, the hand control is provided by the crank handle to be immersed in the engine shaft.

NORMAL DOORS IN THE PALACE OFFICES - Manufacturers; Egidio Proserpio, Villa Brothers, Tornaghi Brothers, Sala Brothers, Ostini and Crespi and Quarti.

They stand out in two categories: the office and office bays, and the office entrance doors. The former have net light of 1.30x2.60 m; The flaps are smooth, perimetrically framed and with a panel made up of two plywood slabs, joined by two parts, to a cellular internal structure. The entrance doors to the offices (shown in the figure below) are the same as the ones up to the height of 2.60 m; Then they continue with a glass overlapping that reaches the soffit of the covering floor; The overlap is divided into horizontal sectors, fixed part and fan opening part.

All these doors are in Slavonian oak, polished to wick. The building counts as a whole no. 1850 of these doors 8100 per m².

1.2.3.4.2 - Lighting equipments

The decorative luminaires of particular decorative character have been studied with great love and expertise by Pietro Chiesa on behalf of the Ditta Fontana di Milano.

For ordinary offices, standard opal glass balloons (diameter 30 or 35 cm, 150 or 200 W lamp depending on room size) were adopted with a 17 mm stem and deep bronze brass rosette.

Archives have been used with glazed iron reflectors distributed according to the requirements of the shelving arrangement. For classrooms, Hall of Assisi, Aula Magna and all public transit halls (corridors, ambulances, stairs, androns, etc.) specially designed and manufactured aesthetically and technically suitable aids for the particular location illustrated in the descriptions of the different environments with the indication of the materials adopted.

In all types of chandeliers, the crystal has been widely used, both glossy and satin, and opal, both for diffusion of light and for decorative effects. Indirect lighting has never been adopted, since the criterion of giving the lighting fixtures a fairly high gloss has prevailed, even without the glare of the glare.

For three types of chandeliers, installed in considerable quantities, here are some descriptive descriptions, as they represent happy solutions even from a technical and constructive point of view.

The hearing room fixture, shown on this page at the top left, consists essentially of a sandblasted and satin-finish curved crystal curved surface: wall mounted, generating a generous and uniform lighting of the premises without disturbing minimal The glare of seeing the posts of judges.

The main and secondary corridor, shown on the left, top (constructed in three different dimensions and fitted with or without suspension stems depending on the width and height of the corridor), consists of a simple rectangular frame and From two satin curved and sandblasted crystals. The luminous efficiency is high, the maintenance is very easy, as the crystals flow freely on the support curves.

The gallery apparatus illustrated on p. 26 is a great suspension lantern in which the two shiny crystal plates, besides having an undeniable decorative value, also help to protect the internal speaker devices from dust. The lighting effect is great and the chandelier is a far from secondary element in the great perspective of the galleries.

1.2.3.4.3 - Water and health services

WATER NETWORK

For the water supply of the building, a large ring of mm 75.00 was made in seamless Mannesmann galvanized iron pipe that surrounds all service groups. In turn, this ring was dissected by means of intercepting members in 4 parts forming another 4 secondary rings each of which is fed by its own grip on the aqueduct citizen and more precisely by two taken on Via Freguglia and two taken on Via Manara. The rings are therefore independent, but there is the possibility of reciprocating feeding.

A shut-off valve group was installed at each town socket to prevent reverse counter rotation due to different water pressures to the sockets, when the supply of a ring takes place through the gripping of another ring .

All the main pipes were placed in special tunnels below the floor of the underground, and close to the separation rails, a large cockpit with floor wire closure was created.

From the rings there are 75 upright columns each, each with its own interlocking gateway, in order to stop the column without compromising the smooth operation of the remaining ones.

The flow rate of all conductors was calculated for the simultaneous delivery of 55% of the health appliances.

SEWAGE

The entire drainage net was made with cast iron cast iron tubing. In each trunk of the internal network and with special regard to the curves or the connections between two different networks, inspection pieces and plugs have been installed with a plug so that they can easily control any point of the pipes.

Each column has its own base for a sealing siphon to prevent sewage from freezing through the drainage columns installed inside the building.

At the base of each column, a special air intake valve was installed to activate continuous air circulation in the column from bottom to top to prevent the fermentation of organic matter in an air-free environment.

All the lead piping for the basin drainage of wash basins and urinals prior to being installed was suitably covered with cardboard paper to overcome the lead crystallization disadvantages of corrosive cement work.

The siphon of latrines and urinals have been connected to a secondary ventilation network in order to eliminate any compression and depression phenomena in the discharge column.

The main secondary ventilation column is in an iron pipe that is installed parallel to the drainage pipe, the connection of the iron pipe clamps to the iron column is in a lead tube.

No secondary ventilation connections have been made to the washbasins, as they are equipped with special siphons with an antifouling device.

FIRE PREVENTION

The fire prevention network consists of 4 independent rings with reciprocating feed connections. The rings are made of wrought iron and cathetered 125.00 mm.

The power take-offs on the city's aqueduct are located two in Via Freguglia and two in Via Manara. Each ring is equipped with two special attachments for the coupling of the autopompe.

There are 34 Upright columns of 60.00 mm in seamless "Mannesmann" galvanized iron pipe. The number and location of fire prevention hydrants has been fixed by the Firefighters' Corps and consists of 153 prevention boxes.

For the Notary Archive Tower, a special autoclave plant was installed at the pressure of 8 atm. With independent connections on the city network. It uses a single column to mount all the fire prevention hydrants that are part of the Tower.

DEVICES

The latrines and urinals are in porcelain stoneware complete with chromed brass fittings built on models of the Work Direction.

The sinks are in fire-cast (special porcelain cast iron) and are applied on invisible shelves. Each sanitary facility was equipped with 1 floor wash hydrant and a closed floor wash water with internal wash.

The latrines, the urinals and the closures are provided with a lead sheet substrate to ensure the floor impermeability.

Altogether were installed: N. 172 turret latrine; N. 34 closet; No. 181 urinals; N. 190 wash basins; No 6 bathtubs; No. 8 wash basins; No. 97 floor closers; No. 8 channel washbasins; 2 shower trays; No. 90 floor wash watering.

1.2.3.4.4 - Heating and air-conditioning system

Manufacturers: DITTA ING. GINI AND AEROMECCANICA MARELLI COMPANY

It was executed under the high command of the communal technical office and in particular waited for ing. Carnimo and the last of the ing. Amorosi of the Technical Office.

The many uses to which the various premises are designed and their different needs have made it necessary to have a careful study of the choice of the most convenient heating system.

It was decided to adopt the central distribution system of hot water heat to a maximum temperature of 85 degrees. For the production of heat, oil was chosen for combustion, such as the one that required the slightest attention and allowed the quickest set of guns. Cornish-type boilers of smoke pipes were adopted with a total potential of 8,000,000 calories per hour; And subdivided into 5 units (with two outbursts) of the heating surface 175 cad sqm.

Rotary diesel fuel burners had been planned, but when it subsequently imposed the need to burn national fuels, and as Cornwall boilers already installed, it was decided to build two separate boilers with a large combustion chamber of shielded and circulating type forced; While Cornwall boilers already installed were used as economizers for new boilers.

Of these new boilers at large screened combustion chamber, only one fitted with mechanical grille was built temporarily, while the space for installing the second was planned: a part of Cornwall's boilers had been temporarily transformed for national coal combustion Extremely satisfactory in all respects. Suitable devices allow you to march in all cases with high boiling water temperature, thus causing the condensation of sulfur gases; Of which domestic coal combustion products are rich and which would cause rapid boiler corrosion. All boilers are equipped with their respective combustion control devices. The water coming out of the boiler at a constant temperature (75 "- 80") comes to three starting collectors, of which the first through 6 branches supplies the premises heated to radiators or thermo-convectors (Offices, Civic Halls) for a potential of about 5,000 .000 calories. The second one serves for the heating of the ambulances, the stairs and the Magna Hall, for a potential of 1,500,000 calories.

The Magna Hall, most of the outpatient clinics and classrooms are heated by means of aérothermal groups with the possibility of recirculation of air; The groups are equipped with air filtration apparatus; They, though extending, decentralized, may be commanded by the central.

Finally, a third collector is used for Criminal Courts and the Archives, but they are warmed to hot air for a potential of about 1,600,000 calories. Each collector has its own group of circulation pumps, each consisting of two units (one of which is a spare), all the groups can operate

independently or in parallel.

The pumps are installed on the return, and each branch is equipped with mixing valve groups with the return water: so the temperature can be varied independently.

This device has proved to be very useful because it allows to adjust the water temperature and thus the consumption of the various branches to the actual needs by reducing consumption.

Two heat counters were installed, one for the first group, and one common for the other two groups; There was also a possibility to install a counter for each branch.

These conditions of control use and at the same time of elasticity and adjustment of the plants have been achieved, which are indispensable and important element for the economy of operation.

The return temperature between the water and the return flow in the plants is expected to be 15-20 degrees at full load, ie with a starting temperature of 85 degrees. The operation has been provided in its continuous assembly and with a slowed down during the colder periods; And intermittent during the other periods, having a general increase in calories compared to the continuous operation of 20%; While for rooms that have a very intermittent operation and which are heated to air, partial increases of 50% to 100% have also been applied to the regular calories.

The direct heating of the rooms is done by means of cast iron radiators and thermoconductors, generally under the window sills. Only in the detained premises, the radiation system was adopted from the floor. For the outpatient clinics, staircases and crèches, indirect air heating was used, as already mentioned.

The chosen system responded satisfactorily to the needs of the service during the first year of operation; Both as regards the ease and convenience of accountability and the economy of consumption.

The thermal power plant and lots 1 and 2 for a total of 6.600.000 calories were executed on the design of the company Ing. Aldo Gini, to whom execution was also entrusted, while Lot 3 for a total of 1,500,000 calories was afluited to Soc. Aeromeccanica Marelli, according to the project studied by the Company itself.

1.2.3.4.5 - Electrical system

LIGHTING SYSTEM

The system includes 2850 single and multiple luminaires with a total of 9550 light bulbs of all power between 10 and 300 watts and a total of 625 KW.

The criteria that led to its implementation, studied in collaboration between the Electrical Services Section of the Municipality. The branch office, and the Work Department, can be summarized as follows:

- 1) Subdivision of the plant into so many electrically separated networks as many are the bodies occupying the building, in order to individually control the energy consumption;
- 2) Centralization of the control of all main circuit breakers of power lines, for reasons of economy and safety of operation, as well as anti-theft protection;
- 3) Partial centralization of the protection bodies of the secondary distribution lines in suitably arranged planes, which largely benefits the well-known advantages of this system while avoiding excessive multiplication of lines and equipment;
- 4) Careful selection of the nature and layout of equipment that must necessarily be in sight (planks, drawer boxes, etc.) in order not to disturb the aesthetics of the premises with such organs;
- 5) Division into two separate independent lighting fixtures installed in each of the chandeliers of corridors, ambulances, stairs, etc.: only one ignition is sufficient for normal service, while the second one remains in reserve, either to replace the first one in case of Failure (the circuits being electrically separate), to add to it when you want more intense lighting;
- 6) Centralization of the floor planes for the control of the chandeliers installed in the public walk-in areas, so that maneuver is easy for authorized personnel, impossible for the public;
- 7) Grouping of these chandeliers at the effects of the command, according to the criterion of the ignition period, as well as the topographical position (almost every hallway has daylight and daylight chandeliers for the trunks with low light illumination, And others for use only in the evening);
- 8) Accurate study for every type of chandelier, technical and aesthetic characteristics, both on lit lamps and on out-of-lamp lamps, in order to harmonize the device with the environment to which it is intended.

The installation work was performed directly "in economy" by the Municipal Technical Office, Lighting Section, directed by Ing. Luigi Accatino, with his own workmanship and material picked up by the municipal warehouses or purchased directly from the manufacturers, following a competition or competition contest.

This form of execution has been chosen, and not by means of a private company, because it was not possible, before the start of the work, to complete a definitive executive project that served as a basis for a contract specification. In fact, some important problems had to be solved

during the course of the works themselves, and it was also expected that the installation of the plant would proceed at a very variable pace to coincide with the wall works, thus failing to meet the conditions for a satisfactory and economical execution in By a private company.

ELECTRIC SYSTEM

Energy is supplied to the lighting system, as well as to the driving force, at a voltage of 280 V between the phases, 160 V between phases and neutral, from three transformer cabs powered by the 9 kV city network of the company Municipal Power Station. To each of them, an energy distribution booth is alongside, containing the general measurements and maneuverings for the various electrical services of the Palace.

The energy distribution system for lighting is made up of 18 electrically separated networks, 12 of which serve the Offices, Classrooms and Archives of the various occupying entities, while the remaining 6 serve the public transit rooms and services in general (3 for normal lighting and 3 for night lighting).

The electric diagram is qualitatively the same for all these networks. It is of the radial type, with 4 node systems, consisting of the following equipment, respectively;

- A) General overview with energy meter, main circuit breaker and fuse valves for the leads:
- B) Floor planks, all of which are derived from the mast with no main switch or valves, equipped with maximum current circuit breakers (one for each outgoing line);
- C) Main outlet cassettes, with fuse valves;
- D) Secondary branch boxes with flying clamps.

The upright lines for feeding the squares are all three-phase and balanced at full load; All the downstream lines of these are instead unipolar.

The "return" conductors of the luminaires and socket outlets are derived, without a valve intermediate, from a ground circuit, which is unique to the whole plant, consisting of conductors of considerable cross-sectional interconnected according to a mixed, cage and radial. The 12 uprights of this circuit are frankly grounded and clamped to the low voltage neutral of the transformation cabins. With the arrangement adopted, the "return" circuit cabs are also minimal in the case of sensitive local load imbalances.

For the lighting circuits of the Offices, an intermediate solution has been adopted between the centralized and the local protection: the automatic circuit breaker (with a capacity of 10 and 15 A) power lines of 5 or 8 mm². Each of which is derived from three circuits (for three lighting units and six taken each) protected with local fuse valves placed in the output cassettes.

MATERIALS AND EQUIPMENT

The conductors used (all in tin-plated copper, insulated in rubber for 600 V operation) are part of bare bottom cable (main lines in the underground), rope part (upright lines), wire part (lines in the corridors and Circuits in the premises).

The maximum conductor section is 75 mm², the minimum of 0.75 mm².

The pipes that protect them, all enclosed, are in the same order: practicable passageways or cement pipes, masonry bricks, wall-hung "Bergmann" type pipes and enamelled steel pipes (under the floor).

The general layout of the distribution cabins (one for each independent grid) consists of marine panels enclosed in each one in their own powder-coated metal sheet case: the control units are hand-operated switch disconnectors and normal-type air switches With flow rates from 15 to 30 A; The protective devices are cartridge or lamella fuse valves, depending on the flow rate.

The central control panel (unique for the lighting and power plant) consists of two large marble panels, which carry buttons and light gems for controlling and remote control of general cabinets.

On top of it the tone devices are grouped so that the maneuver is simple and secure: in particular, just turn 6 switches to disconnect the voltage at all the buildings of the building, while various combinations are possible to leave only some privileged services available, removing the rest.

Floor planks, all externally all the same for uniformity reasons, although the automatic circuit breakers vary from a minimum of 3 to a maximum of 20, are made of marble panels mounted within wooden boxes embedded in the wall of the corridors. The switches are one-pole, magnetically and thermally snap-locked with fixed calibration. They have porcelain base and bakelite protection and are suitable for a particularly compact mounting, so the wall niches containing the squares have a very small size of 50 cm (width) per 30 cm (height) per 20 cm (depth). All internal connections are easy to inspect by removing the metal protection mask.

The shutter door, polished wood, is used for the signaling plant.

The main outlet cassettes, which contain terminals and valves for the supply of corridor and office circuits, are very large and deep (height cm 20, width 40 cm, depth 12 cm) and also hold a compartment for the terminal blocks of the 'Signaling plant. They are made of impregnated wood and equipped with polished aluminum sheet cover. The clamps are of the mantle type, insulated in porcelain; The valves are porcelain, one-pole, with cartridge fuses.

All the cassettes are wall-mounted and accessible by the corridors, so the fuse change, even requiring the use of a ladder, forces you to disturb the work in the offices.

The secondary and secondary sorting boxes are made up of the boxes of bakelite of the enclosed switches. These boxes were specially constructed with a depth greater than normal so that behind the body of the switch (fitted with normal expansion fastening), it could find a pair of flywheel terminals. (Coat type, porcelain insulated) as well as the "wealth" of the wires.

With this solution, the two-pronged advantage has been achieved to place the pouring member in a comfortably accessible position and to avoid the unhealthy effect of the common boxes with badly concealed lids at the top of the wall.

The switches are of the push-type type, with an inside of bakelite and crystal disk, expansion mount.

The power sockets, including a bakelite interior and a crystal disk, are equipped with a 2A cartridge fuse valve, which can be removed from the front with easy operation.

MOTOR FORCE DISTRIBUTION SYSTEM

The plants that use power are; The Thermal Power Station, the Telephone Center, the lifts, the servomotors for the operation of the main gates. The total installed engines for these services are 59 with a total power of approximately 360 KW.

Since each of the aforementioned installations has electrical cabinets for the maneuver, control and protection of its machinery, and since the building has not been equipped with a general power take-off network, the task of the distribution system consists exclusively of To feed, with appropriately dimensioned and protected lines, each of the above-mentioned frames.

GENERAL SYSTEM DIAGRAM

Given the importance of the services concerned, it is appropriate to equip each of the control panels of an independent power supply line with its own valves and a teleruttore, so that, in the event of a failure, interruption would not extend to several services. Of course, all these remote sensors are remote controlled from the central control panel.

In the general maneuver and measurement drawings (5 in all) the lines are grouped in order to keep separate control of the consumption of the various services (heating, telephones, elevators and gates).

1.2.4 - Courthouse of Milan as an art gallery

1.2.4.1 - Information

The Milan court building is one of the undisputed landmarks of the city for its majesty, location and the manifold ties that tightly link it with our recent history. However, though a place known by every Milanese citizen, even those who do not deal directly with its functions, the same cannot be said for what it conceals and jealously guards inside.

Frescoes, sculptures, mosaics, reliefs, all inspired by the same theme of Justice, which never unfolds at random but follows a specific idea, to combine and bring together, in a natural way, two basic aspects of our history and culture: the artistic and the legal traditions. Anyone who happens to have walked along the corridors, porches and stairways of the building will not not have missed the balance and harmony between its functional aspect, the architectural solutions and the works of art which complete and enhance the project.

One of the aims of this thesis is to give awareness of this heritage to the people, while highlighting the artistic choices that inspired the architect Marcello Piacentini, who wished to give coherence and consistency to the whole project, personally hand-picking more than 140 works by 52 artists of his time with which to adorn the building. Little known works, sometimes neglected, some of great value, by the creative genius of artists like Sironi, Carrà, Manzù and many others who have now regained their visibility and invite you to explore once again the court building with renewed curiosity and awareness.

The historical events leading to the construction of the court building are explained so far. The building works in fact began in 1932 under the guidance of the architect Marcello Piacentini, and his worthy collaborator, the architect Ernesto Rapisardi, and only ended in 1940. On the contrary, the artistic and cultural features of this important building are less known.

First of all, its extension: a four-sided cube-shaped building, as large as the Piazza del Duomo, divided into three longitudinal sections, which run along its vestibules, galleries, courtyards, stairways and open out on at least 1,300 rooms and about 50 courtrooms. It must also be considered its architecture: grandiose, monumental and solemn, inspired by the ideals of proportion, harmony and rationality, though not without its celebratory rhetoric and theatrical aspects, but superbly enriched with marbles, fine wood furnishings and bronze plates. Last but not least, the art collection features 140 works by 52 contemporary artists (including Mario Sironi, Carlo Pini, Leone Lodi, Salvatore Fiume, Giacomo Manzù, Arturo Martini Arturo Dazzi, Gino Severini, Carlo Carrà), personally selected by Piacentini.

Most of the artists invited by Piacentini to this collaboration have realized that the function of art is also to accompany imaginative imagery with truths of thought and exemplifications of morality. In order to be "in the function" of an artwork, art does not give in to those who are its

technical means and its aesthetic problems. The connection of paintings, mosaics, sculptures to an architectural design as well as wanted and determined in this building Marcello Piacentini, assumes the character and consistency of a decorative and moral "necessity".

The creations of these artists naturally live in the atmosphere of the palace, not as a superfluous complement; But as a glorious and leafy vegetation related to the earth that has created the dominant and exquisite wharves of stones and marbles.

The work was supposed to crown Piacentini's personal quest: being the author of the "greatest building among those built by the regime, also thanks to the works of art of the best living Italian artists, all personally picked by Piacentini, in order to turn the Court Building into a museum of contemporary art".

The much abstract, hermetic, that derives from the conception of the mole is tempered and interrupted by the works of painting and sculpture embedded in architecture. Many are the works they find in the interior of the building; and, if some, purely decorative, appear as pleonasm of a square and sober discourse, others are part of it, conclude the periods and reinforce arguments. Among these are the Statue of Justice of Selva at the center of the symphonic courtyard, the three great reliefs of Dazzi, Romanelli, Martini. Of course, it is much easier to match the sculpture or mosaic of painting to architecture. And we must immediately mention the great Siroli Mosaic page and the decorative sculptural complex of Maraini. But infinite other sculptors and painters have found the field for their works as in the ancient complexity of the cathedrals and in the best Renaissance palaces. Different temperaments, contrasting personalities, different manners and schools, harmonize in the same marble symphony, naturally organize themselves in the fusion and distribution of the members of the building. Not all artists were equally aware of their task; For a misunderstood sense of "artistic independence" some dared to conform to the purpose of the building, to adhere to the austere simplicity that Piacentini had always been aware of. In the face of such a terrible and superhuman profession, such as the administration of justice, some painters have been confined to "making color", forgetting how painting speaks from the walls of the Palazzo Comunale di Siena and from the times of the Sistine.

The Court building halls, courtyards, rooms are decorated with frescoes, paintings, mosaics, sculptures, bas-reliefs and are all inspired by the common theme of Justice.

Certainly, after more than 70 years, the incompleteness of the main concept of the building can be perceived. The concept in fact was openly announced in the austere and solemn opening ceremony on 23 July 1940 and aimed to gather in the new building the various court offices, which were then scattered around the city.

The Milan Court Building was designed with this ambitious goal. It was in fact presented as

“grand and rational at the same time, worthy to represent both Justice and Milan”; moreover, its position in the centre of the city aims to underline the pivotal role of justice in the civil and social development. However, the similarities between Justice and the distinctive architectural elements of the building do not end here, because Justice must be rational, just like the rational project conceived by Piacentini in the '30s; it must also be efficient, practical and authoritative, just like the Court Building, from its main side facing Corso di Porta Vittoria, appeared in the eyes of lawyers and judges who first walked along its corridors and offices on its opening day in 1940. The rich decoration of the walls of the halls with the works by the most prominent artists of the time gives the whole Building an aura of the sacredness of Justice. Each art work is inspired by the concept of Justice, perhaps as a warning to everyone and to recall the highest meaning of every single action taking place within the walls of the Court Building itself.

The distance between the legal world and art is only apparent, because, through art the human soul expresses its aspiration to reach the perfection of which justice is an essential part: art therefore becomes the noble expression of the ideals of the person and of Justice, as a natural need felt by the human being. It is namely the very certainty of this unsuppressible need which fuels our commitment, that we who work in the legal world and deal with Justice have been called to fulfill despite the difficult conditions that Justice faces in Italy.

According to the study carried out by the lawyer Carlo Accetti -who in 1943 wrote a brief article on the building in which he used to work- the leading theme of the art works should have been more varied because there are different representations of the same themes that, in the end, becomes monotonous; he especially points out in that, the theme of a punishing kind of Justice is represented too many times. However, according to him: “Justice means also compassion, release and relief of the soul and the body”. The works embellish halls, main courtyards and the majority of the courtrooms.

The Palace of Justice is enriched with works of art so as to become a Museum of Modern Art; And it is a proof of the existence of a wealthy, highly regarded contemporary Italian and fascist art, grown up with new times and ready to collage with moral and political guidelines related to tradition and seeding of the future.

This Palace of Justice, for its grandeur, for its mass, for its harmonious constructional solution, is like an island planted in the heart of Milan and, if nothing else comes back to what is called the Lombard architecture, Generally aspiring to colorful paintings, a chiaroscuro dynamism, full of effects and strokes, it is linked to the oldest examples and schemes of Roman basilicas, which, in the bones of the City of Sant' Ambrogio and of Constantine, carry the Imperious and solemn affirmation of classicism. The predominance of hard marble like the Strona Valley, granite like the Baveno and the Pantheon, come from the same chains of mountains that appear in all their majesty to those who look at the Arches Tower to the north, link the Palace to Milan where, For centuries it will say its word of austere beauty and proclaim the faith in justice.

INTRODUCTION



Figure 1.2.17 - The Palace of Justice in Milan reveals its treasures of the twentieth century.

Below is a list of the original works with the addition of a few contemporary art pieces (marked by the contour) that between the late 1980s and early 1990s won a competition to decorate those courtrooms that had remained empty due to destruction or removal.

1.2.4.2 - Artworks on the ground floor



Legal battle by STEFANO FESTA (1958)

Fresco (1991)

Location: COURTROOM 4 - Ground Floor

On the left side of the work the three helmets, recurrent elements in many of Festa's works, representing the ego of the viewer. On the upper right we can see another symbol dear to him: a kind of sun symbolizing society having both a positive and a negative impact on the ego. In fact, inside the sun there are triangles of different colours, whose interpretation is left to the viewer. In this case, the viewer must also grasp the meaning the real subject of the fresco: the "Lottagiuridica", that is the "legal battle" depicted with white silhouettes below the sun.



Ex itinere. Triptych of travellers by GIOXE DE MICHELI (1947)

Oil on canvas (1992 – 93)

Location: COURTROOM 11 - Ground Floor

The triptych shows three different travellers: if the two on the sides are bearing gifts from their birthplace, the third one in the centre stops and rests on the steps of the courthouse, which is easily recognizable behind him. At his feet we can see exotic fruits, a book and a salamander, the only symbolic elements surely referring to Justice.



Triptych of Justice by EMILIO TADINI (Milano 1927 – ivi 2002)

Oil on canvas (1991)

Location: Ground Floor - Entrance from Via San Barnaba

The artist uses his typical skyscrapers to represent on both sides Veritas and Pietas which contribute to the success of Justice, standing at the centre and painted in lighter hues.

1.2.4.3 - Artworks on the first floor



Cesare Beccaria by GIUSEPPE GRANDI (Ganna 1843 – Milano 1894)

Marble (1870)

Located: FIRST FLOOR HALL

Monument to Cesare Beccaria created for the a square in Milan dedicated to him, now replaced by a fusion in bronze.



Justice by ATTILIO SELVA (Trieste 1888 – Roma 1970)

Porphyry statue, Valle Strona marble and gilded metal

Located: COURTYARD OF HONOR

The statue is in porphyry, head and arms in white Valle Strona marble the emblems are in gilded metal. The author gave the Greek goddess Themes the appearance and attitude of a matron, sitting stiffly: her right hand holding the sword and her left the scepter. The statue has an austere and stiff attitude.



Graeco-Roman wrestling by SILVANO TAIUTI (Firenze 1909 – Roma 1985)

Basin with mosaic floor

Located: SECOND CENTRAL COURTYARD

Men and beasts fighting. The style used for this mosaic features black figures on a light background recalling Greek and Roman pottery.



Symbol of Justice by BRUNO INNOCENTI (Firenze 1906 – ivi 1986)

Bas-relief in white marble (1938)

Location: Hall of the Court of Appeal and Assize, left side

The upper part of the panel is mutilated featuring only in the lower part a compass, symbol of the straight path followed by Justice.



Symbol of Justice by BRUNO INNOCENTI (Firenze 1906 – ivi 1986)

Bas-relief in white marble (1938)

Location: Hall of the Court of Appeal and Assize, left side

At the top the work features the sword of Justice bathed in the sunlight driving it, while in the lower part a snake envelops a branch and a torch.



Cain's condemnation by GIOVANNI PRINI (Genova 1877 – Roma 1958)

High-relief in white marble (1937-1939)

Location: COURT OF APPEAL AND ASSIZE - First Floor

In this work Cain has just killed his brother Abel. The Divine Justice comes from above brandishing a sword to punish Cain, already overwhelmed by guilt.



Justice armed with the Law by MARIO SIRONI (Tempio Pausania, Sassari

1885 – Milano 1961)

Mosaic (1936)

Location: COURTROOM - COURT OF APPEAL AND ASSIZE - First Floor

In the Thirties Sironi often dealt with the decoration of regime buildings, using ancient techniques, like this mosaic. In 1932 he jointly signed, with with Campigli, Carrà and Funi, the “Manifesto of Mural Painting”. In the centre of this work Justice is holding the sword and the tablets of the Law, flanked on the right by a male figure representing Force (originally clutching a fasces now worn out) and on the left by a female figure symbolizing Truth. Additional symbols of Justice are the balance of justice and the tree behind them, while the coat of arms and the eagle refer to the Roman world.



Justice and the Executive Power by ERCOLE DREI (Faenza 1886 – Roma

1973)

Bas-relief (1937 – 1939)

Location: COURTROOM 3 - COURT OF APPEAL AND ASSIZE - First floor

In this bas-relief Justice is veiled, holding a sword, her classic symbol. Together with her we see the personification of the Executive Power lightly touching her with one hand, while pointing to the Tablets of the Law with the other. Behind them we can see the effect of these two powers: some people peeking from behind bars.



Theseus and the Minotaur by CARLO PINI (Bologna 1902)

Bas-relief in white marble (1938 – 39)

Location: Hall of the Criminal division, left side

At the bottom Theseus is fighting the Minotaur.
At the top he is protected by the goddess Athena recognizable by the helmet, the spear and the snake.



Perseus and Medusa by CARLO PINI (Bologna 1902)

Bas-relief in white marble (1938 – 39)

Location: Hall of the Criminal division, left side

Below Perseus showing the head of Medusa he has just defeated.
In the upper part we can see an eagle with outstretched wings.



The archer by CARLO PINI (Bologna 1902)

Bas-relief in white marble (1938 – 39)

Location: Hall of the Criminal division, left side

In the lower part we can see an archer in the act of shooting an arrow but, as the upper part is lacking, it is hard to understand which character the scene refers to.



Justice with symbols by CARLO PINI (Bologna 1902)

Bas-relief in white marble (1938 – 39)

Location: Hall of the Criminal division, left side

In the lower part Justice is represented not only with sword but also with wings. In the upper part, the typical symbols of Justice are featured: the column, the tree and the ladder.



Sant'Ambrogio whipping blasphemous people by ENRICO SAROLDI (Carmagnola,

Torino 1878 – Milano 1954)

Pink marble bas-relief (1937 – 1939) - 490x480 cm

Location: COURTROOM 7 - COURT OF ASSIZE - First Floor

The work refers to an episode of the history of Milan: Bishop Ambrose (which can be identified thanks to his attire, miter and pastoral staff, as well as his classic symbol: the three-stringed scourge) while punishing the followers of Arius lying at his feet.



The Praetor Urbanus, between two lictors, in his official functions by TIMO

BORTOLOTTI (Darfo, Brescia 1884 – Milano 1954)

Bas-relief in marble (1939)

Location: COURTROOM 1 - COURT OF ASSIZE - First Floor

As a clear reference to Roman justice, the work features the urban praetor at its centre, flanked by lictors leaning on fasces. The fasces were the highest attributes of Roman magistrates and hint at their capacity to flog and behead. In this case they haven't got an ax because inside the city of Rome one had the right to appeal against death sentences.



The Fall of Lucifer by ALBERTO BAZZONI (Salsomaggiore, Parma 1889 – Milano 1973)

Pink marble bas-relief (1937 – 1939) - 490x480 cm

Location: COURTROOM criminal section IV-XI - COURT OF ASSIZE - First Floor

Biblical Justice is here expressed through the Archangel Michael. He is brandishing a sword and, with a strong diagonal movement, fights off Lucifer, who is represented in human shapes with the exception of a very hairy chest, his only animal legacy.



Brutus as the judge of the traitors of the Motherland by GALIZZI NINO (Bergamo 1891 – ivi 1975)

Bas-relief in marble pink

Location: COURTROOM 5 - COURT OF ASSIZE - First Floor

Brutus in the background takes the dagger to punish the traitors who, in the foreground, seek to protect themselves with a cloak.



Justice between a salamander and a dove by CARLO PINI (Bologna 1902)

Bas-relief in pink marble

Location: COURTROOM - COURT OF ASSIZE - First Floor

The personification of Justice with arms raised in the centre is surrounded by the dove to the left, the symbol of peace that can not exist without Justice itself, and the salamander to the right, the creature which, according to Medieval beliefs, does not die even if thrown in the fire. It symbolises justice that fears nothing and always survives.



The new Code of Criminal Procedure by VINCENZO EULISSE (Venezia 1936)

Fresco 1989

Location: COURTROOM D former 5TH of the criminal division - First Floor

The scene is divided into two parts: the upper features the present day negativity showing a city collapsing and a ship in a stormy sea. At the bottom, the positive values which are still surviving: on the left a man with the plow symbolizes work, while on the right another one is killing a wild beast (evil). In the foreground a man and a woman represent love and solidarity.



The Tree of Justice by CARLA TOLOMEO (Pinerolo, Torino 1946)

Oil and acrylic on canvas (1991)

Location: Courtroom E - First Floor

The Tree of Justice is depicted with its roots firmly fixed in the ground and its high branches that jut into the sky, as if to bind the terrestrial to the celestial world. At its feet, in fact, as to symbolize heavenly Justice, we see the Archangel Michael to the left and, to the right, Theseus as the symbol of earthly justice.



Justice and Peace between the United States of Europe by LAURA E

SALVATORE FIUME (Urbino 1953) (Comisio, Ragusa 1915 – Milano 1997)

Oil on canvas (1991)

Location: COURTROOM C - First Floor

In the foreground the terrestrial globe is surmounted by some flags, on which stands a female figure who personifies both Justice (the scale) and Peace (the olive branch).



The Lombard League by LEONE LODI (Soresina, Cremona 1900 – 1974)

Bas-relief in white marble (1938)

Location: Hall of the Criminal division, right side

Founded in 1167 in Pontida, the League was set up to bring the provinces of Lombardy together and fight against Barbarossa's siege.



The Visconti by LEONE LODI (Soresina, Cremona 1900 – 1974)

Bas-relief in white marble (1938)

Location: Hall of the Criminal division, right side

A knight with a sword points to the coat of arms of this Milanese aristocratic family.



The fascist laws by LEONE LODI (Soresina, Cremona 1900 – 1974)

Bas-relief in white marble (1938)

Location: Hall of the Criminal division, right side

Below we see three male figures holding some codes, in the upper part there is a reference to fascist laws: the single dish balance, the coin, the eagle and the hourglass on the crescent moon. Above a winged figure.



Saint Ambrose by LEONE LODI (Soresina, Cremona 1900 – 1974)

Bas-relief in white marble (1938)

Location: Hall of the Criminal division, right side

The saint is depicted with his attributes, the pastoral staff and the three-stringed scourge, flanked by two other saints in front of the basilica dedicated to him.



The foundation of the fasces by LEONE LODI (Soresina, Cremona 1900 – 1974)

Bas-relief in white marble (1938)

Location: Hall of the Criminal division, right side

In the lower part, three men are holding fasces, above, behind them, you can see the façade of a classical temple with the sun peeping over the columns.

Removed



St. Michael and the Dragon by ALFREDO BIAGINI (Roma 1886 – ivi 1952)

Relief in white marble (1937 – 1939)

Location: Hall of the Criminal division, right side

II CORTROOM - CRIMINAL COURT OF APPEAL - First Floor The Archangel Michael is traditionally represented with the sword (the same attribute of Justice) while slaying the dragon, symbol of evil.



The condemnation of Cain by VITALIANO MARCHINI (Melegnano, MI 1888 – Mergozzo, NO 1972)

Bas-relief in metal (1937 – 1939)

Location: COURTROOM H - CRIMINAL COURT OF APPEAL - First Floor

The topic of Cain killing his brother Abel is a recurrent theme: in this case it is God himself who goes to Eden, symbolically represented by the tree behind them, in order to punish this grave sin.

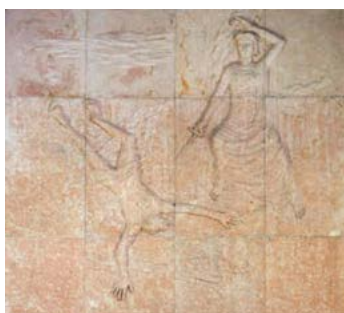


The dawn of the innocent by SALVATORE FIUME (Comisio, Ragusa 1915 – Milano 1997)

Oil on canvas (1989)

Location: Hall of the Criminal division, right side

In an ethereal atmosphere, where dawn is indicated by the the solar disk in the lower left, the innocent is getting ready to go up the stairs that will lead him to freedom. Behind him the little men of the law, judges and lawyers, while Destiny, holding a dove, and Justice pointing to the sky, are watching over him.



The earthly Justice and divine retribution by LUIGI BROGGINI (Cittiglio, Varese 1908 – Milano 1983)

Pink marble bas-relief (1937 – 1939) - 490x480 cm

Location: IV COURTROOM- CRIMINAL DIVISION- First Floor

With the same iconography of the expulsion of Lucifer from Archangel Michael, here is the personification of Justice which punishes a nude figure falling into the abyss.



The Archangel Michael by EROS PELLINI (Milano 1909 – ivi 1993)

Bas relief in red granite and metal (1937 – 1939) - 490x480 cm

Location: COURTROOM - CRIMINAL DIVISION - First Floor

St. Michael is depicted with his attributes: bracelets, spear and shield, which are made of metal. At his feet is the defeated dragon, symbolising evil.



Justice between the Legislative and the Executive Powers by LUCIO

FONTANA (Rosario de Santa Fè, Argentina 1899 – Comabbio, Varese 1968)

Pink veined marble bas-relief (1937 – 1939)

Location: ARCHIVE (EX-SCHEDA) - First Floor

The bas-relief is divided into three parts: in the central one represents Justice holding a balance in her left hand and pointing up, as if to emphasize the divine inspiration. On her the right we can see the personification of the Legislative Power, depicted holding the scroll of the Laws, while on the left the Executive Power, whose symbols are the axe and the staff.



Guilt kneeling to Justice in the act of submitting by ANTONIO MARAINI

(Roma 1886 – Firenze 1963)

High-relief in white marble (1938)

Location: LECTURE THEATRE - First Floor

Maraini, who began his career in an artistic atmosphere dominated by the Italian Art Nouveau movement lead by Bistolfi, in the 1920s his style became a representative of Art Deco. From 1928 to 1940 he was the Chairman of the Biennale in Venice. In this high-relief we see Justice depicted in the centre with the left arm resting on the tablet of the Laws and the right one raised to the sky. At her feet is the personification of Guilt on his knees, with his head covered, begging for forgiveness. On the sides we can recognise the divine Justice on the left, and the earthly Justice on the right.



The good which does (not) kill the evil by GIACOMO MANZÙ (Bergamo 1908 – Roma 1991)

Bas-relief in marble or other material in terracotta imitation

Location: Courtroom of the former minor section - First Floor

The Good with the dagger in his hand, according to the interpretations, kills or has mercy on the personification of evil.

1.2.4.4 - Artworks on the third floor



The Roman Justice by ROMANO ROMANELLI (Firenze 1882 – Milano 1968)

High-relief in white marble from Carrara (1936 – 1937) - 480x500 cm

Location: HALL - COURT OF APPEAL - Third Floor

Romano Romanelli, son of the sculptor Raffaello, was heir to an artistic tradition headed by his grandfather Pasquale, pupil of Bartolini. Besides sculpture, he started the military career, which brought him many honours. His art is characterized by a strong link with the Ancient world: Greek, Etruscan and the Renaissance adapted to the present time thanks to a detailed study of French sculpture of the late nineteenth century (Rodin and Bourdell). This high-relief features Trajan granting the grace to a woman: the heart of the story is in the gash that opens under the horse of Trajan, namely in the construction of the pyramid line connecting the horse head, where two lines are drawn into two directions: one running to the right along the female figure, and the other to the left, along the horse mane, up to its outstretched leg. The scene takes place outdoors with an architecture that recalls the Roman tradition in the background, featuring a large crowd holding fasces and Roman inscriptions; the faces often recall the many portraits the artist made during his career.



Fascist Justice ARTURO MARTINI (Treviso 1889 – Milano 1947)

High-relief in white Carrara marble (1936 – 1937) - 450x500 cm

Location: HALL OF THE COURT OF APPEAL - Third Floor

Arturo Martini, one of the greatest Italian sculptors between the two World Wars, manages to capture the typical characteristics of the sculptors of the late nineteenth century and perfectly succeeds in blending in elements of Etruscan sculpture and from the fifteenth century, in order to create figures with simple shapes but great emotional charge. Martini is an unparalleled storyteller, and in this work he was able to depict all the characters of Justice (fascist or corporate). At the centre of the relief we can see the personification of Justice sitting on the trunk of the Tree of Good and Evil, and holding her traditional attributes: the balance and the sword. Around her, several examples. In the upper left, a few heroes of the Greek mythology symbolising human audacity: Daedalus and Icarus, Perseus with the head of Medusa, and a fallen anonymous warrior brought back from victory. In the upper part, to the right, we can see representations of human passions: Beauty, Love, Vanity and Pegasus. Below, to the right, the representation of the prodigal son features a family bound together by work and affection. Finally, at the bottom left, two processions headed by a bishop and a lawyer stand as a representation of religious and civil justice.



Biblical Justice by ARTURO DAZZI (Carrara 1881 – Pisa 1966)

High-relief in white Carrara marble (1936 – 1937) - 490x500 cm

Location: HALL OF THE COURT OF APPEAL - Third Floor

Arturo Dazzi decided to represent Biblical Justice with the help of three episodes: in the left part the expulsion of the evil angels, on the right, divided by a palm tree, the expulsion of Adam and Eve from Paradise and, below, the judgment of King Solomon. At the foot of the king are two women who have given birth to two babies with a few days difference. Since one of the babies died immediately after birth, both women are claiming motherhood over the living child. In order to unveil the truth, Solomon orders to cut the baby in half and give one part to each woman. Following this decision, the real mother, in order to prevent the child from, waives its claims by determining the triumph of Justice. The episode thus became the emblem of judgments reached with wisdom, which comes directly from God.



Zaleuco judge of Locri by GIOVANNI COLACICCHI (Anagni, Frosinone 1900 – Firenze 1992)

Oil on masonite panels (1939) - 490x480 cm

Location: COURTROOM - ATTORNEY GENERAL'S SECTION - Third Floor

The scene narrates the history of Zaleuco, legislature of Locri, who is depicted in a sitting position. He is judging his son, who is standing covering his eyes, because accused of adultery. The punishment for this offense was blinding and although the citizens were willing to grant their pardon, Zaleuco, oblivious to the pleas of the adulteress at his feet, ordered that an eye be removed from his son, in accordance with the laws that he himself imposed. Zaleuco had one of his own eyes removed, in order to share the retribution.



Thou shall not kill by MASSIMO CAMPIGLI (Firenze 1895 – Saint Tropez, Francia 1971)

Fresco (1939) - 490x480 cm

Location: COURTROOM - ATTORNEY GENERAL'S SECTION - Third Floor

Campigli, the co-signer along with Carra and Funi of Sironi's "Manifesto of Mural Painting" in 1932, is the author of this fresco featuring a concentration of figures that seem to cry out for Justice for the serious crime of murder.

INTRODUCTION



Marco Aurelio by OTTAVIO STEFFENINI (Cuneo 1889 – Milano 1971)

Fresco - 490x480 cm

Location: COMPUTER ROOM - COURT OF APPEAL - Third Floor

The Roman emperor Marcus Aurelius stands in the centre of the fresco, in the same position of statue dedicated to him in the square of the Campidoglio in Rome. The only additions are the tablets of the Law. In the background, the Coliseum and an arch with the coffered fornix is a clear reference to the capital city. The inscription below: ordinem rectum fires iniecit (rule imposed order to the free will).



Christ calms the storm by GIOVANNI VAGNETTI (Firenze 1898 – 1956)

Encaustic (1939) - 490x480 cm

Location: V COURTROOM - CRIMINAL SECTION - Third Floor

This work depicts the Biblical story where Christ is in the boat with the apostles, terrified by the storm. To show them that they must believe in him, Christ calms the storm with one motion.



Justice by ANTONIO GIUSEPPE SANTAGATA (Genova 1888 – 1985)

Mosaic (1937 – 39)

Location: Hall of the Court of Appeal, left side

Justice is represented with the sword in her right hand and the olive tree twig in the left. At her feet the inscription "Lex" is printed in the open code.



Justinian by ANTONIO GIUSEPPE SANTAGATA (Genova 1888 – 1985)

Mosaic (1937 – 39)

Location: Hall of the Court of Appeal, left side

The Emperor Justinian is holding a scroll which says "Digestum" an allusion to the Roman Law reform. At the bottom, the open code features the Capitoline she-wolf.



The Monk Graziano by ANTONIO GIUSEPPE SANTAGATA (Genova 1888 – 1985)
Mosaic (1937 – 39)
Location: Hall of the Court of Appeal, left side

The monk Graziano is holding a volume that reads “decretum Gratiani” which refers to a collection of ecclesiastical laws, while his other hand is holding the cross. The code at his feet shows a representation of a griffin.



Napoleon by ANTONIO GIUSEPPE SANTAGATA (Genova 1888 – 1985)
Mosaic (1937 – 39)
Location: Hall of the Court of Appeal, left side

Napoleon dressed as a magistrate is holding the “Napoleonic Code” which he enacted. At his feet on the open code we can see the iron crown.



Fascist Justice by ANTONIO GIUSEPPE SANTAGATA (Genova 1888 – 1985)
Mosaic (1937 – 39)
Location: Hall of the Court of Appeal, left side

A soldier in Fascist uniform is holding a scroll with the words “Fascist laws.” On the code at his feet there is the balance.



Parable of the Talents by GIULIO ROSSO (Firenze 1897 – 1976)
Fresco (1937 - 1939) - 490x480 cm
Location: COURTROOM in Sect.10 - CRIMINAL DIVISION - Third Floor

Also this work refers to the Bible and, specifically, to the parable of the talents. In the scene the master calls his servants to see the fruits obtained with the gold coins (talents) that he had given them: at the back, we can see the man who is turned away because he has buried the talent without letting it grow.



Christ between the legislator and the law enforcer by PIO

SEMEGHINI (Quistello, Mantova 1878 – Verona 1964)

Fresco (1938) - 490x480 cm

Location: COURTROOM in Sect.4 - CRIMINAL DIVISION - Third Floor

Representation of divine justice: Christ features at the centre of the scene with his right hand raised to the sky and the left holding the banner of the resurrection flanked by the legislator who is carrying a code (where we read “Commandments”) and by the law enforcer, who is depicted with a spear and a shield.



Adam and Eve after the sin by MARIO TOZZI (Fossombrone 1895 –

St. Jean du Gard, Francia 1979)

Fresco (1937 - 1939) - 490x480 cm

Location: COURTROOM in Sect.2 - CRIMINAL DIVISION - Third Floor

In the scene represented by Tozzi, the original sin has already been committed, and we are facing the consequences: Eva is lying on the ground, oppressed by guilt, while Adam, upset, is covering his face with the hand. Above them, the armed angel is coming to to punish them, driving them away from Eden.



Justice between heaven and earth by PRIMO CONTI (Firenze 1900

– ivi 1988)

Oil on canvas within the frame (1936 - 1938) - 490x480 cm

Location: COURTROOM in Sect. 5- CIVIL DIVISION - Third Floor

The upper part of the work features at the centre Christ enthroned with the Father behind him, with the triangle on His head and the Book of the Law. To their right the blessed souls are ascending to heaven with the help of the Archangel Michael who is holding a sword, while to their left, following the hand of Christ, the damned souls descend to darkness. In the lower part, a group of souls are awaiting judgment; among them Napoleon and Mussolini are recognizable. Having placed the Duce among those who can be judged, the painter received an official reprimand and this painting was banished until 1942. The figure of Mussolini, which was covered in the post-war period, has now been brought to light thanks to the restoration works.

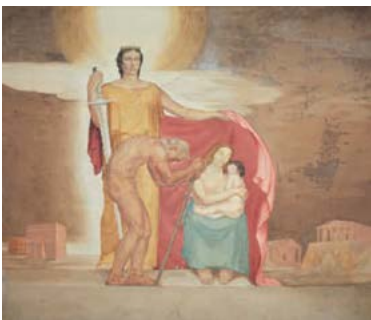


Justice by ALBERTO SALIETTI (Ravenna 1892 – Chiavari 1961)

Fresco (1938) - 490x480 cm

Location: COURTROOM in Sect. 7 - CRIMINAL DIVISION - Third Floor

Justice is depicted on a throne while holding the sword in her right hand and the Corpus Iuris in her left. On the sides, her traditional attributes: the balance with the olive and oak branches. In the lower frieze we can see additional attributes of Justice, such as the doves, the palm and the olive tree, the sword and the salamander interspersed with inscriptions: *ius est ars boni et aequi* quibus nos sacerdotes appellet iustitiam namque culimus = law is the art of what is good and right, thanks to which we are called to be its priests, for this reason Justice is our cult.



Justice protects the family by M. GIOVANNI TOLLERI

Fresco - 490x480 cm

Location: COURTROOM 1 Criminal Court - Third Floor

Here Justice is winged with the sword in her right hand while with her left hand is tending her cloak to protect and defend a woman with a child in her arms and a man who is bowing.



The Archangel Michael with Adam and Eve by ENZO MORELLI

(Bagnacavallo 1896 – Bogliaco del Garda 1976)

Fresco - 490x500 cm

Location: Central Hall - Third Floor

The Archangel Michael holding his traditional attributes, the sword and the balance, is crossing the scene in diagonal. On the left, there is a man on the ground, representing the defeated evil, while on the right, in the second plan, there are Adam and Eve and a man with a bucking horse.



The Italian civilization sets the Abyssinian slavery free by ANSELMO

BUCCI (Fossombrone 1887 – Monza 1955)

Polished plaster - 490x480 cm

Location: COURTROOM 10 civil division - Third Floor

On the right, Italy is depicted with helmet and sword, and pointing to the slave on the left whose chains have been broken.



The archangel Gabriel between Adam and Eve by GIANFILIPPO

USELLINI (Milano 1903 – Arona, Novara 1971)

Fresco - 490x480 cm

Location: COURTROOM 3 CRIMINAL DIVISION - Third Floor

The scene is dominated by the large tree of Good and Evil, or an allusion to the garden of Eden, on which the Archangel Gabriel is sitting with the sword in hand, flanked by the tablets of the Law and the balance. At his feet, in reduced size, there is Adam working the land and Eve taking care of the offspring.



The attributes of Justice by GINO SEVERINI (Cortona 1883 – Parigi 1966)

Mosaic (1937 – 39)

Location: hall of the Court of Appeal, right side

In this work, allegorical figures related to justice are presented: the tree of good and evil, reference point of the right, while the turtle has the meaning of stability. Below the sheaf of wheat and the dove.



The attributes of Justice by GINO SEVERINI (Cortona 1883 – Parigi 1966)

Mosaic (1937 – 39)

Location: Hall of the Court of Appeal, right side

Other symbols include: the eye bandage which alludes to impartiality, the palm tree and the elephant that evoke immortality, and the compass that points to the right path. At the bottom a water bird and a two-faced herm.



Justice by GINO SEVERINI (Cortona 1883 – Parigi 1966)

Mosaic (1937 – 39)

Location: Hall of the Court of Appeal, right side

Justice is represented here while holding the tablets of the Law. The references to symbols that surround it are shrouded with mystery: the palm tree, the bull and the sun at the bottom.



Justice by GINO SEVERINI (Cortona 1883 – Parigi 1966)

Mosaic (1937 – 39)

Location: Hall of the Court of Appeal, right side

Justice is pictured here with a cloud covering her face, probably alluding to impartiality, and surrounded by some of her attributes: the lion, the balance and the eye at the bottom.



The attributes of Justice by GINO SEVERINI (Cortona 1883 – Parigi 1966)

Mosaic (1937 – 39)

Location: Hall of the Court of Appeal, right side

Archangel Michael with sword and balance flies over a symbolic walled city, under him Justice is represented by an ostrich which, in ancient times was believed to have all the feathers of the same length. Therefore a symbol of fairness. Below, a code and a laurel wreath.



Moses which sends flames from the sky on pagan simulacra by

ACHILLE FUNI (Ferrara 1890 – Appiano Gentile, Como 1972)

Fresco (1937 – 1939) - 490x480 cm

Location: COURTROOM 6 - CRIMINAL DIVISION - Third Floor

Moses on Mount Sinai holding the tablets of the Law dictated by the Lord. The wrath of the latter is represented by the red colouring of the sky red and by the attack on pagan idols, such as the golden calf the Jews had asked Aaron for and other simulacra, which were then destroyed by the wrath of Moses.



The Judgement of Solomon by GUIDO CADORIN (Venezia 1892 – ivi 1975)

Fresco (1939) - 490x480 cm

Location: COURTROOM 8 - CRIMINAL DIVISION - Third Floor

Cadorin retells the story of the judgment of Solomon, who is called upon to decide which is the real mother of the two contending ones. On the left we see that the executioner who is going to kill the child is stopped by the supplications of the real mother.



Moses with the Tablets of the Law by SIRO PENAGINI (Milano 1885 – Solcio 1952)

Fresco (1939) - 490x480 cm

Location: COURTROOM - CRIMINAL DIVISION - Third Floor

Moses kneeling points with his right hand to the sky, i.e. God, who gave the tablets of the Law, which he is holding in his left hand.

Inscription: Iustitia non novit patrem non novit matrem veritatem novit personam non accipit deum imitatur = justice never knew father, never knew mother, does not admit of falsehood, in imitation of God.



The Roman justice by GUIDO MARUSSIG (Trieste 1885 – Gorizia 1972)

Mosaic (1938) - 490x480 cm

Location: COURTROOM 8a - CRIMINAL DIVISION - Third Floor

The personification of justice in Roman clothes is coming out of a door with a threatening attitude, brandishing the sword in the right hand and holding the balance in the left. The theme of the door will then be developed in many ways by the artist in the postwar period. The panels on the sides used to be decorated with fasces, which were then scraped off. Inscription: Romana atque lictoria iustitia prodit = the Roman justice and Fascist beneficial.



The two robbers by ARNALDO CARPANETTI (Ancona 1898 – Milano 1969)

Fresco (1937 – 1939) - 490x480 cm

Location: COURTROOM 6a - CRIMINAL DIVISION - Third Floor

Justice with her attributes stands out for her imposing size along with its symbols: brandishing the sword with the right hand and the balance in her left raised to the sky. The judge sitting just below her, repeats the same gesture so to indicate the man's guilt at his feet, guilty of stealing the bag of gold in the foreground. Inscription: men are good only thanks to Justice.



Justinian gives new laws and frees a slave by CARLO CARRÀ (Quargnento,

Alessandria 1881 – Milano 1966)

Fresco (1938) - 490x480 cm

Location: COURTROOM C - CIVIL DIVISION - Third Floor

The Emperor Justinian is seated on a throne in the open with his left foot on the terrestrial globe, the scroll of the Law in his left hand and his right hand raised in the act of freeing a slave sitting on the ground to the left. The scene is completed to the left with a woman with a baby in her arms and, on the right, with a man with his back turned, and a woman raising her arms.



King Darius frees Daniel from the lions' den by FERRUCCIO FERRAZZI (Roma 1891 – ivi 1978)

Encaustic (1938) - 490x480 cm

Location: COURTROOM B - CIVIL DIVISION - Third Floor

The work presents the Biblical story in which Darius, the king of Persia, sentences Daniel to the lions' den because he disobeyed a religious order. Daniel, once in the arena, is protected by the angel of the Lord who holds back the lions, so Darius, now convinced of the power of God of the Jews, saves Daniel. In the scene we see the angel of the Lord who holds the lions while Dario holds out his hands towards Daniel.



Trajan and the widow by FERRUCCIO FERRAZZI (Roma 1891 – ivi 1978)

Encaustic (1938) - 490x480 cm

Location: Central Records Office - CIVIL DIVISION - Third Floor

The scene depicted here refers to the episode of Golden Legend where the Emperor Trajan faces a woman asking for Justice as her son had been killed in a battle by Trajan's son. In exchange, Trajan gave her his own son. The episode later became the symbol of Roman justice. Inscription on the banner: S.P.Q.R. = Senatus Romanus Populosque.



Judgement by CARLO CARRÀ (Quargnento, Alessandria 1881 – Milano 1966)

Fresco (1938 – 1939) - 490x480 cm

Location: COURTROOM A - CIVIL DIVISION - Third Floor

In his second work Carrà deals with the issue of the Last Judgement: the scene takes place outdoors, in the centre is Christ with his right hand raised pointing to the sky. At his feet the souls of the dead emerge from the graves to face the Last Judgement.



Bust of King Vittorio Emanuele by DOMENICO RAMBELLI (Pieve del Ponte 1886 – Roma 1972)

Bronze

Location: Hall of the Court of Appeal, right side

Originally located in the main hall, the work was paired with a bust of Mussolini by the same author. The bust is presently placed in an office on the third floor, while that the Duce's was destroyed. The signature is engraved at the bottom on the right side.

1.3 - SWOT analyses

1.3.1 - Analysis on Milan

STRENGTHS

Milan is the focal point of the region and an international gateway for local economic clusters

Strong (inter)national brand of Milan and important driver of the national economy.

WEAKNESSES

There is little sign of awareness that 'what is good for Milan, is good for its surroundings' and vice versa.

Hierarchical way of working between layers of government which causes a lack of coordination and collaboration.

Large amount of small municipalities with individual land use plans, which leads to fragmented spatial planning and negative externalities.

There appears to be strong local competition between firms (often family-oriented and lacking a managerial culture), instead of reaping the benefits of clusters together.

The regional public transport system is not well integrated with the Milanese public transport system; trains run on too low frequencies.

OPPORTUNITIES

Milan starts thinking and acting beyond their municipal borders (see example fair and extension of metro lines)

Suburbs could become less dependent on Milan since they experience a relatively higher growth of employment than Milan.

Expo 2015 can create a stronger regional marketing brand.

Strong feeling of urgency to improve the infrastructure system (road and rail) in order to reduce congestion (counts mainly for Region of Lombardy).

Future governance arrangements can build on the activities of existing intermunicipal platforms such as Centro Studi PIM and Milano Metropoli.

THREATS

Negative externalities in Milan such as pollution, congestion, lack of affordable housing require a regional approach, but the conditions for such an approach are hardly present.

Continuing institutional fragmentation, such as splitting up the Milan province in 2009, and a lack of a culture of cooperation makes metropolitan governance complicated.

Lack of space for new development in Milan, and continued policies for centralisation of higher-order urban functions may hamper their development

1.3.2 - Analysis on the Courthouse

STRENGTHS

Analyzing the strengths of the Milan City and specially the surrounding parts of the courthouse of Milan. The courthouse locates in the Guastalla district of No.1 zone, one of the heart place of Milan. It is encircled by many historical buildings and monuments, also very closed to the Duomo Church. Whether the streets, shops or buildings, this is full of a strong historical atmosphere, and the taste of literature and art. In between those buildings also existing the peaceful residential building. The natural and landscape beauty of the area is undoubtedly one that gives quiet and silence to tourists and locals. Tourism is definitely a further strength, people from all over the world come to visit the ancient city, enjoy the incorporation with modern and classical.

WEAKNESSES

The court wasn't treated as an art gallery for a long time and many of the infrastructure had not kept up.

The court is mainly to fulfill the duties of the court, and did not prepare for the convenience of many tourists. In contrast, in the same area, the others has long been the development of historical monuments and the surrounding has been very good for the tourists ready.

OPPORTUNITIES

As mentioned above, whether it is the construction of the court itself, or the works of art within the building, are very good to attract tourists, and is located in Milan, the combination of classical and modern metropolis. The surrounding transport facilities are also very convenient and easy to travel. There are many schools around, so it is also convenient to organize students to visit and study in the holiday school.

THREATS

The court building itself was the product of the early years, so there were many factors to consider when planning. Old buildings are also fragile and need to be strengthened and maintained in the future. Need to find their own characteristics and Milan has been the city's other art gallery competition.

2. INVESTIGATION

2.1 - Overview

This investigation takes place at Tribunale di Milano, starting from March 3, 2016. The aim of the tests is to provide an accurate measurement for the room, indicated with red rectangle below, to have plans and sections, while also perform thermographic and psychrometric analyses in order to investigate any damages of the room, specially the causes of salt efflorescence on the fresco and damages caused by heating system and any other potential issues.

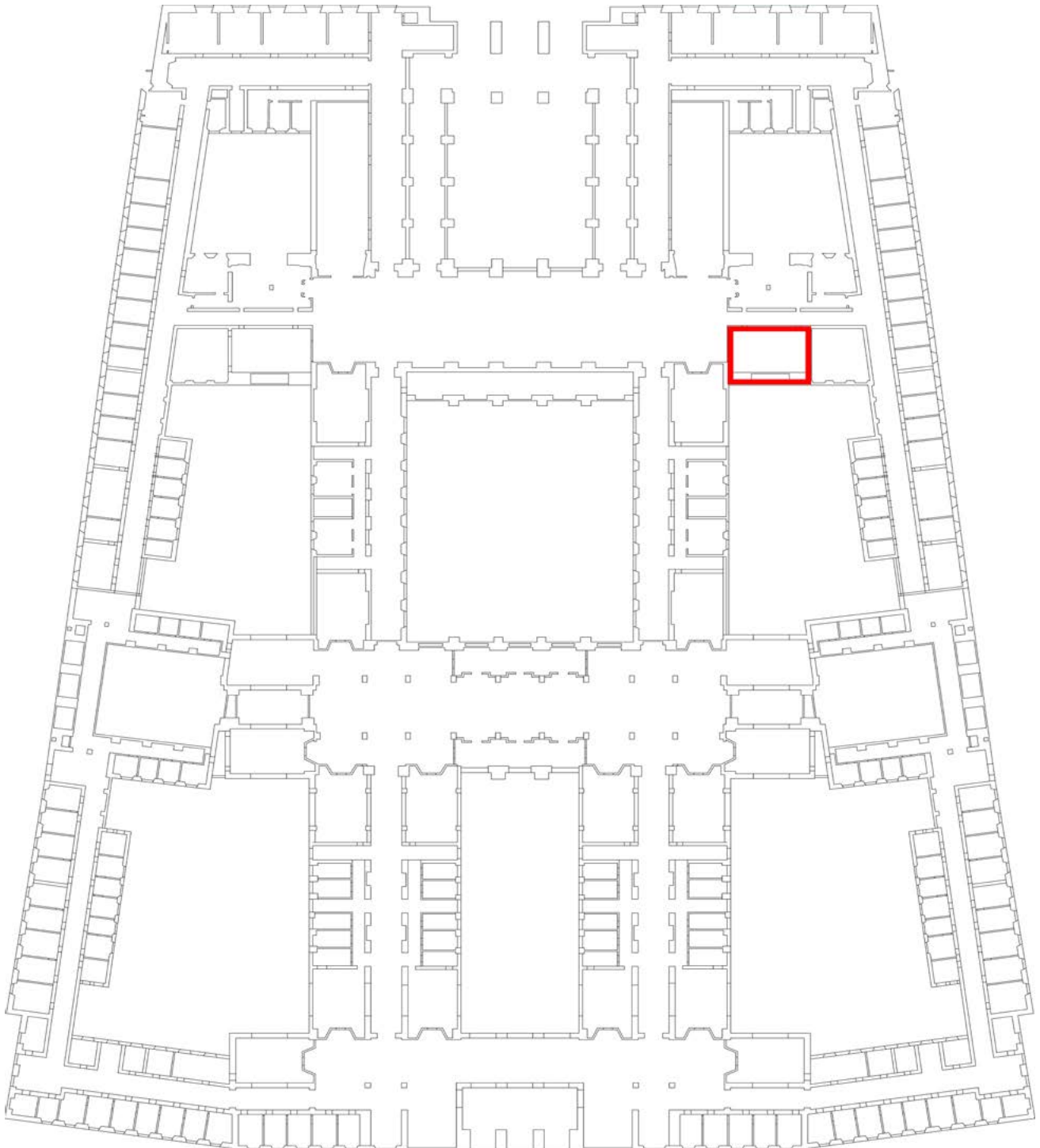


Figure 2.1.1 - Location of the Stefanini Room - Third floor plan of the courthouse.

2.2 - Metric survey procedure

Phases of the conservation cycle; are analysis, diagnosis, therapy and monitoring.

These 4 stages in the cycle have metric information needs that must be adequately met by establishing the principle of matching an intensity of capture to a given process. The validity of a variety of metric activities is established; for example, at the earliest stage of the cycle when hand drawn building plans and details can convey highly valuable information to the project team. Such drawings may not exhibit rigorous metric performance but require high orders of information selection in a short time span such as is needed for rapid assessment of damage or in the inventory of cultural heritage: an awareness of the enhanced value of such records when they have a metric base is, of course, important when planning information capture by anticipating future data utility.

Information capture is required to meet both the needs of specific conservation issues and the wider baseline condition record requirement: the phases in the cycle where metric survey is the primary tool for preparing site information.

The initial phase of the metric survey was due to the following:

- Creating digital drawings with proper measurement for further usage.
- Understand the various materials presented on the various facades and on different parts of the same facade, this may allow us to draw conclusions about the techniques and building phases;
- Understand details and problems on the facades under consideration that are not visible to the naked eye. This is possible in the phase of further diagnosis, thanks to techniques such as thermography and psychrometry analysis.

First step was to sketch the room, in order to study how to measure properly and have a guide while measuring it. Then, we used a rope to have straight line across the long side of the room and mark couple of points as reference points and measured the distance with a laser meter, from two of these points to a corner of the room. These two points were chosen in order to create a triangle with wide angles between three points.

Long opposite corners are also measured diagonally. Then, this approach applied to multiple corners, and due to that, it was possible to find correct dimensions of the room.

After the dimensions are acquired, the sketches are transferred to digital environment by using AutoCAD.

2.3 - Thermographic survey procedure

FLIR P640 model thermographic camera used for this survey. A thermographic camera is a device that forms an image using infrared radiation, similar to a common camera that forms an image using visible light.

Thermographic shooting took place in March 2016, a day with an average temperature and no rainfall. The test procedure includes scanning all of the walls in the room; including the wall with fresco that has salt efflorescences, the wall with a large window that looking the courtyard and with heating system; and also scanning the ceiling.

After the thermographic survey, we had a couple of images for each surface, which were showing only a portion of that surface. The results were modified by changing the temperature spans for each image, setting the same temperature range for each individual wall and ceiling, using software IRT Analyzer and IRT Stitch. After that, these images are combined in order to have an organic thermographic image of that surface. Also, it was possible to measure the temperature in each point of the image with the insertion of two parameters, the emissivity and the ambient temperature, which allow obtaining the correct temperature.

In general, temperature span is 1.5°C to 2°C with exception of the north wall and usually minimum temperature is around 20°C and maximum temperature is around 23°C for all the walls. The reason for higher span on the north wall mentioned above is because of the big temperature differences due to window and heating system. An analysis of the various images it was possible to understand any possible problems and reasons of those problems.

Thermography:

- Field of view (FOV) / Minimum focus distance :45° × 34° / 0.2 m (0.7 ft.)
- Image Frequency:30 Hz-
- Focus Automatic or manual (electric or on the lens)
- Focal Plane Array (FPA) / Spectral range:Uncooled microbolometer / 7.5–13 μm
- IR resolution:640 × 480 pixels
- Image Frequency:30 Hz-
- Object temperature range:–40°C to +500°C (–40°F to +932°F)
- Accuracy ±2°C (±3.6°F) or ±2% of reading
- Field of view (FOV) / Minimum focus distance :45° × 34° / 0.2 m (0.7 ft.)
- Operating temperature range:–15°C to +50°C (+5°F to +122°F)
- Storage temperature range:–40°C to +70°C (–40°F to +158°F)

Operators

Room surveys and processing were performed by Baris Demirel, Liu Yuheng and Lu Shan.

2.4 - Psychrometric survey procedure

Although the principles of psychrometry apply to any physical system consisting of gas-vapor mixtures, the most common system of interest is the mixture of water vapor and air, because of its application in heating, ventilating, and air-conditioning and meteorology. In human terms, our thermal comfort is in large part a consequence of not just the temperature of the surrounding air, but (because we cool ourselves via perspiration) the extent to which that air is saturated with water vapor.

The analysis were performed with the psychrometer and with that, it was possible to record, point by point, moving in the environment in order to get data about temperature, relative humidity and specific humidity.

A temperature is an objective comparative measurement of hot or cold. It is measured by a thermometer. Several scales and units exist for measuring temperature, the most common being Celsius (denoted °C; formerly called centigrade), Fahrenheit (denoted °F), and, especially in science, Kelvin (denoted K).

Relative humidity is the ratio of the vapor pressure of moisture in the sample to the saturation pressure at the dry bulb temperature of the sample.

Specific humidity is defined as the proportion of the mass of water vapor per unit mass of the moist air sample (including both dry air and the water vapor); it is closely related to humidity ratio and always lower in value.

For this process, we created an imaginary grid inside the room with 1.5m distances between each lines, vertically and horizontally, and marked each intersection points. In the end we got 54 points, in addition of an external point outside of the room.

This survey was done four different days, March 10, April 21, July 22 and October 28. Also, this survey was repeated twice in the same day, one is in the morning at 11am, another one is in the before evening at 5pm.

By processing the collected data could be obtained of graphs showing the trend of temperature, specific humidity and relative humidity in the various environments.

The observation of these graphs can be made regarding the homogeneity of these functions and then see if there are imbalances and possible problems especially regarding the moisture.

Operators

Room surveys and processing were performed by Baris Demirel, Liu Yuheng and Lu Shan.

2.5 - Environmental data

March 10, 2016, 11.00am

Outside: 52.6% relative humidity; Temperature 13.5° C

Inside: 31.4% relative humidity; Temperature 21.5° C

March 10, 2016, 5.00pm

Outside: 40.4% relative humidity; Temperature 17° C

Inside: 29.3% relative humidity; Temperature 21.6° C

April 21, 2016, 11.00am

Outside: 35.3% relative humidity; Temperature 11.3° C

Inside: 30.1% relative humidity; Temperature of 22.1° C

April 21, 2016, 5.00pm

Outside: 43% relative humidity; Temperature 22.1° C

Inside: 29.8% relative humidity; Temperature of 22.5° C

July 22,2016, 11:00am

Outside:30.3% relative humidity; Temperature 32.3

Inside: 52% relative humidity; Temperature 29.3

July 22,2016, 5:00pm

Outside:40% relative humidity; Temperature 36

Inside: 31.5% relative humidity; Temperature 29.1

October 28,2016, 11:00am

Outside:59.2% relative humidity; Temperature 22.5

Inside: 53.6% relative humidity; Temperature 18.7

October 28,2016, 5:00pm

Outside:43% relative humidity; Temperature 18.8

Inside: 52.5% relative humidity; Temperature 21

3. SURVEY AND DIAGNOSTICS

3.1 - Metric survey

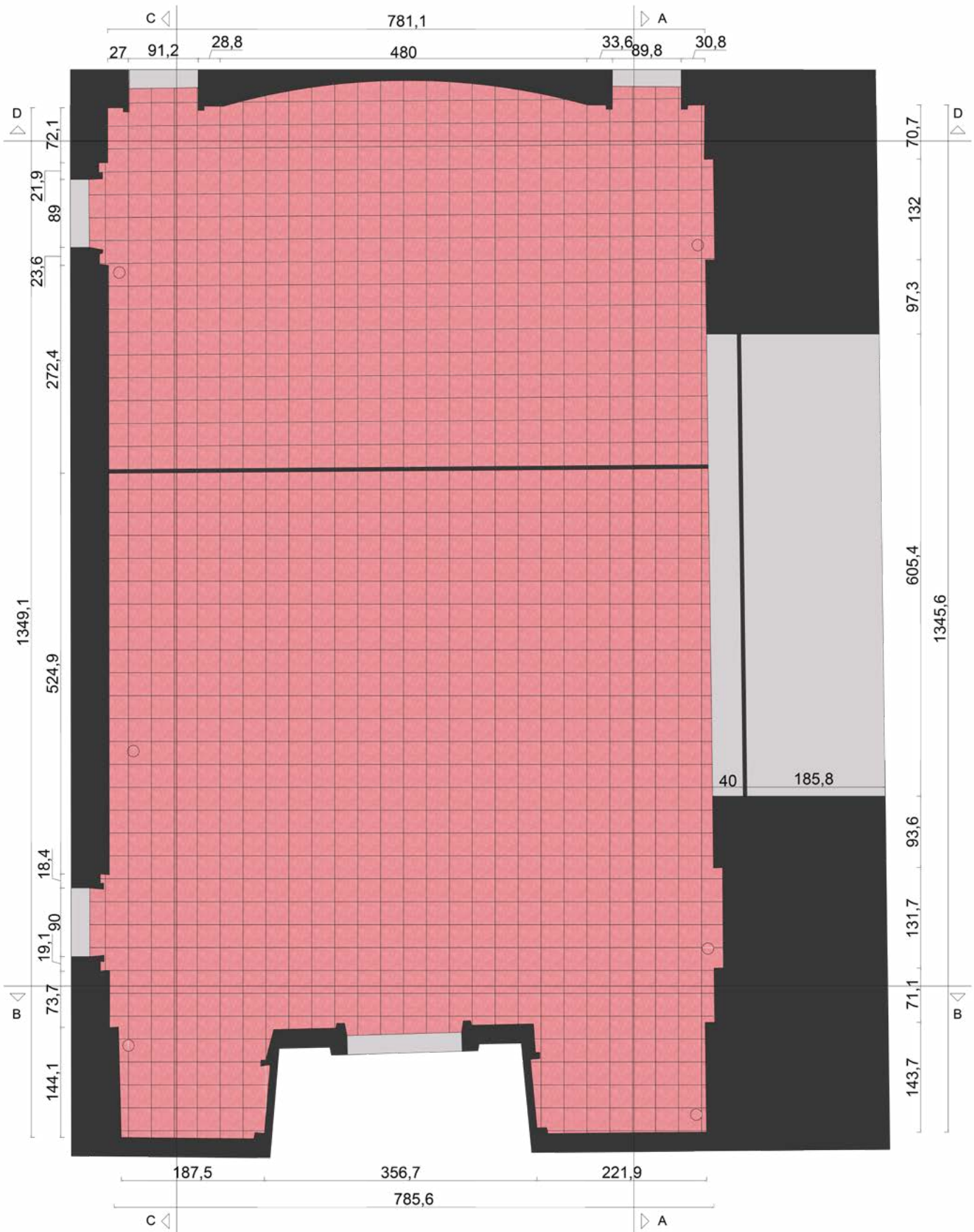


Figure 3.1.1 - Stefanini Room Plan.

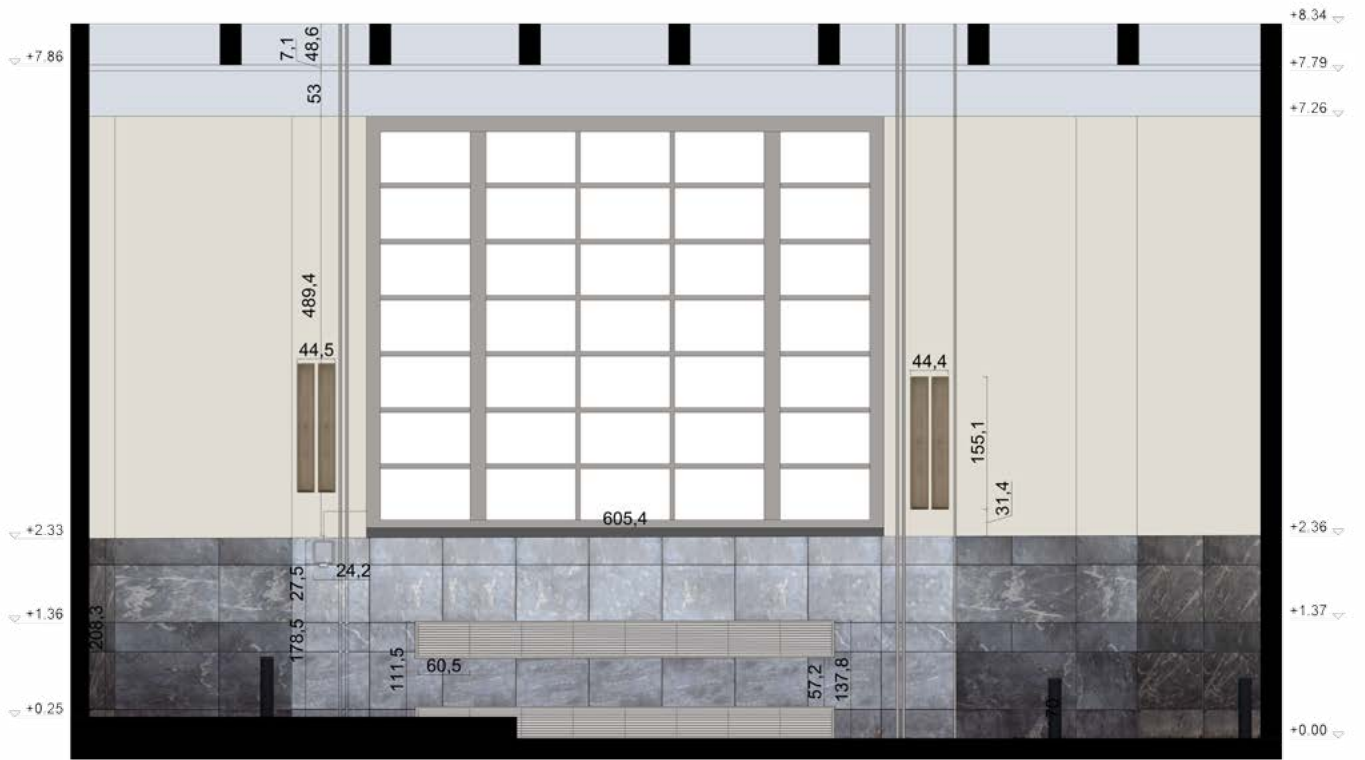


Figure 3.1.2 - Stefanini Room Section AA - South wall.



Figure 3.1.3 - Stefanini Room Section BB - West wall.



Figure 3.1.4 - Stefanini Room Section CC - North wall.

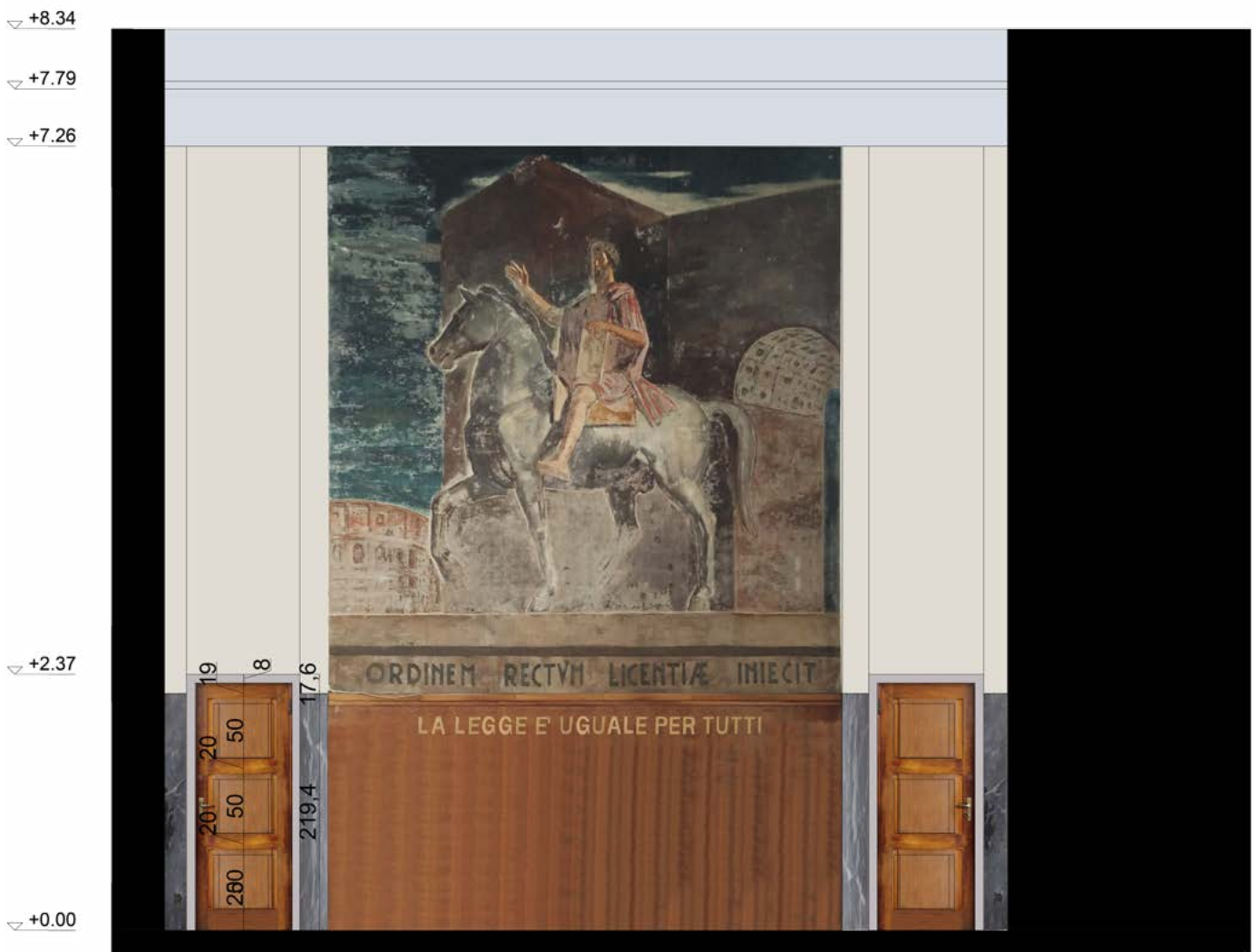


Figure 3.1.5 - Stefanini Room Section DD - East wall.

3.2 - Thermographic survey

3.2.1 - East wall

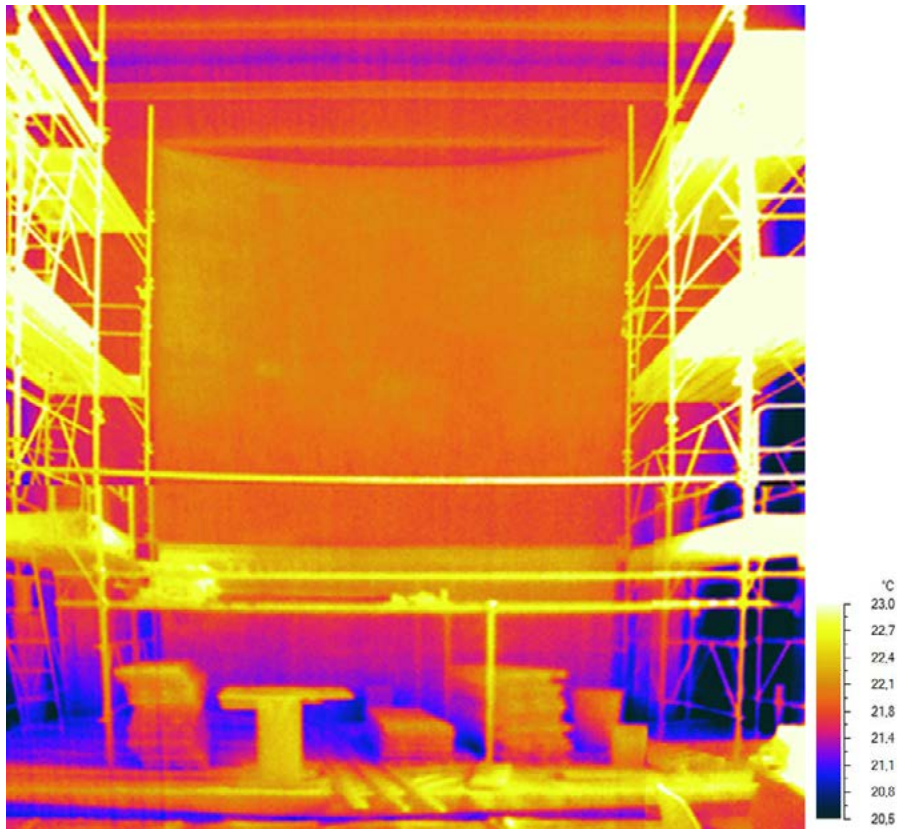


Figure 3.2.1 - Thermographic image of the east wall / temperature between 20.5 -23.0°C.



Figure 3.2.2 - Photograph of the east wall.

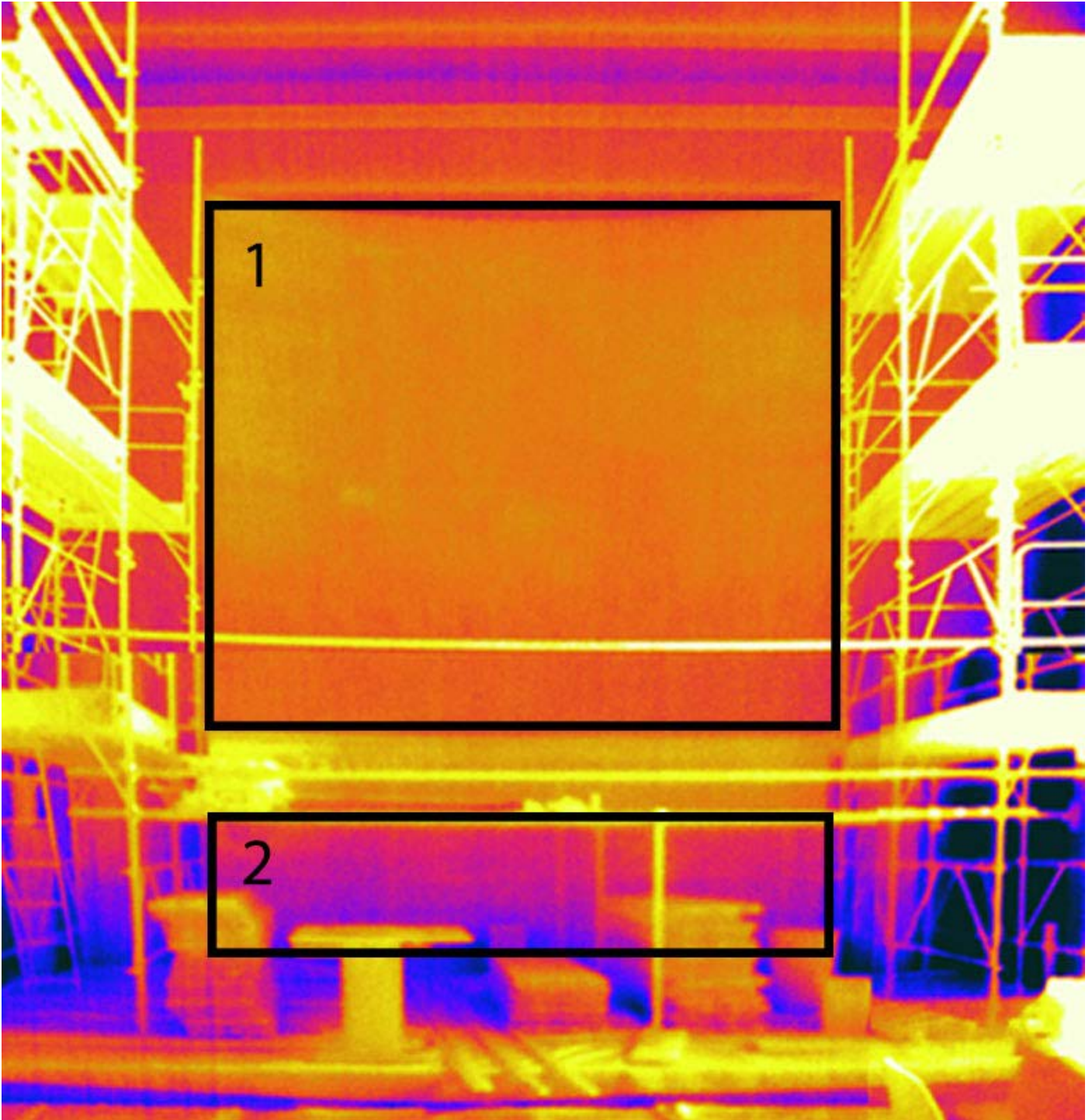


Figure 3.2.3 - Critical areas of the east wall.

(1) We know there is salt efflorescence problem with the fresco on the wall, along with damages on the painting.

(2) The bottom part of the wall is covered by timber which causes a lower temperature than rest of the wall.

3.2.2 - South wall

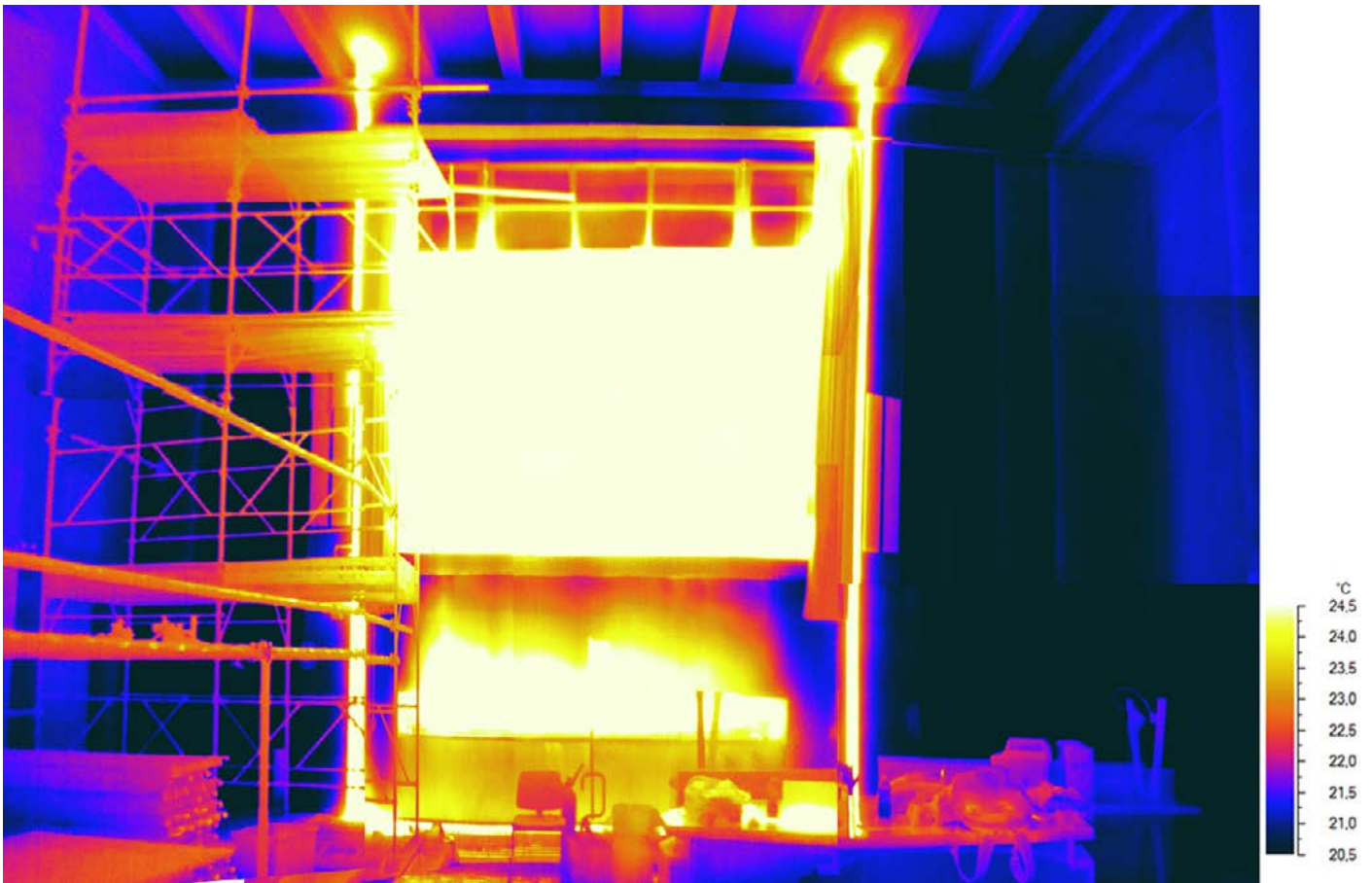


Figure 3.2.4 - Thermographic image of the south wall / temperature between 20.5 - 24.5°C.

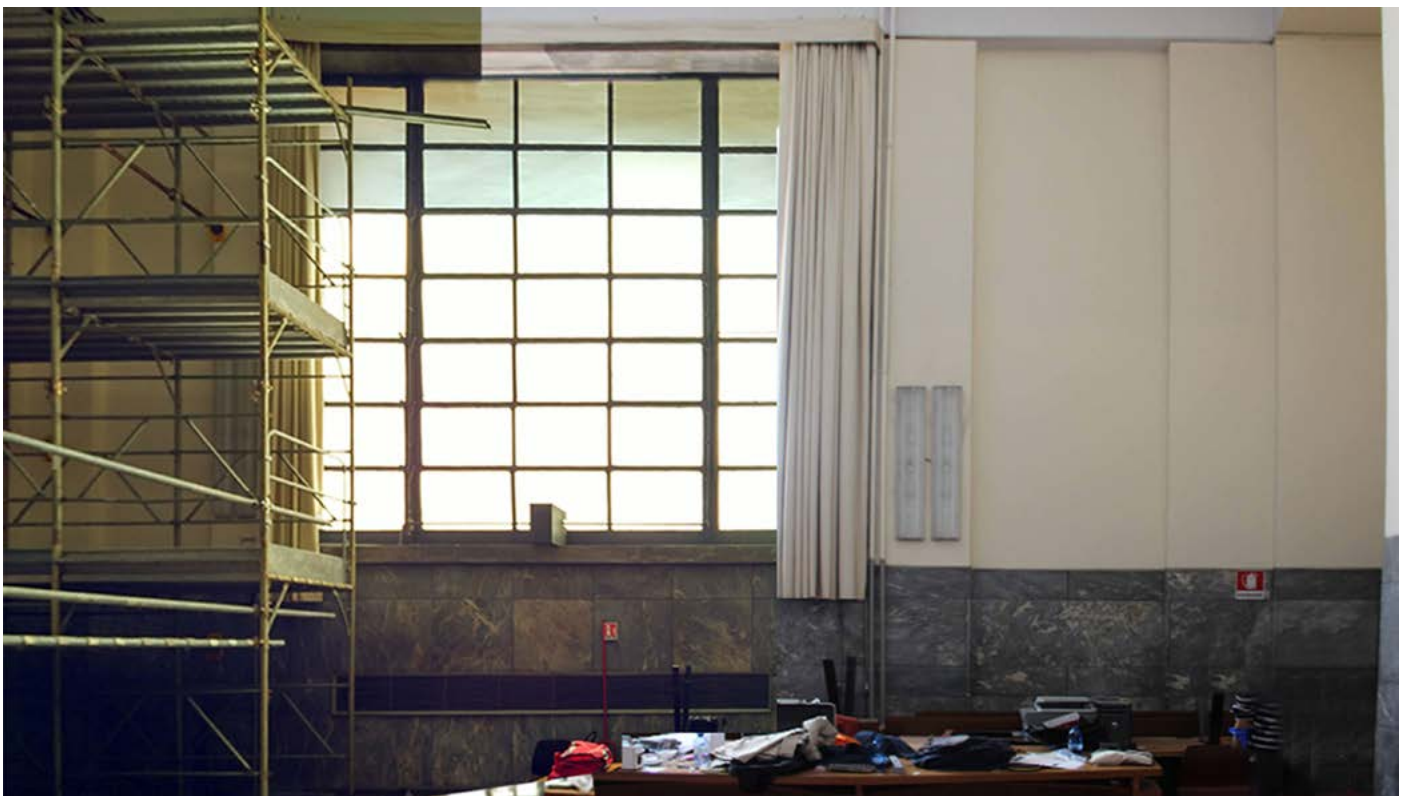


Figure 3.2.5 - Photograph of the south wall.

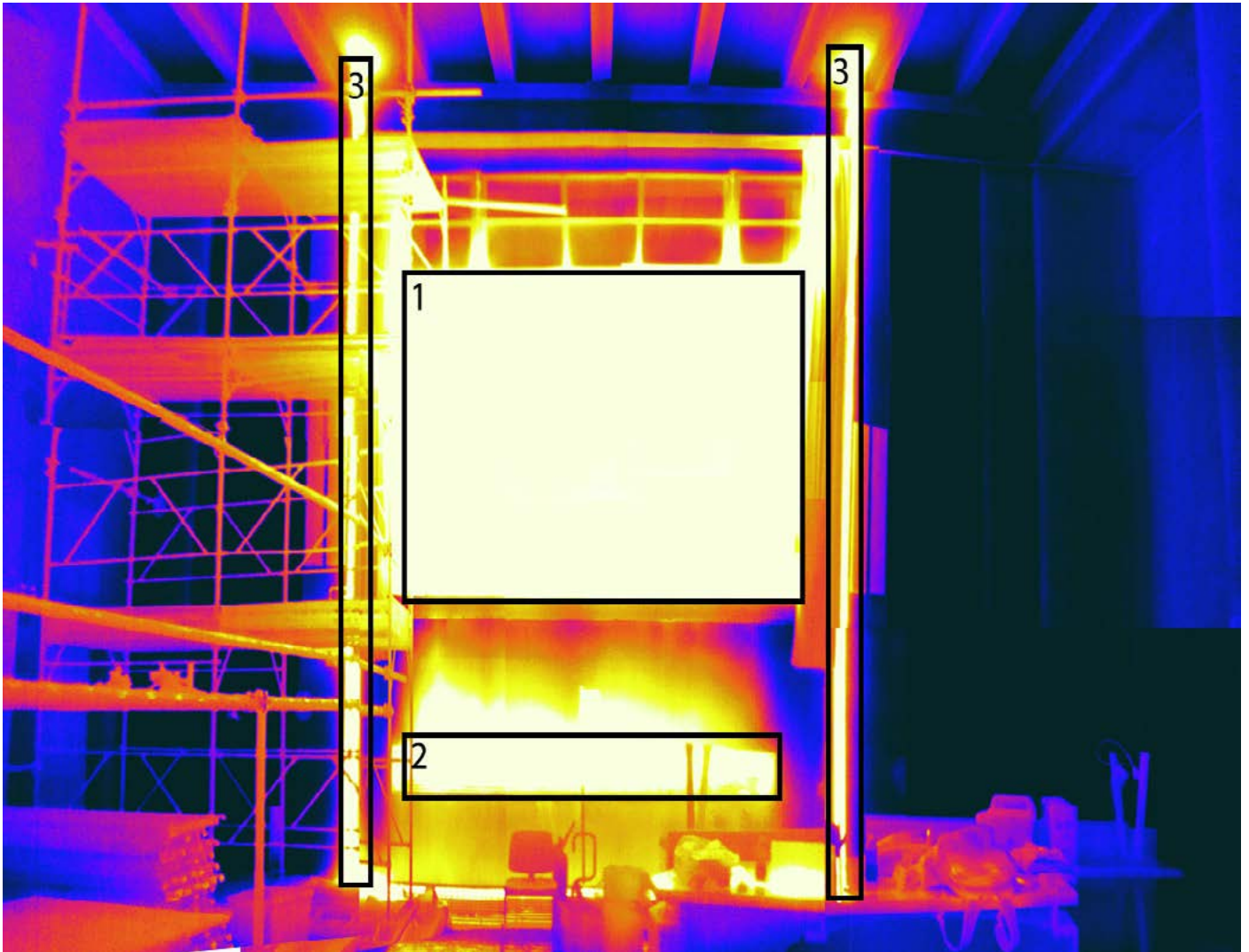


Figure 3.2.6 - Critical areas of the south wall.

(1) This wall has big temperature differences due to the large window facing south.

(2) Bottom part of the wall has the outlet of the heating system, therefore that part is also has very high temperature compared to the rest.

(3) Pipes of the heating system located in that area, coming from bottom floor and going all along the wall to the upper floor.

3.2.3 - West wall

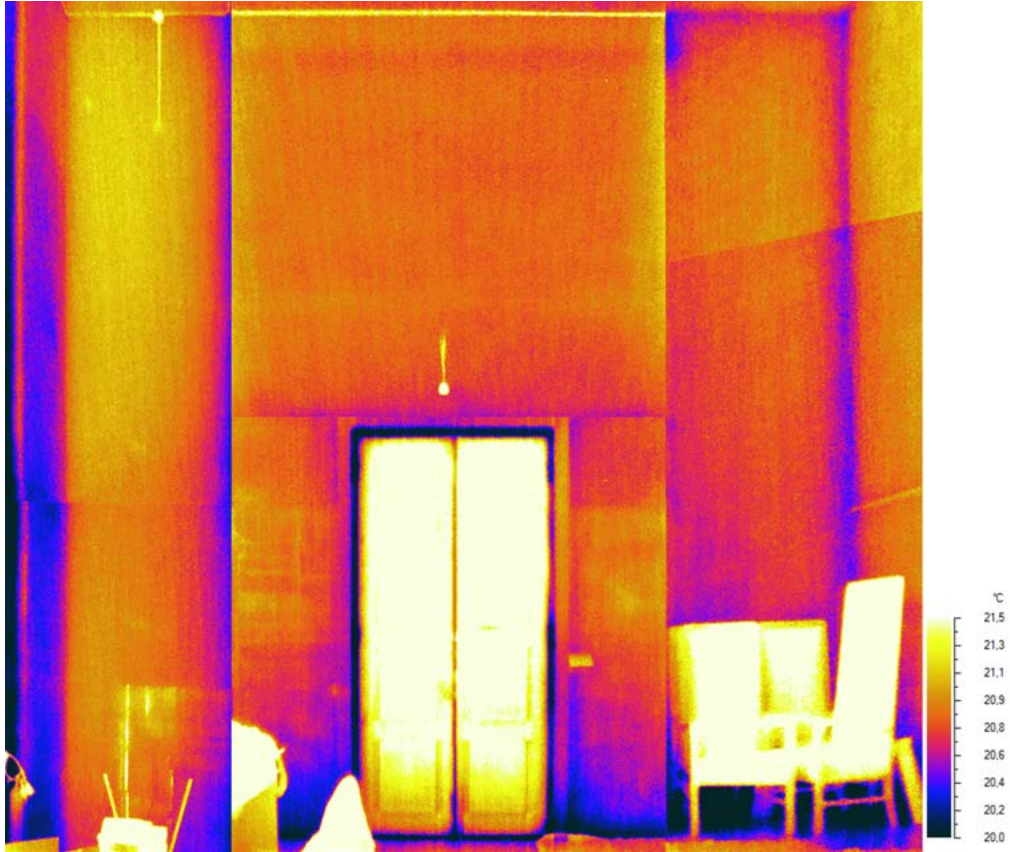


Figure 3.2.7 - Thermographic image of the west wall / temperature range between 20.0 - 21.5°C.

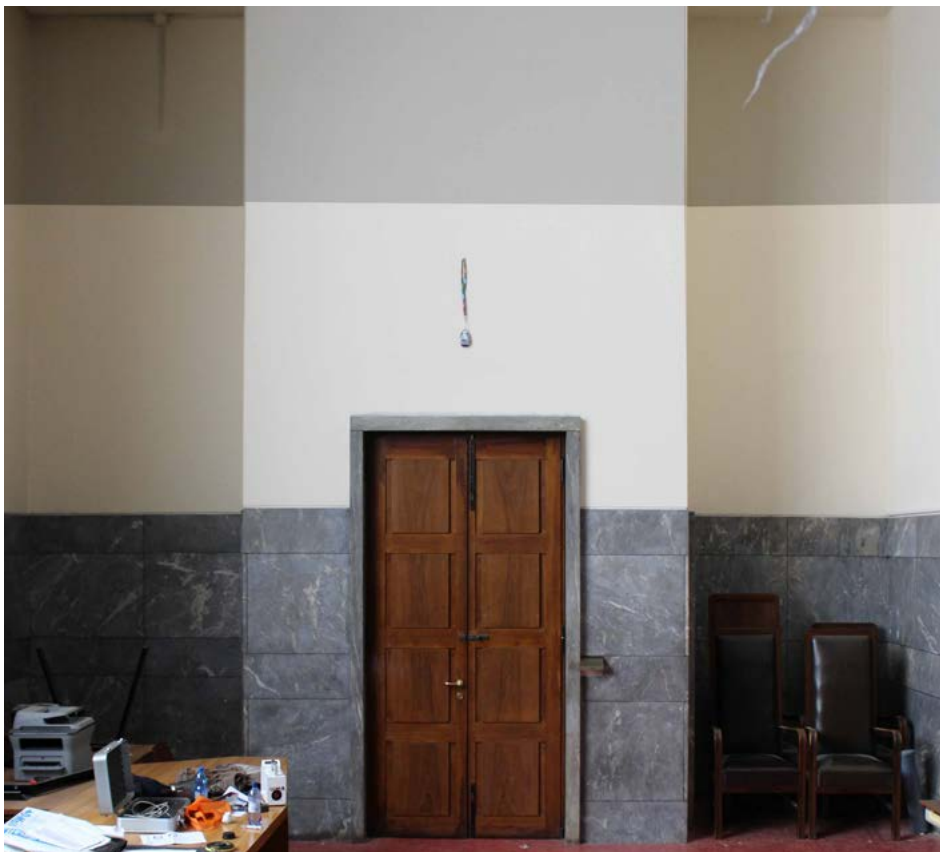


Figure 3.2.8 - Photograph of the west wall.

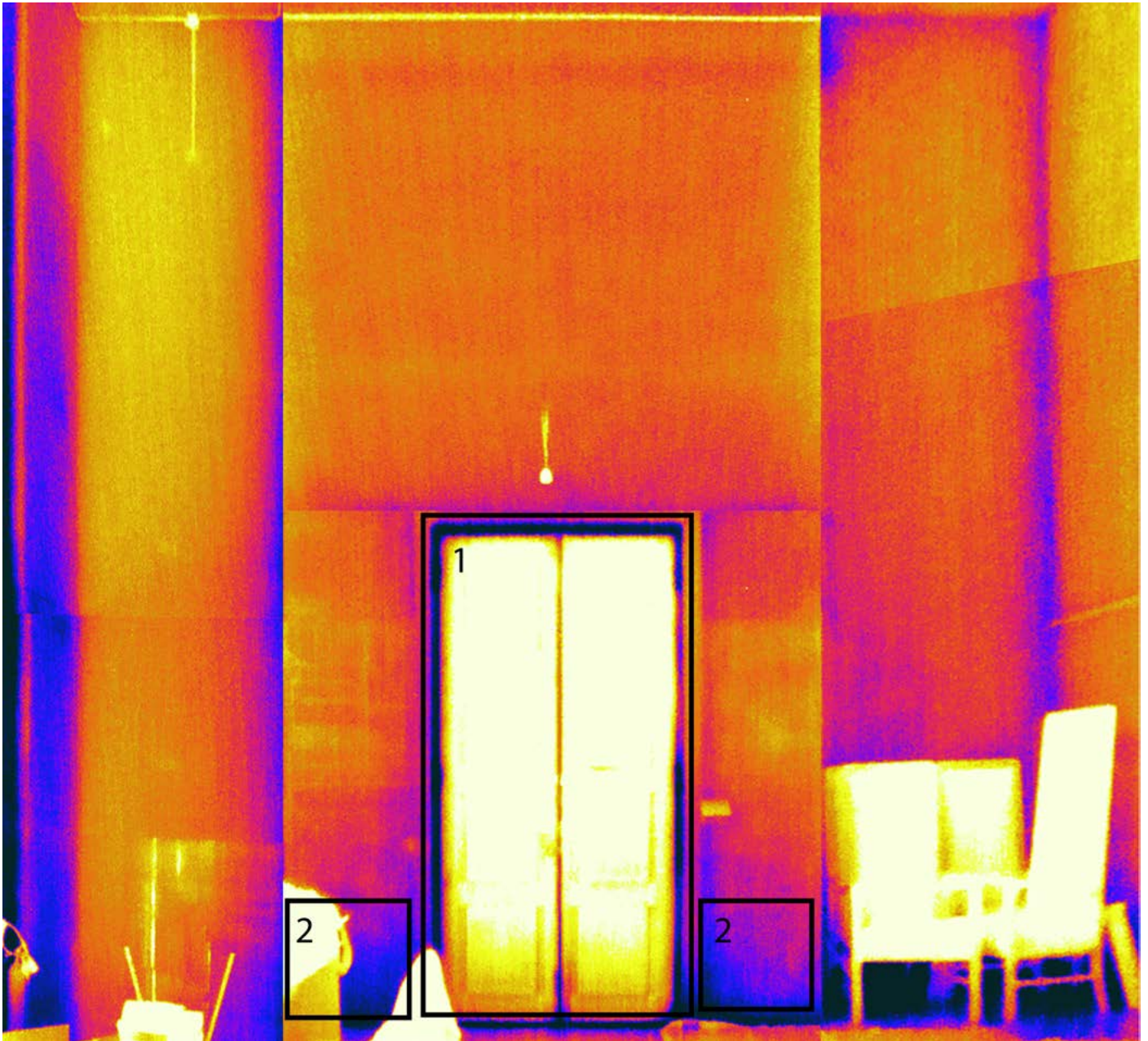


Figure 3.2.9 - Critical areas of the west wall.

(1) Wooden door has a very high temperature compared to the other parts of the wall

(2) Bottom corners of the wooden door has low temperature in comparison with the rest of the wall. This can be an indication of a possible damage.

3.2.4 - North wall

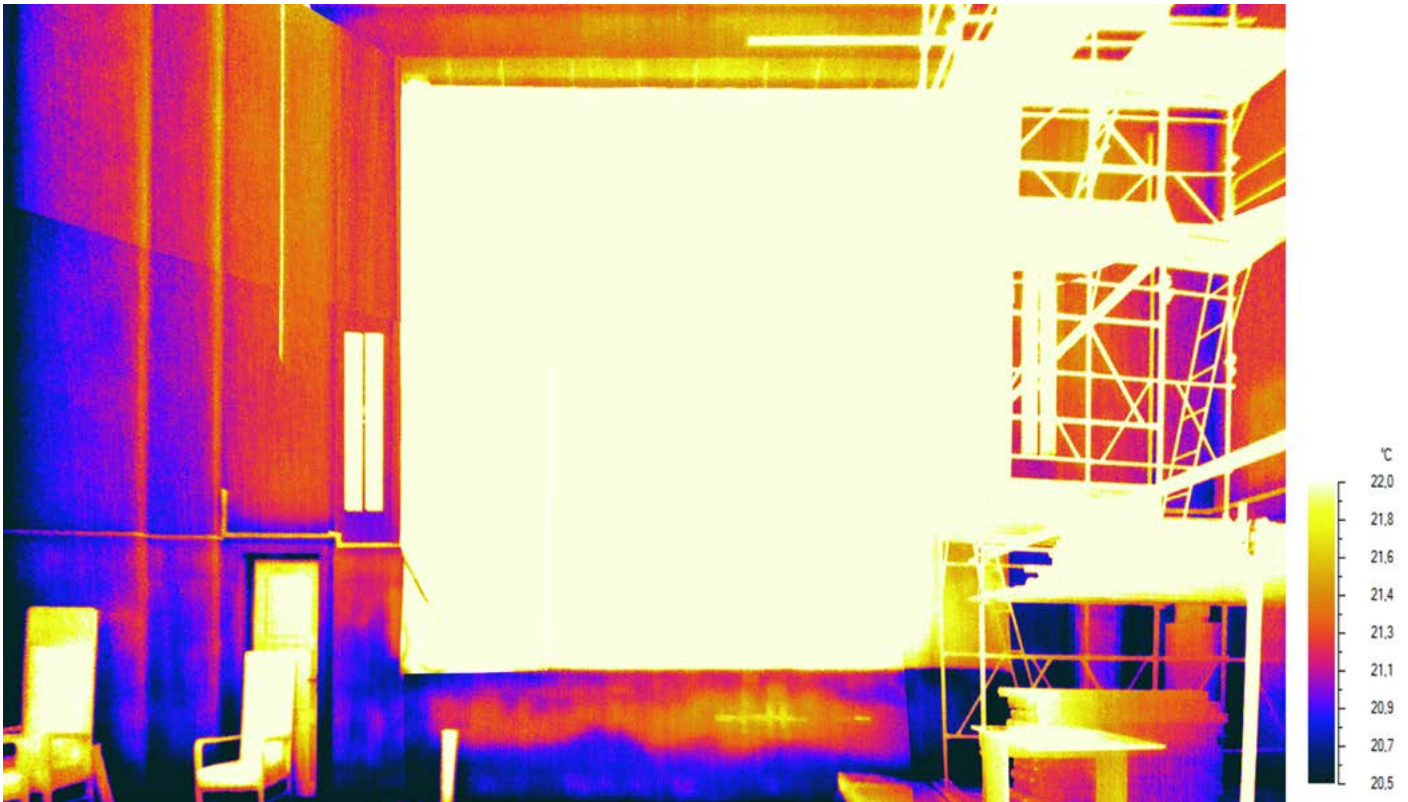


Figure 3.2.10 - Thermographic image of the north wall / temperature range between 20.5 - 22.0°C.



Figure 3.2.11 - Photograph of the north wall.

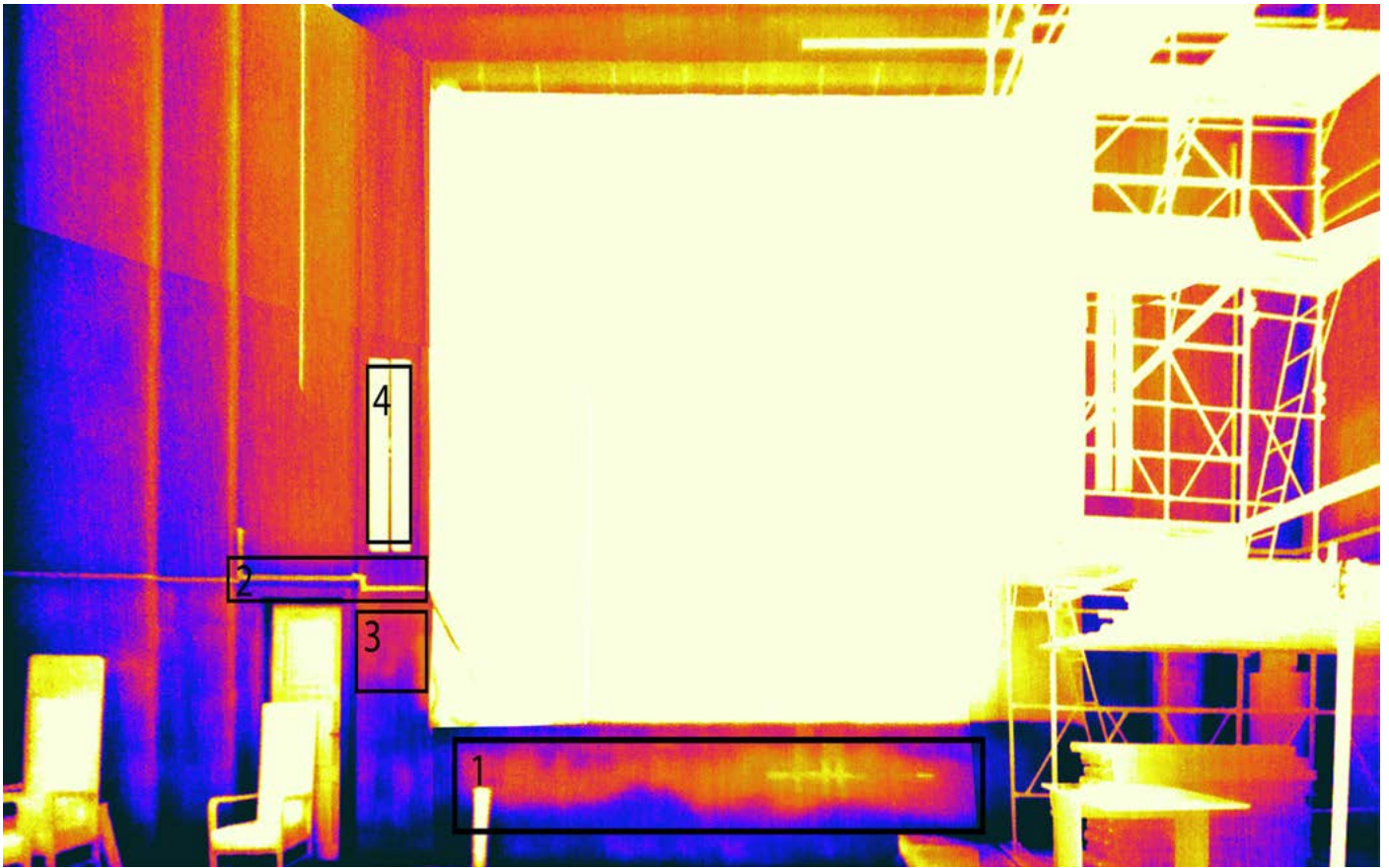


Figure 3.2.12 - Critical areas of the north wall.

(1) A significantly high temperature part at the bottom of the wall, could be related to the heating system or there is a damage in the wall itself.

(2) Pipes of the heating system, relatively higher temperature compared to the other parts of the wall.

(3) Higher temperature of this part could be either related the pipes of the heating system or a possible damage on the wall.

(4) Lighting system on the wall have higher temperature due to being operated for a certain amount of time.

3.2.5 - Ceiling

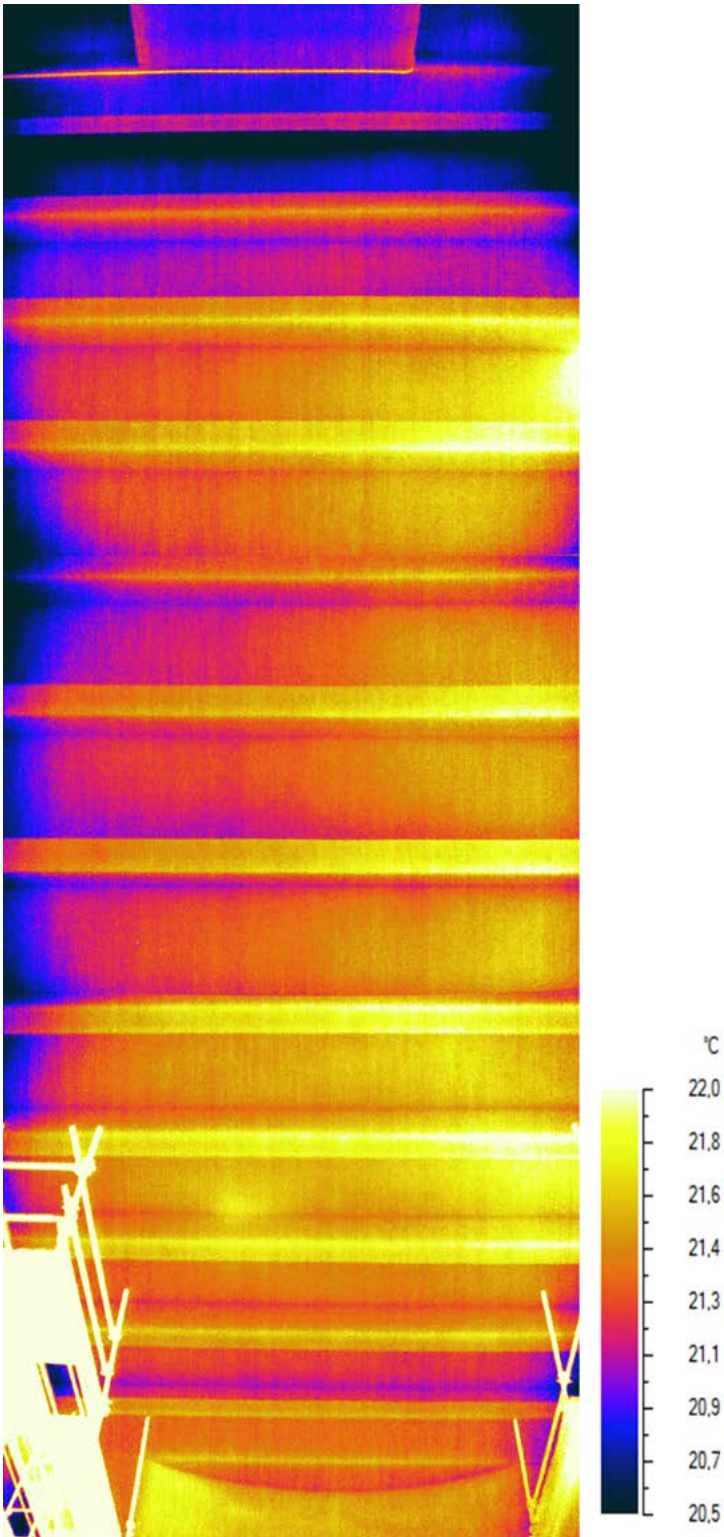


Figure 3.2.13 - Thermographic image of the ceiling / temperature range between 20.5 -22.0°C.



Figure 3.2.14 - Photograph of the ceiling.

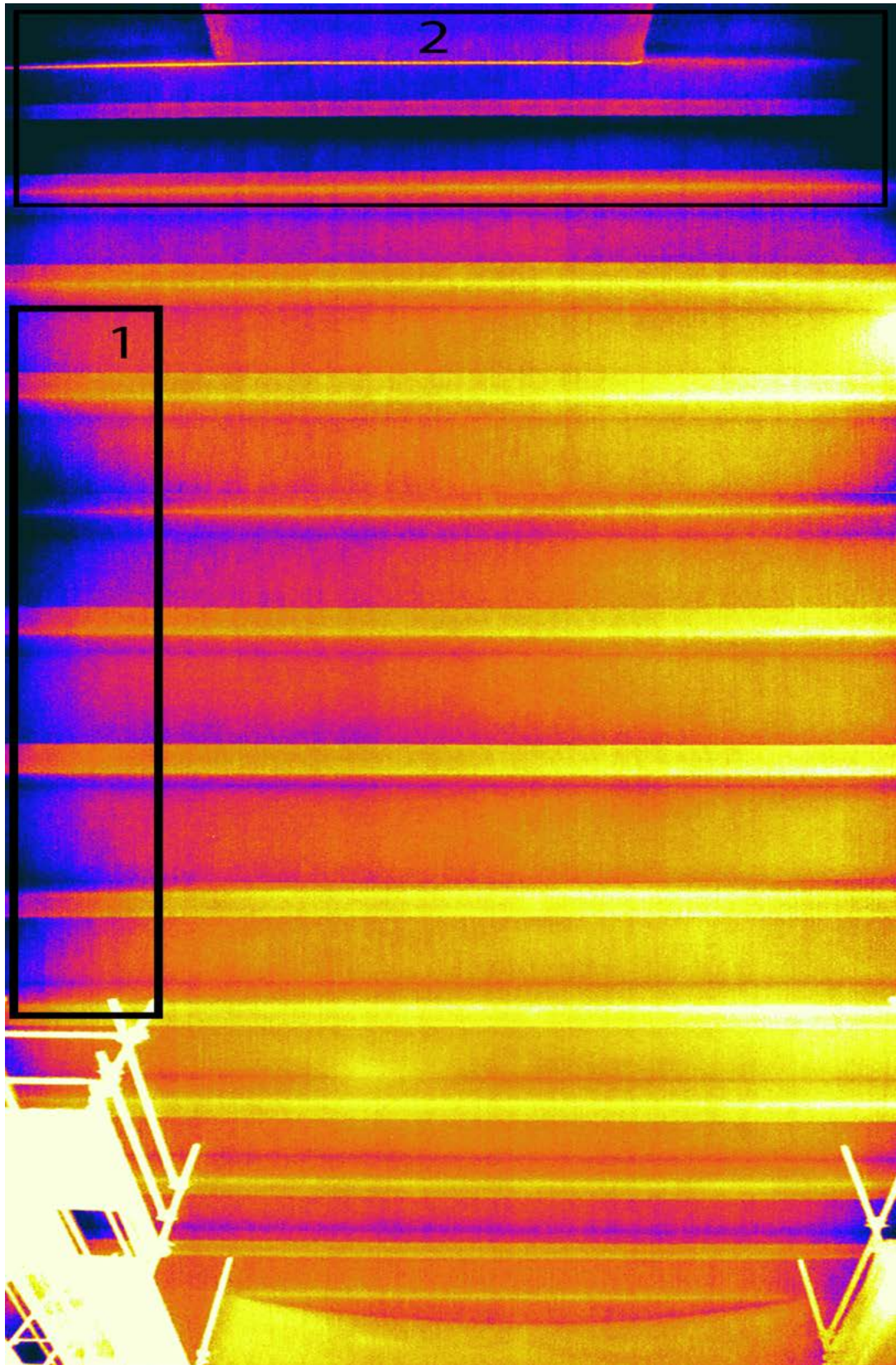


Figure 3.2.15 - Critical areas of the ceiling.

(1) North part of the ceiling has lower temperature compared to the south part, mostly because of the temperature increase during the day, due to the large window.

(2) Similar comparison can be made for the east part of the ceiling, this difference could be related to the fresco on the wall.

3.3 - Psychrometric analysis

3.3.1 - Psychrometric data on March 10 at 11.00am

Point on Ground	X axis	Y axis	Temperature	Relative Humidity	Specific Humidity
1	770	0	21.4	32.1	5.1
2	620	0	21.3	31.4	5.0
3	470	0	21.5	30.6	4.9
4	320	0	21.4	31.5	5.0
5	170	0	21.4	31.2	5.0
6	0	150	21.4	31.1	5.0
7	0	150	21.6	30.4	4.9
8	170	150	21.3	31.5	5.0
9	320	150	21.2	31.9	5.0
10	470	150	21.1	32.5	5.1
11	620	150	21.1	31.8	5.0
12	770	300	21.3	31.0	4.9
13	770	300	21.7	30.6	5.0
14	620	300	22.0	30.9	5.1
15	470	300	21.4	32.1	5.1
16	320	300	21.3	31.9	5.0
17	170	300	21.3	31.8	5.0
18	0	450	21.5	30.7	4.9
19	0	450	21.4	32.3	5.1
20	170	450	21.3	31.5	5.0
21	320	450	21.3	31.6	5.0
22	470	450	21.3	31.5	5.0
23	620	450	21.6	30.5	4.9
24	770	600	21.7	30.8	5.0
25	770	600	21.4	31.6	5.0
26	620	600	21.4	31.6	5.0

SURVEY AND DIAGNOSTICS

27	470	600	21.4	31.6	5.0
28	320	600	21.6	31.3	5.0
29	170	600	21.5	31.5	5.1
30	0	750	21.5	31.3	5.0
31	0	750	21.3	31.9	5.1
32	170	750	21.6	30.6	4.9
33	320	750	21.6	31.4	5.1
34	470	750	21.6	31.4	5.1
35	620	750	21.7	30.8	5.0
36	770	900	21.7	30.6	5.0
37	770	900	21.7	30.6	5.0
38	620	900	21.5	31.6	5.1
39	470	900	21.5	31.3	5.0
40	320	900	21.6	30.9	5.0
41	170	900	21.5	32.4	5.2
42	0	1050	21.6	31.2	5.0
43	0	1050	21.6	31.4	5.1
44	170	1050	21.5	31.1	5.0
45	320	1050	21.3	32.3	5.1
46	470	1050	21.3	32.0	5.1
47	620	1050	21.7	30.5	4.9
48	770	1050	21.9	30.0	4.9
49	770	1170	21.6	31.5	5.1
50	620	1170	21.3	31.8	5.0
51	470	1170	21.3	32.0	5.1
52	320	1170	21.4	31.8	5.1
53	170	1170	21.5	31.0	5.0
54	0	1170	21.5	31.0	5.0

External Data: temperature 13.5°C, relative humidity 52.6%

This data shows that, there are colder areas near the fresco and near the entrance door. This could be related to damages on fresco and the door. Also internal temperature is approximately 8°C higher than external temperature.

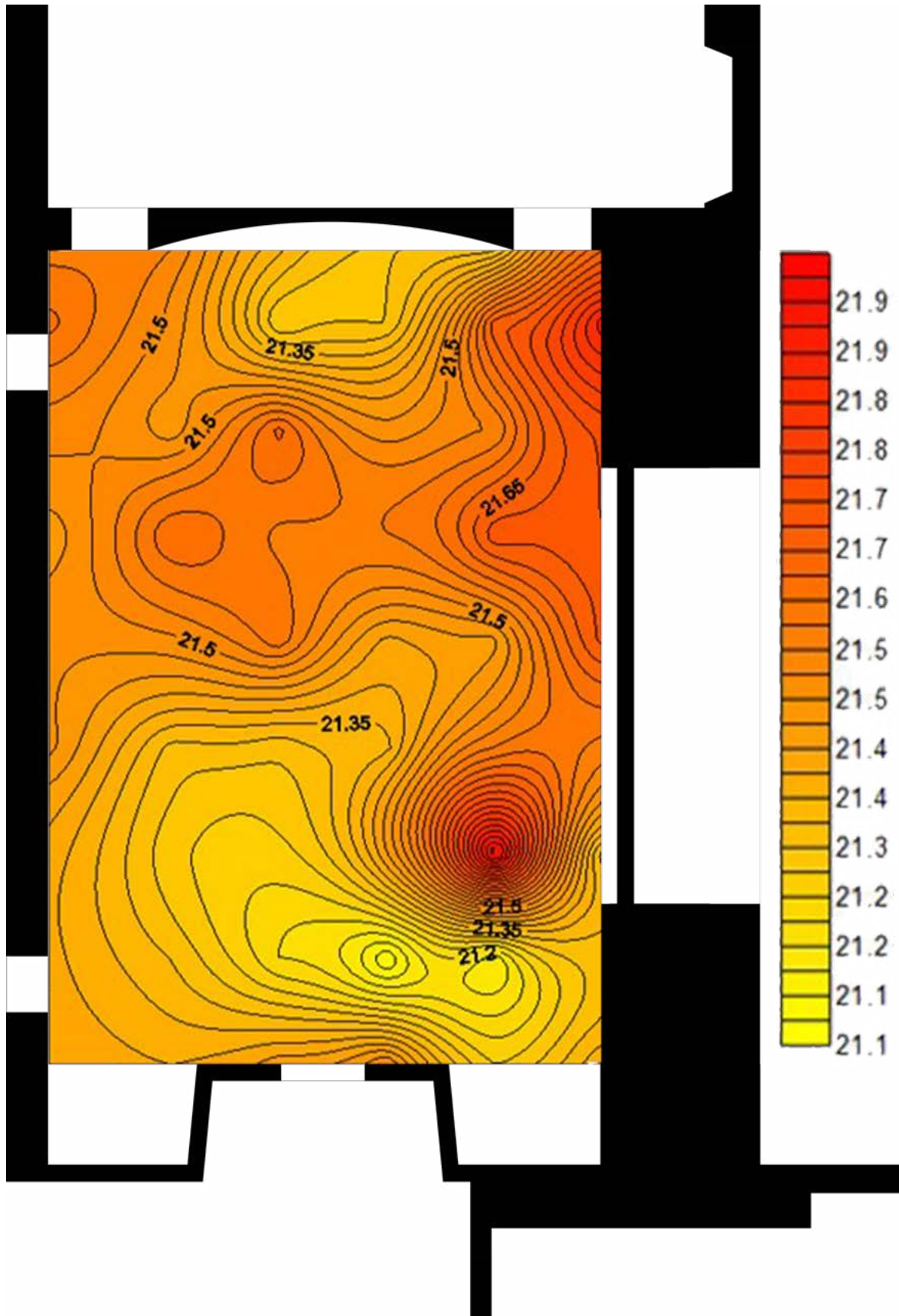


Figure 3.3.1 - Temperature on March 10 at 11.00am.

Relative humidity gets reduced near the window and doors in general. Internal relative humidity is around 20% less than external humidity.

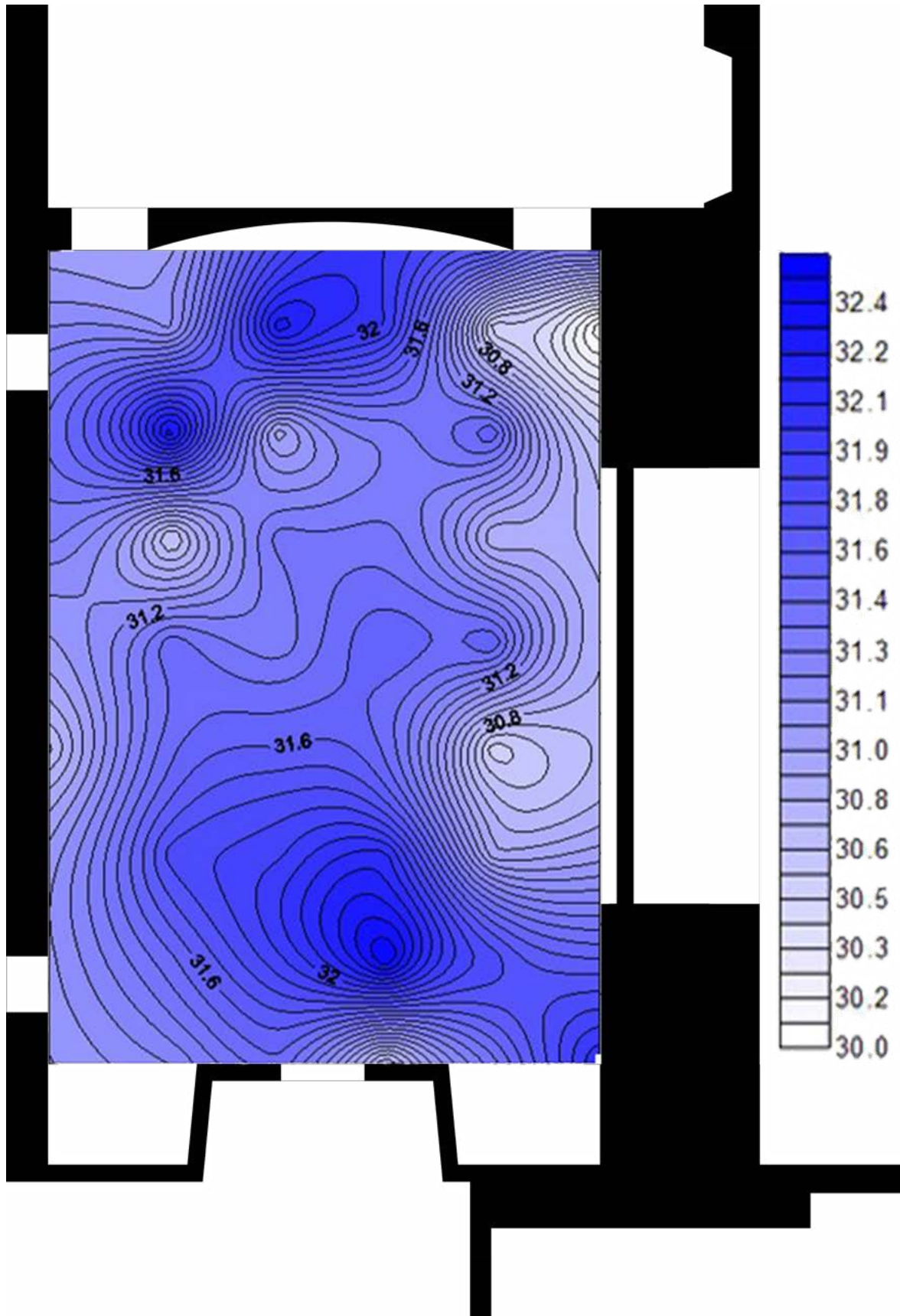


Figure 3.3.2 - Relative humidity on March 10 at 11.00am.

Specific humidity graph has a similar result with relative humidity graph. It gets lower at the parts that closer to window and doors.

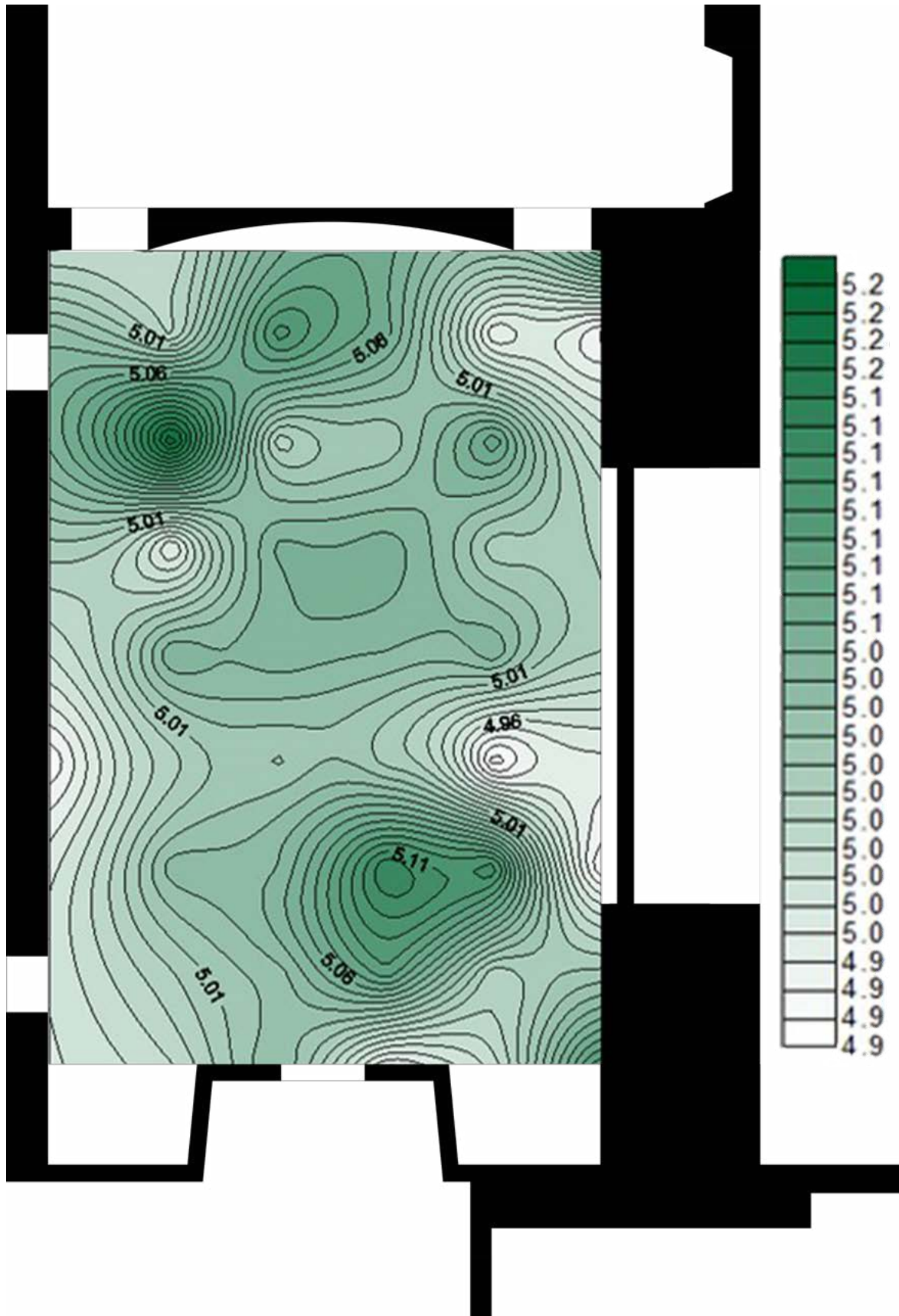


Figure 3.3.3 - Specific humidity on March 10 at 11.00am.

3.3.2 - Psychrometric data on March 10 at 5.00pm

Point on Ground	X axis	Y axis	Temperature	Relative Humidity	Specific Humidity
1	770	0	21.7	31.4	6.4
2	620	0	21.6	31.5	5.6
3	470	0	21.7	31.6	5.1
4	320	0	21.7	30.3	4.9
5	170	0	21.8	29.7	4.9
6	0	150	21.9	28.7	4.7
7	0	150	21.7	29.2	4.8
8	170	150	21.6	29.2	4.7
9	320	150	21.6	29.1	4.7
10	470	150	21.6	29.1	4.7
11	620	150	21.6	28.7	4.7
12	770	300	21.5	29.4	4.7
13	770	300	21.8	28.2	4.6
14	620	300	22.0	27.8	4.6
15	470	300	21.7	29.2	4.8
16	320	300	21.4	30.0	4.8
17	170	300	21.5	29.1	4.7
18	0	450	21.5	29.4	4.7
19	0	450	21.6	28.6	4.6
20	170	450	21.6	28.9	4.7
21	320	450	21.5	29.1	4.7
22	470	450	21.6	28.5	4.6
23	620	450	21.6	28.6	4.6
24	770	600	21.8	28.2	4.6
25	770	600	22.0	27.9	4.6
26	620	600	21.8	29.0	4.7
27	470	600	21.6	29.9	4.8

SURVEY AND DIAGNOSTICS

28	320	600	21.3	30.4	4.8
29	170	600	21.4	29.9	4.8
30	0	750	21.5	29.4	4.7
31	0	750	21.5	29.3	4.7
32	170	750	21.5	29.3	4.7
33	320	750	21.5	29.1	4.7
34	470	750	21.5	29.0	4.7
35	620	750	21.5	28.9	4.7
36	770	900	21.5	29.1	4.7
37	770	900	21.8	28.5	4.7
38	620	900	21.7	28.7	4.7
39	470	900	21.7	29.0	4.7
40	320	900	21.7	28.8	4.7
41	170	900	21.6	29.2	4.7
42	0	1050	21.6	29.2	4.7
43	0	1050	21.6	29.0	4.7
44	170	1050	21.7	28.7	4.7
45	320	1050	21.8	28.6	4.7
46	470	1050	21.7	28.8	4.7
47	620	1050	21.7	29.4	4.8
48	770	1050	21.6	29.0	4.7
49	770	1170	21.6	30.2	4.9
50	620	1170	21.7	29.8	4.8
51	470	1170	21.6	30.1	4.9
52	320	1170	21.5	30.1	4.9
53	170	1170	21.6	29.7	4.8
54	0	1170	21.7	29.2	4.8

External Data: temperature 17°C, relative humidity 40.4%

At night time, colder spots gets hotter, yet the north wall side gets colder. This might be related with potential heat loss. The external temperature gets increased during the day, yet the difference is still approximately 4°C less than internal temperature.

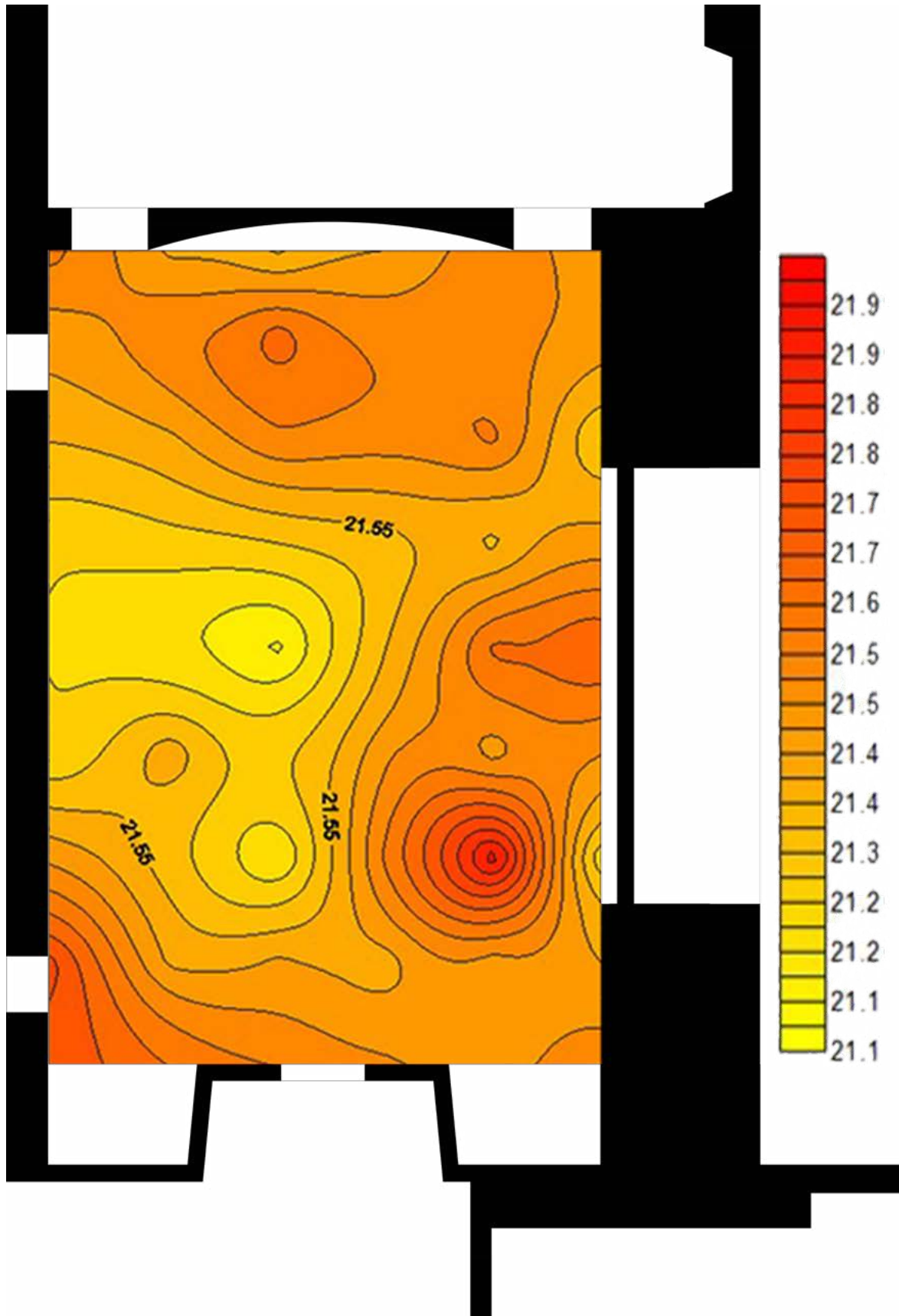


Figure 3.3.4 - Temperature on March 10 at 5.00pm.

Afternoon graph has similar results with morning graph, yet the internal relative humidity reduced around 2%, while external relative humidity reduced around 12% during the day.

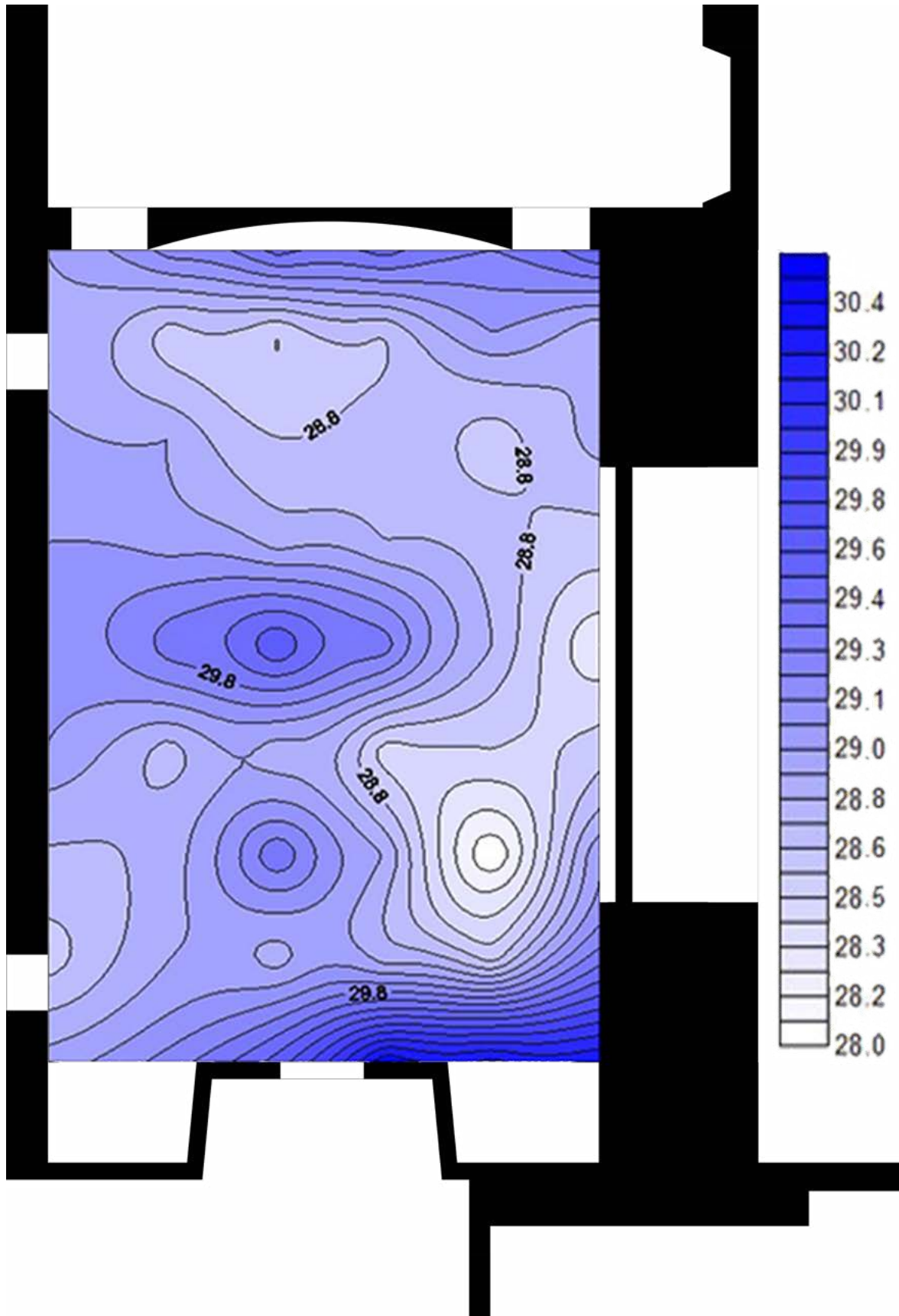


Figure 3.3.5 - Relative humidity on March 10 at 5.00pm.

Specific humidity graph in the afternoon is also similar to the morning graph, yet there are more areas with lower specific humidity compared to the morning graph.

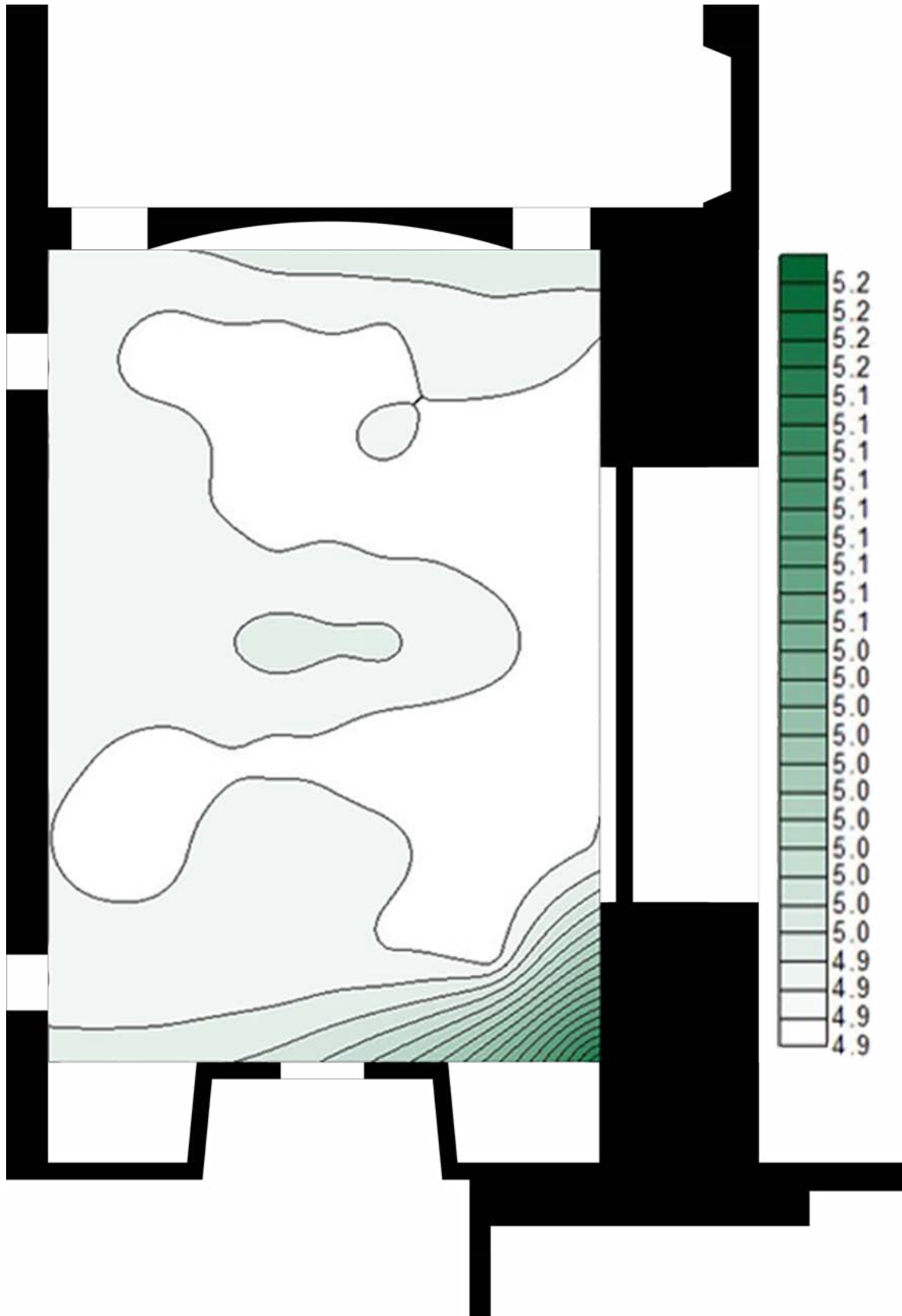


Figure 3.3.6 - Specific humidity on March 10 at 5.00pm.

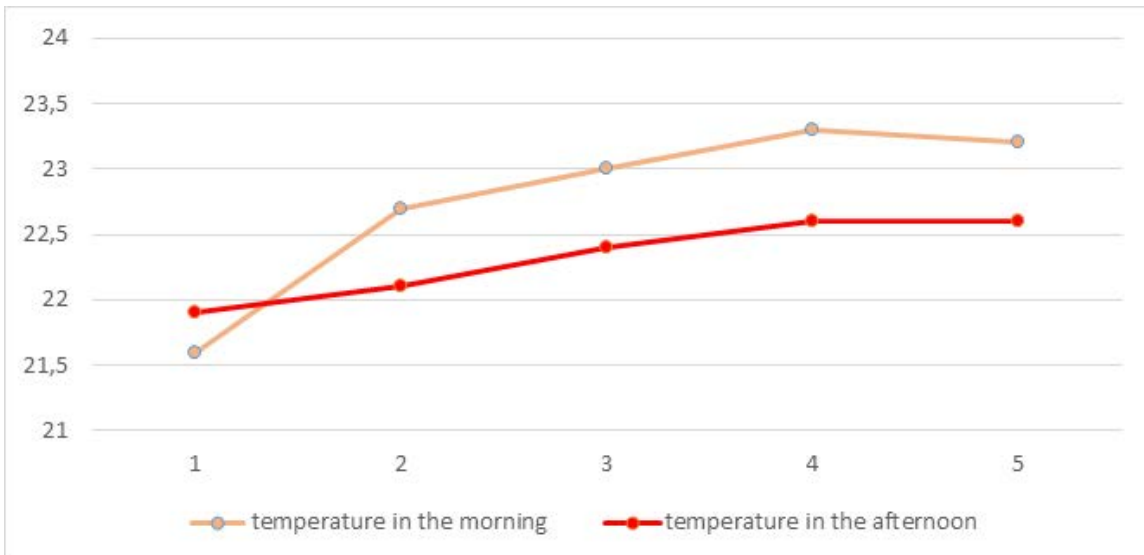


Figure 3.3.7 - Morning and afternoon comparison of temperature on March 10.

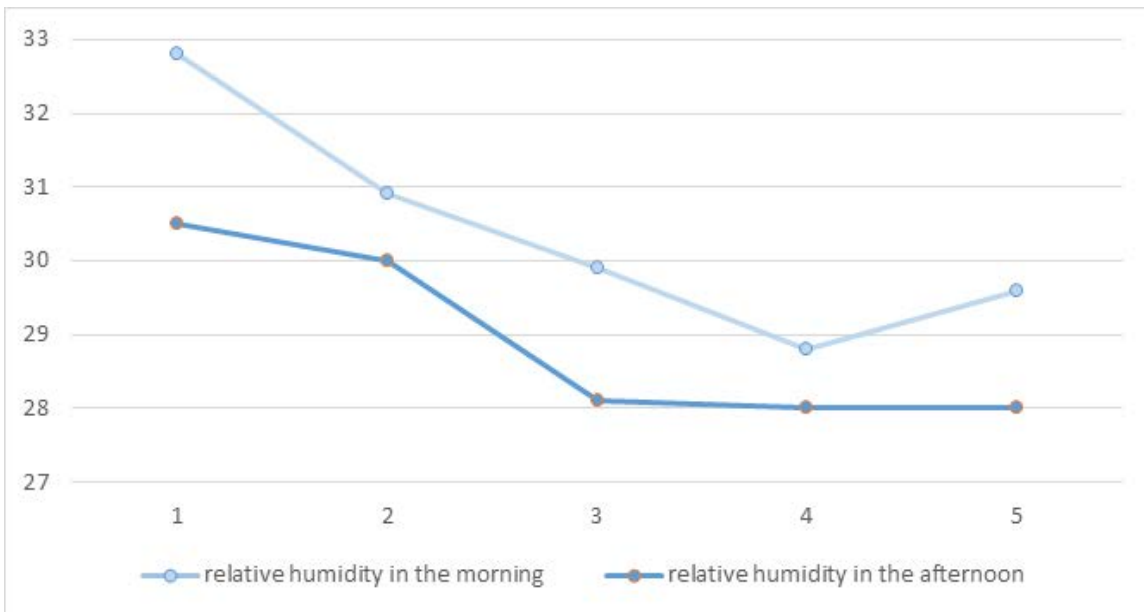


Figure 3.3.8 - Morning and afternoon comparison of relative humidity on March 10.

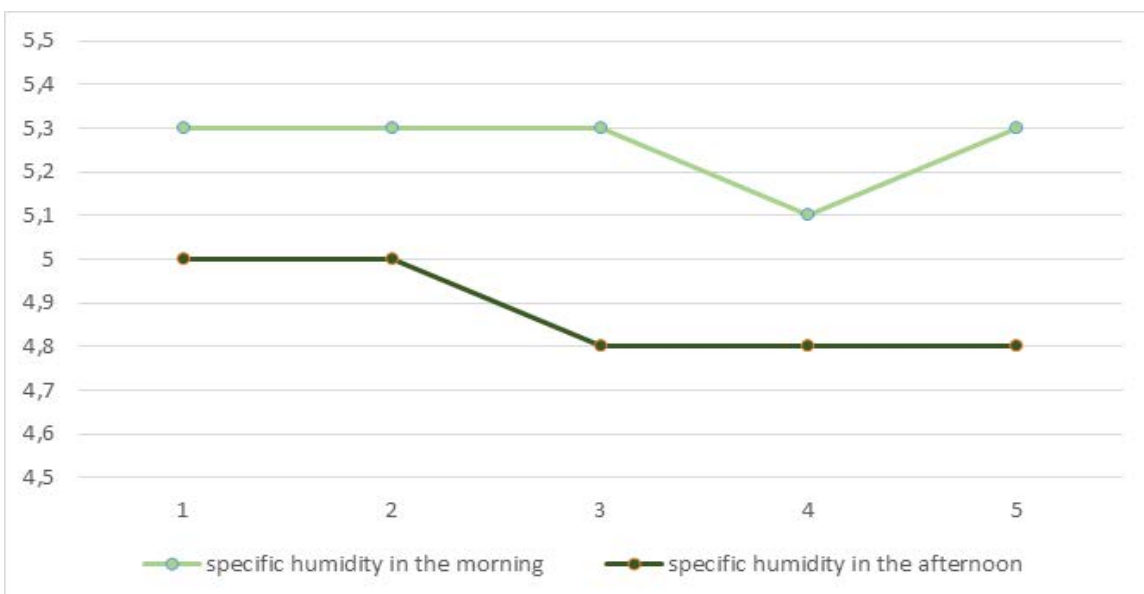


Figure 3.3.9 - Morning and afternoon comparison of specific humidity on March 10.

3.3.3 - Psychrometric data on April 21 at 11.00am

Point on Ground	X axis	Y axis	Temperature	Relative Humidity	Specific Humidity
1	770	0	22.1	32.2	5.3
2	620	0	21.9	31.7	5.1
3	470	0	22.0	30.6	5.0
4	320	0	22.1	30.1	4.9
5	170	0	22.1	30.1	4.9
6	0	150	22.2	29.6	4.9
7	0	150	22.0	30	4.9
8	170	150	22.0	30	4.9
9	320	150	22.1	30	4.9
10	470	150	22.0	30.2	4.9
11	620	150	22.2	30	4.9
12	770	300	22.1	30.1	5.0
13	770	300	22.0	30.9	5.0
14	620	300	21.9	30.6	5.0
15	470	300	22.4	29.5	4.9
16	320	300	22.2	30.6	5.1
17	170	300	22.1	30.6	5.0
18	0	450	22.2	30.5	5.0
19	0	450	22.0	31.1	5.1
20	170	450	21.9	31.4	5.1
21	320	450	21.9	31.3	5.1
22	470	450	21.9	30.6	5.0
23	620	450	22.1	30.2	5.0
24	770	600	22.0	31	5.1
25	770	600	22.1	30.6	5.0
26	620	600	22.1	30.7	5.0
27	470	600	22.1	30.7	5.0

SURVEY AND DIAGNOSTICS

28	320	600	22.2	30.5	5.0
29	170	600	22.2	30.3	5.0
30	0	750	22.1	30.6	5.0
31	0	750	22.0	31.3	5.1
32	170	750	22.0	31.3	5.1
33	320	750	22.0	31.1	5.1
34	470	750	22.0	31.1	5.1
35	620	750	22.1	31	5.1
36	770	900	22.2	30.5	5.0
37	770	900	22.1	30.7	5.0
38	620	900	22.2	30.2	5.0
39	470	900	22.0	31	5.1
40	320	900	22.0	31	5.1
41	170	900	22.1	30.7	5.0
42	0	1050	22.0	31.6	5.2
43	0	1050	22.1	32	5.2
44	170	1050	22.0	32	5.2
45	320	1050	21.9	31.9	5.2
46	470	1050	21.9	31.6	5.1
47	620	1050	22.0	31.8	5.2
48	770	1050	22.0	31.3	5.1
49	770	1170	22.1	30.9	5.1
50	620	1170	22.0	31	5.1
51	470	1170	22.1	31.9	5.2
52	320	1170	22.0	31.9	5.2
53	170	1170	22.1	31.6	5.2
54	0	1170	22.1	32.4	5.3

External Data: temperature 11°C, relative humidity 40%

Temperature difference between internal and external environment is between 10-11°C in the morning and it is very high. Internal temperature is almost the same with the March data, but external temperature is around 2.5°C higher in March.

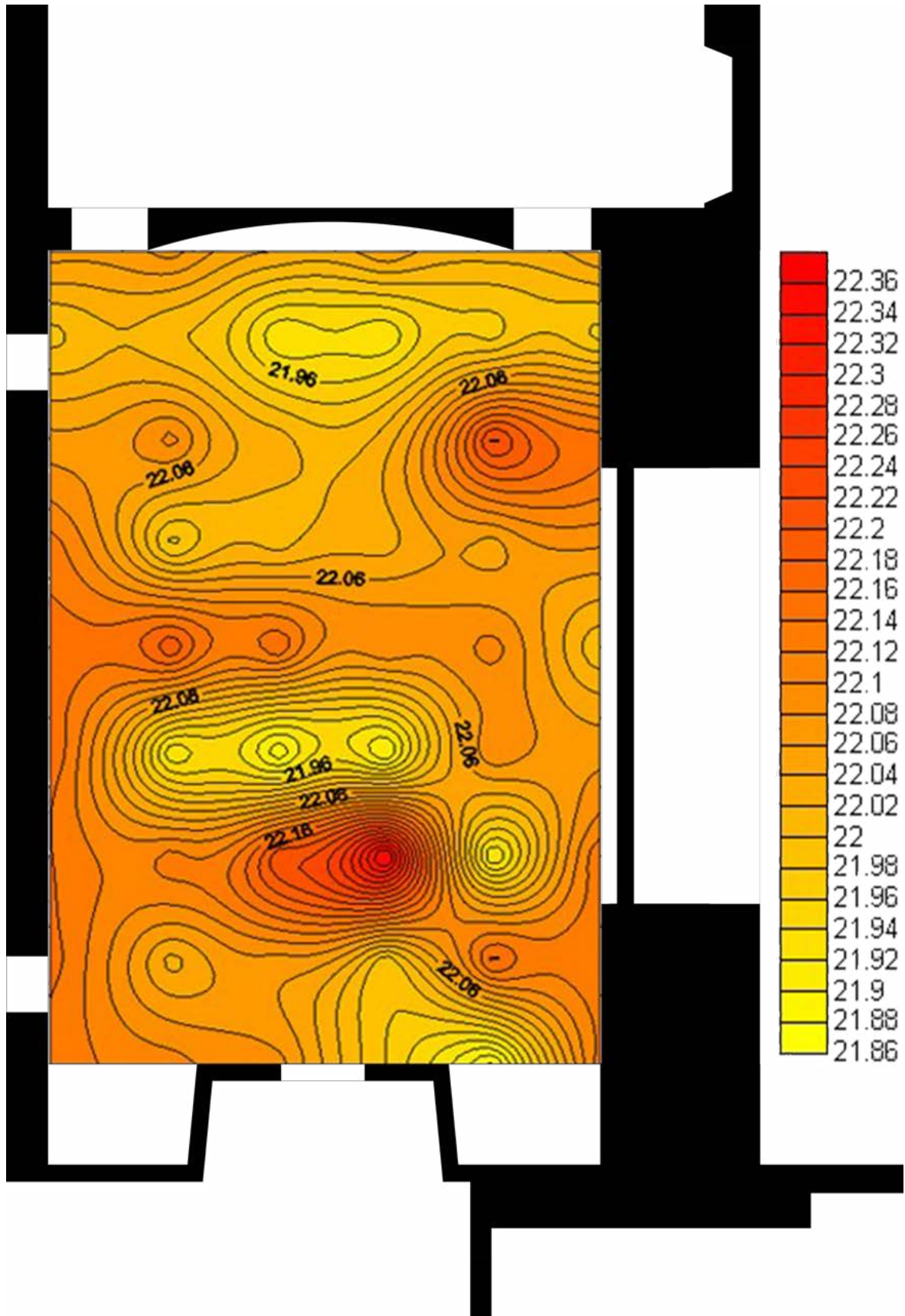


Figure 3.3.10 - Temperature on April 21 at 11.00am.

Relative humidity graph on March and April have similar results in the interior, but exterior relative humidity on March is 12% higher than exterior relative humidity on April.

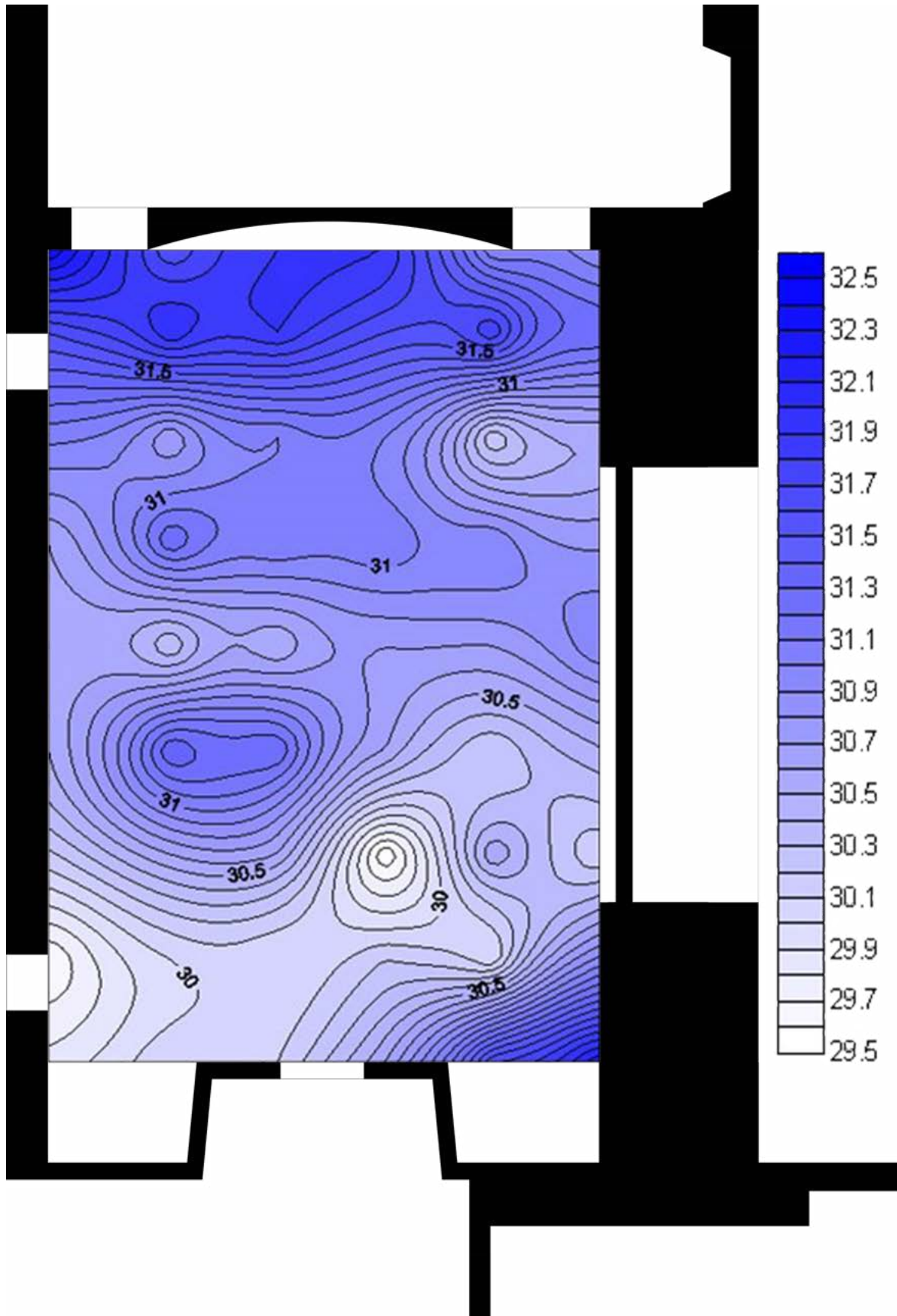


Figure 3.3.11 - Relative humidity on April 21 at 11.00am.

Specific humidity range on April is a little bit bigger than March graph. Other than that there are mostly similarities.

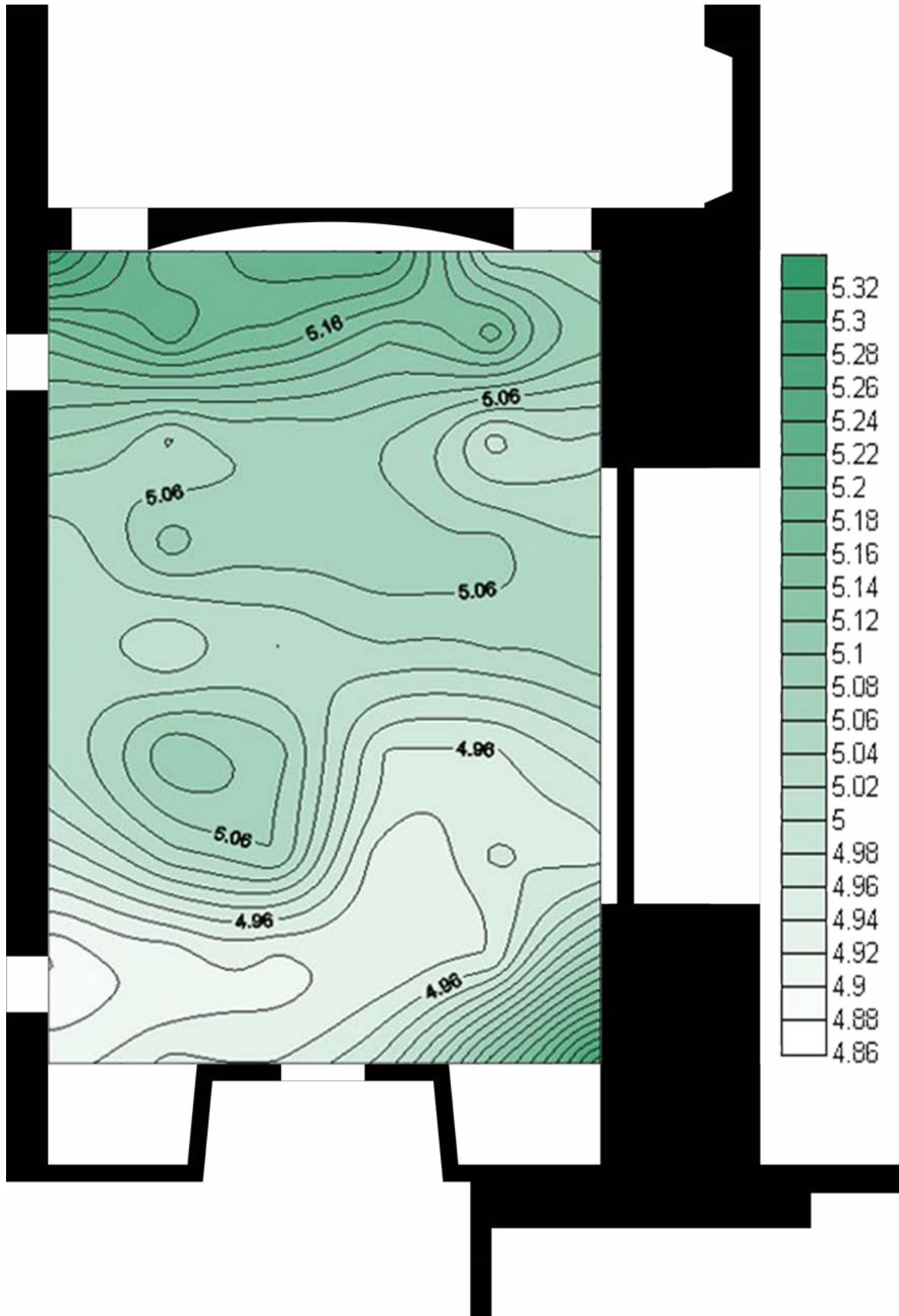


Figure 3.3.12 - Specific humidity on April 21 at 11.00am.

3.3.4 - Psychrometric data on April 21 at 5.00pm

Point on Ground	X axis	Y axis	Temperature	Relative Humidity	Specific Humidity
1	770	0	22.73	31.4	5.3
2	620	0	22.75	34.6	5.9
3	470	0	22.28	36.4	6.1
4	320	0	22.23	32.2	5.4
5	170	0	22.55	29.4	5.0
6	0	150	22.69	28.8	4.9
7	0	150	22.74	29	5.0
8	170	150	22.62	29.6	5.0
9	320	150	22.63	29.7	5.1
10	470	150	22.59	29.7	5.1
11	620	150	22.59	29.6	5.0
12	770	300	22.59	29.3	5.0
13	770	300	22.61	29.2	5.0
14	620	300	22.48	29.5	5.0
15	470	300	22.44	29.5	5.0
16	320	300	22.39	29.5	5.0
17	170	300	22.48	29.1	4.9
18	0	450	22.51	29	4.9
19	0	450	22.46	29.2	4.9
20	170	450	22.38	29.5	4.9
21	320	450	22.43	29.5	5.0
22	470	450	22.55	29.3	5.0
23	620	450	22.58	29.2	5.0
24	770	600	22.76	28.4	4.9
25	770	600	22.67	28.8	4.9
26	620	600	22.6	29.1	4.9
27	470	600	22.61	29.1	5.0

SURVEY AND DIAGNOSTICS

28	320	600	22.49	29.2	4.9
29	170	600	22.44	29.8	5.0
30	0	750	22.39	29.6	5.0
31	0	750	22.48	29.2	4.9
32	170	750	22.48	29.2	4.9
33	320	750	22.64	28.9	4.9
34	470	750	22.63	29	4.9
35	620	750	22.51	29.5	5.0
36	770	900	22.56	29.2	5.0
37	770	900	22.61	29.1	5.0
38	620	900	22.63	29	4.9
39	470	900	22.48	30.1	5.1
40	320	900	22.5	30	5.1
41	170	900	22.43	29.9	5.0
42	0	1050	22.43	29.9	5.0
43	0	1050	22.41	30	5.0
44	170	1050	22.47	30	5.1
45	320	1050	22.76	30.4	5.2
46	470	1050	22.41	30.9	5.2
47	620	1050	22.51	30.1	5.1
48	770	1050	22.49	30	5.1
49	770	1170	22.44	30.3	5.1
50	620	1170	22.44	29.9	5.0
51	470	1170	22.25	30.3	5.0
52	320	1170	22.62	29	4.9
53	170	1170	22.44	29.8	5.0
54	0	1170	22.49	29.6	5.0

External Data: temperature 11, relative humidity 40%

Interior and exterior temperature in the morning and the afternoon mostly remains the same throughout the day.

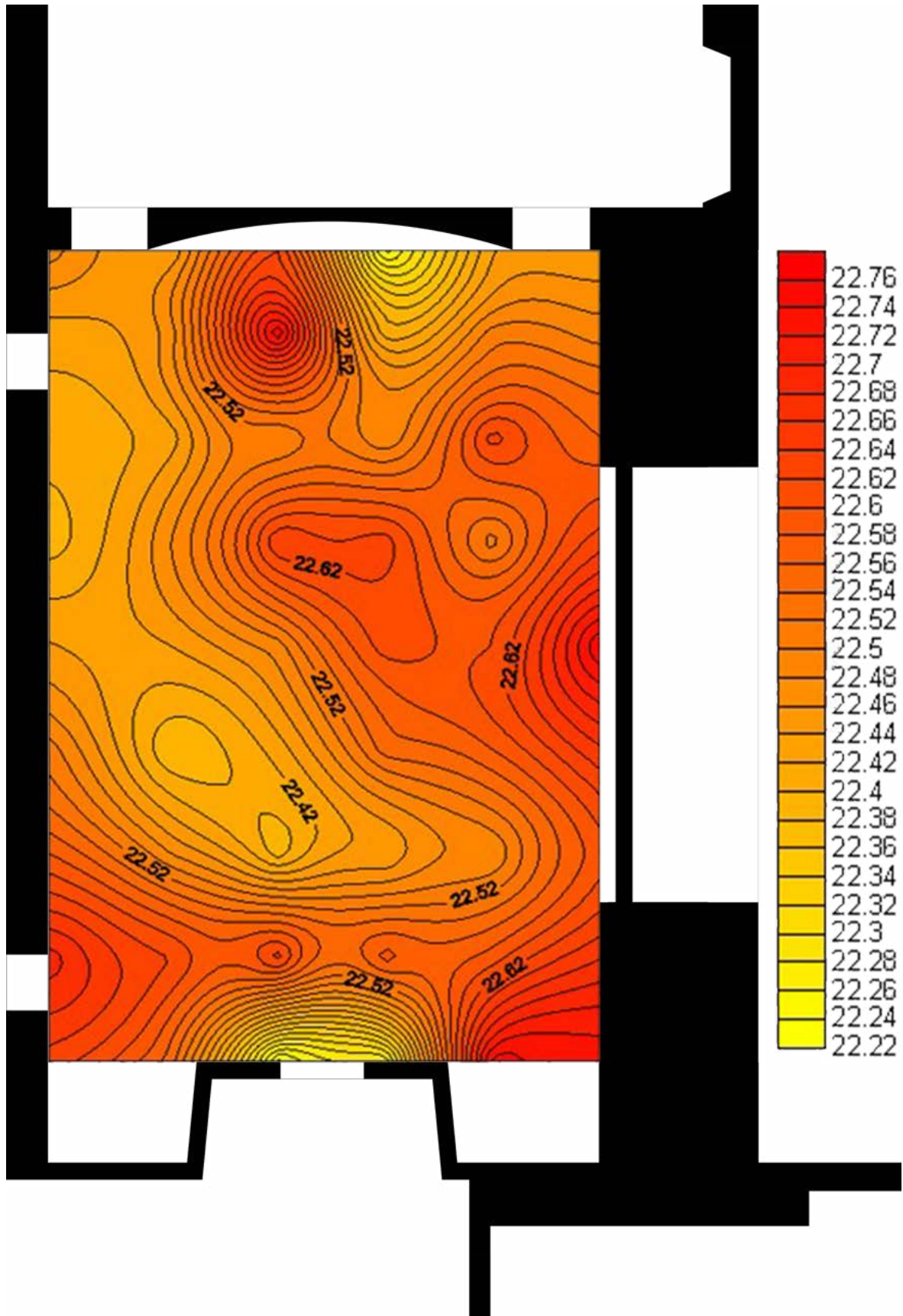


Figure 3.3.13 - Temperature on April 21 at 5.00pm.

Range of the interior relative humidity increases in the afternoon, as the difference between minimum and maximum gets to 8.5%. Also the maximum interior relative humidity gets closer to exterior relative humidity

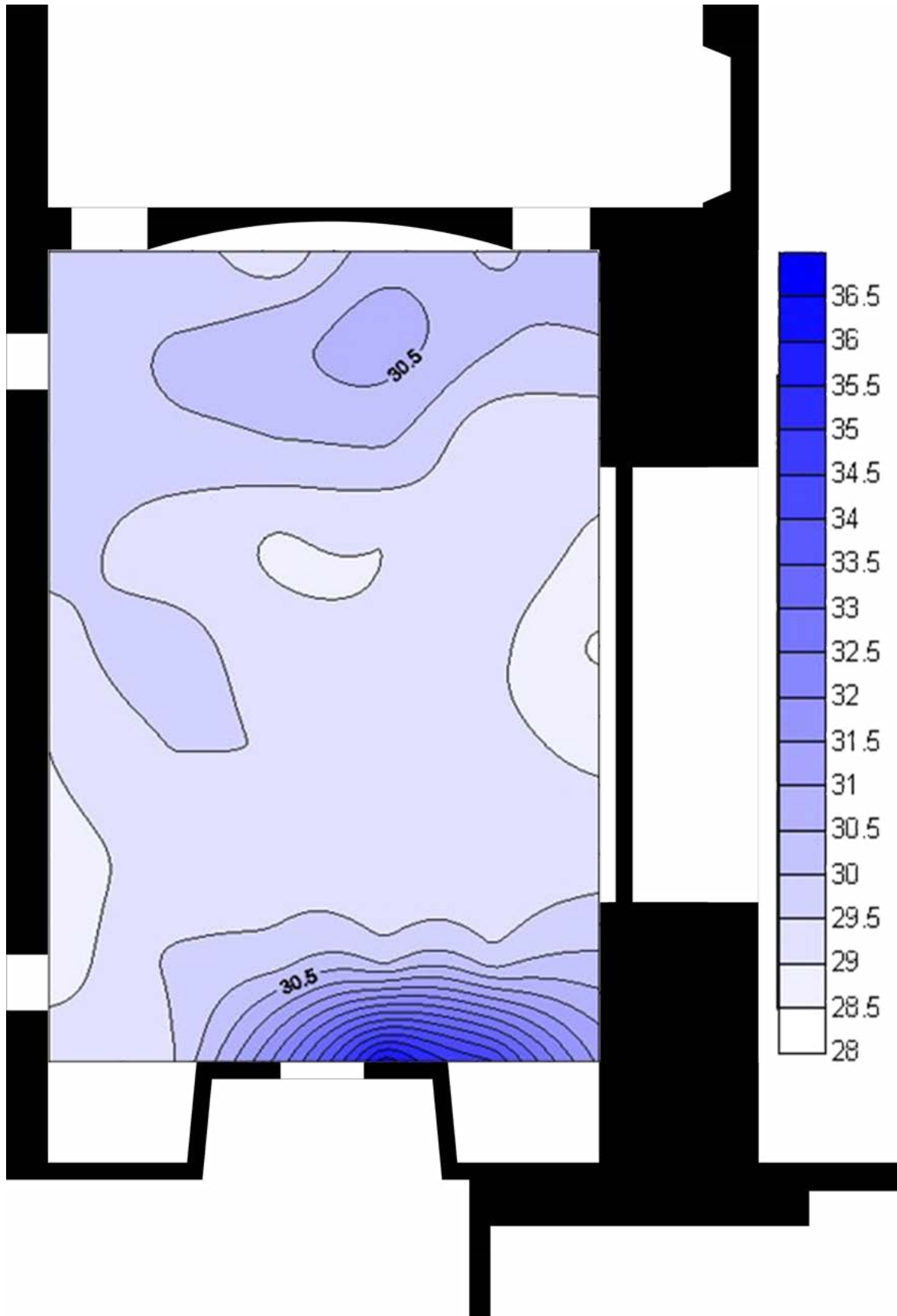


Figure 3.3.14 - Relative humidity on April 21 at 5.00pm.

Specific humidity range in the afternoon increases compared to the range in the morning. Other than that, the results are pretty similar.

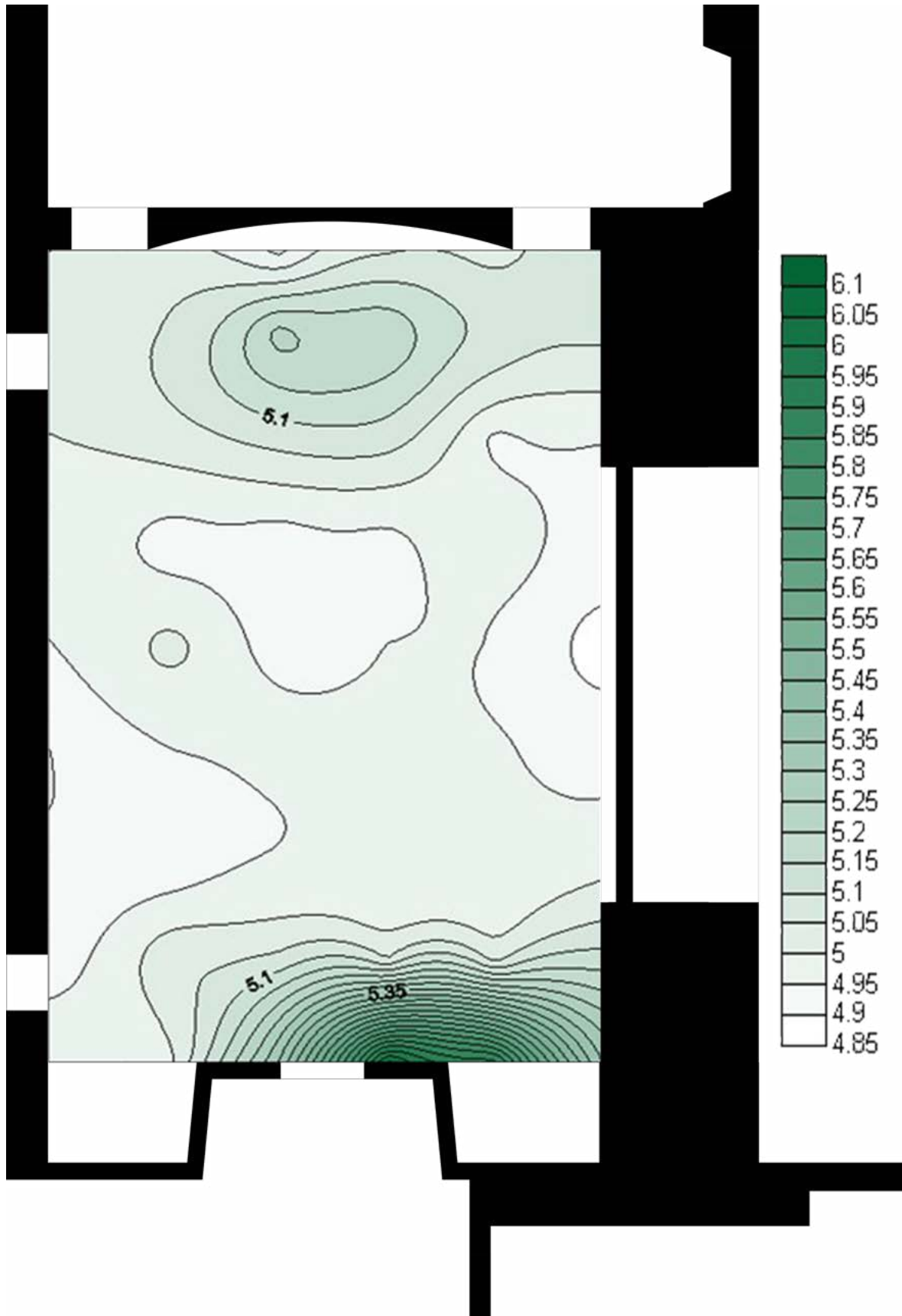


Figure 3.3.15 - Specific humidity on April 21 at 5.00pm.

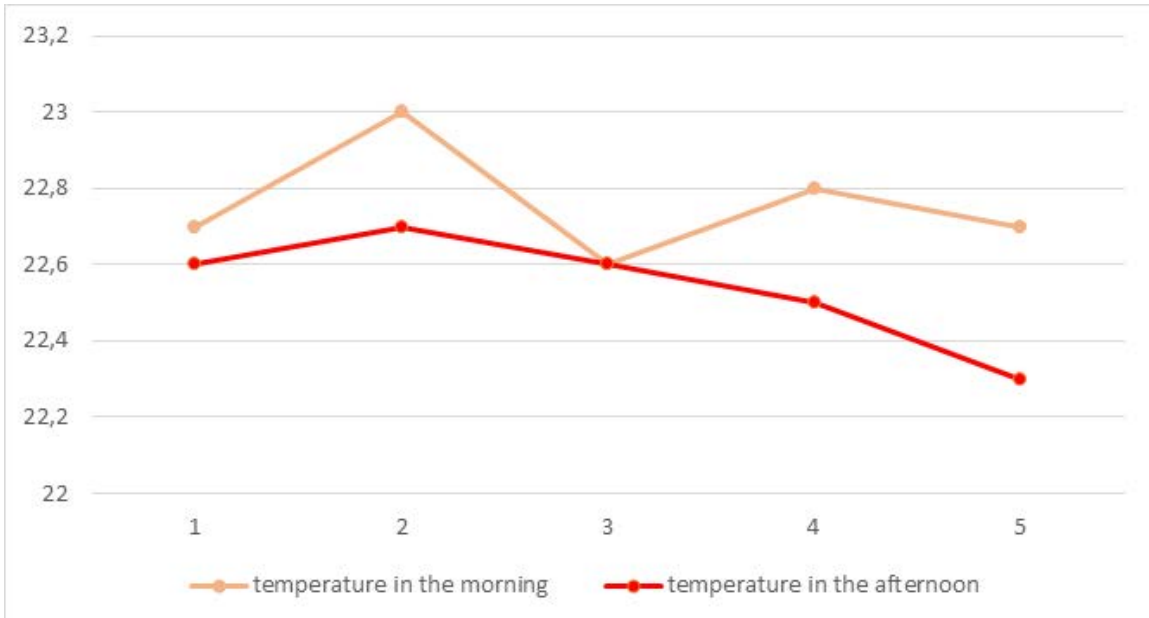


Figure 3.3.16 - Morning and afternoon comparison of temperature on April 21.

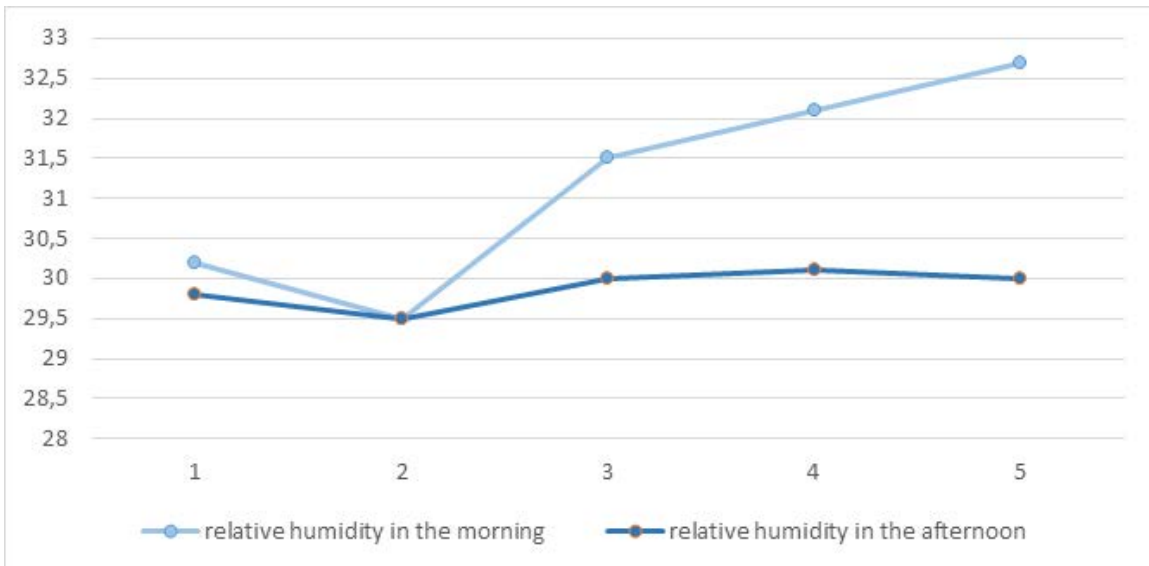


Figure 3.3.17 - Morning and afternoon comparison of relative humidity on April 21.

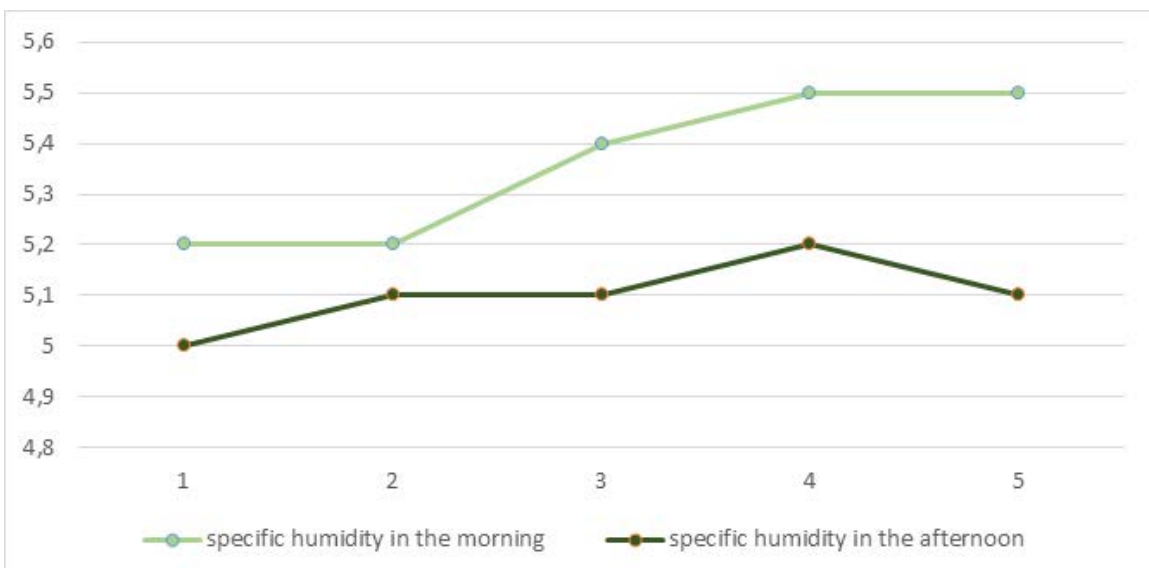


Figure 3.3.18 - Morning and afternoon comparison of specific humidity on April 21.

3.3.5 - Psychrometric data on July 22 at 11.00am

Point on Ground	X axis	Y axis	Temperature	Relative Humidity	Specific Humidity
1	770	0	28,92	32,2	13,67
2	620	0	28,94	31,7	12,74
3	470	0	29	30,6	12,41
4	320	0	29,07	30,1	12,41
5	170	0	29,05	30,1	12,29
6	0	150	28,99	29,6	12,25
7	0	150	29,05	30	12,27
8	170	150	29,07	30	12,28
9	320	150	29,06	30	12,27
10	470	150	29,02	30,2	12,26
11	620	150	28,97	30	12,12
12	770	300	29,1	30,1	12,29
13	770	300	29,01	30,9	12,25
14	620	300	29,05	30,6	12,15
15	470	300	29,05	29,5	12,15
16	320	300	29,07	30,6	12,27
17	170	300	29,11	30,6	12,32
18	0	450	28,96	30,5	12,41
19	0	450	28,98	31,1	12,13
20	170	450	28,94	31,4	12,28
21	320	450	28,95	31,3	12,16
22	470	450	28,99	30,6	12,14
23	620	450	29,03	30,2	12,26
24	770	600	29,09	31	12,28
25	770	600	29,07	30,6	12,14
26	620	600	29,13	30,7	12,20
27	470	600	29,17	30,7	12,33

SURVEY AND DIAGNOSTICS

28	320	600	29,16	30,5	12,33
29	170	600	29,01	30,3	12,28
30	0	750	29,01	30,6	12,21
31	0	750	29,15	31,3	12,20
32	170	750	29,25	31,3	12,27
33	320	750	29,2	31,1	12,35
34	470	750	29,07	31,1	12,29
35	620	750	29,07	31	12,27
36	770	900	29,08	30,5	12,24
37	770	900	29,06	30,7	12,15
38	620	900	29,07	30,2	12,14
39	470	900	28,95	31	12,15
40	320	900	28,99	31	12,11
41	170	900	29,06	30,7	12,12
42	0	1050	29,13	31,6	12,20
43	0	1050	29,01	32	12,36
44	170	1050	29,09	32	12,27
45	320	1050	29,03	31,9	12,25
46	470	1050	28,92	31,6	12,25
47	620	1050	28,97	31,8	12,11
48	770	1050	28,85	31,3	12,19
49	770	1170	29,03	30,9	12,23
50	620	1170	29,03	31	12,39
51	470	1170	29,02	31,9	12,40
52	320	1170	28,94	31,9	12,29
53	170	1170	28,94	31,6	12,41
54	0	1170	29,07	32,4	12,38

External Data: temperature 32.3°C, relative humidity 30.3%

This data shows that, there are colder areas near the fresco and near the entrance door. This could be related to damages on fresco and the door. Also internal temperature is approximately 4 lower than external temperature.

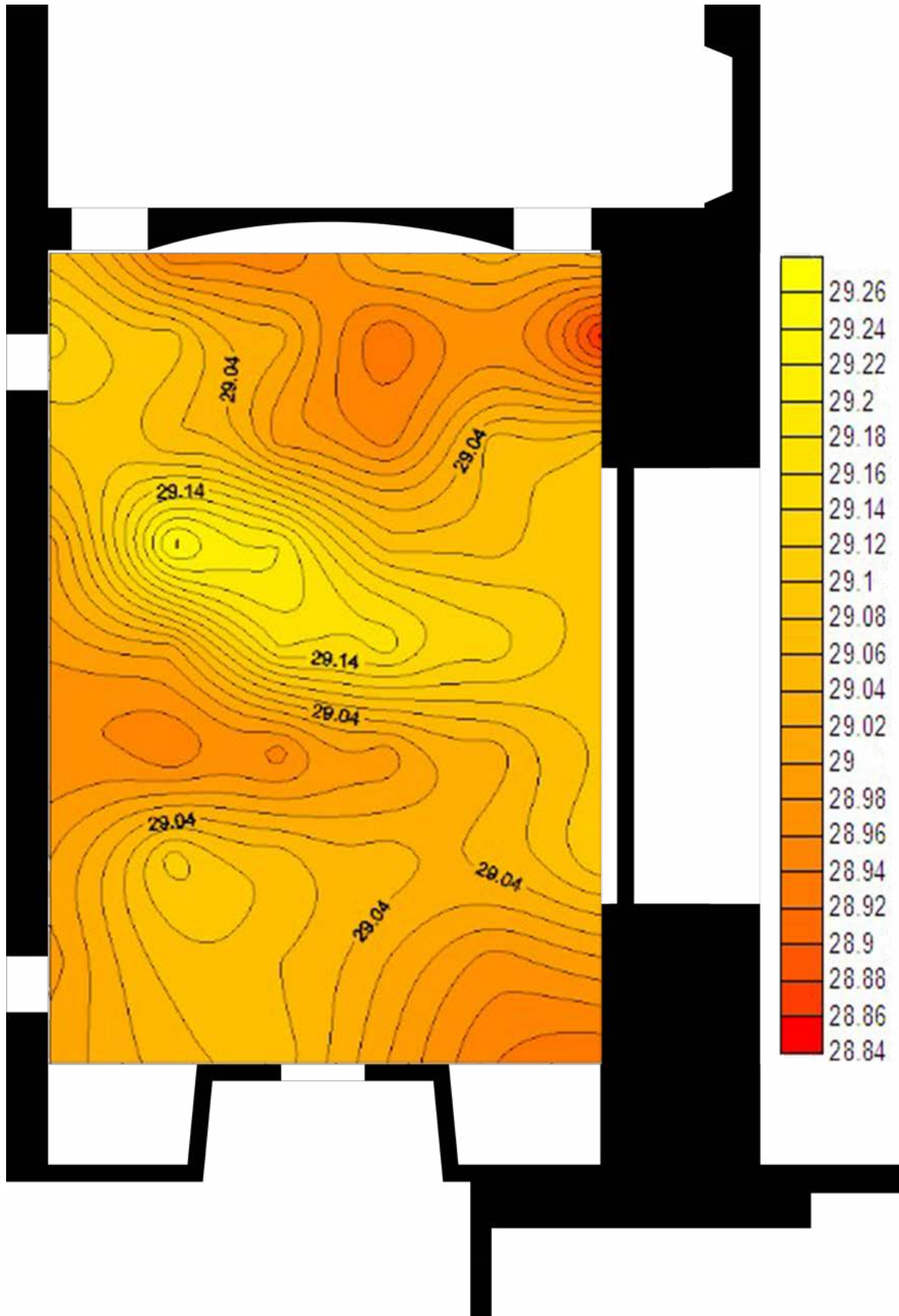


Figure 3.3.19 - Temperature on July 22 at 11.00am.

Relative humidity gets reduced near the window and doors in general. Internal relative humidity is around 22% higher than external humidity.

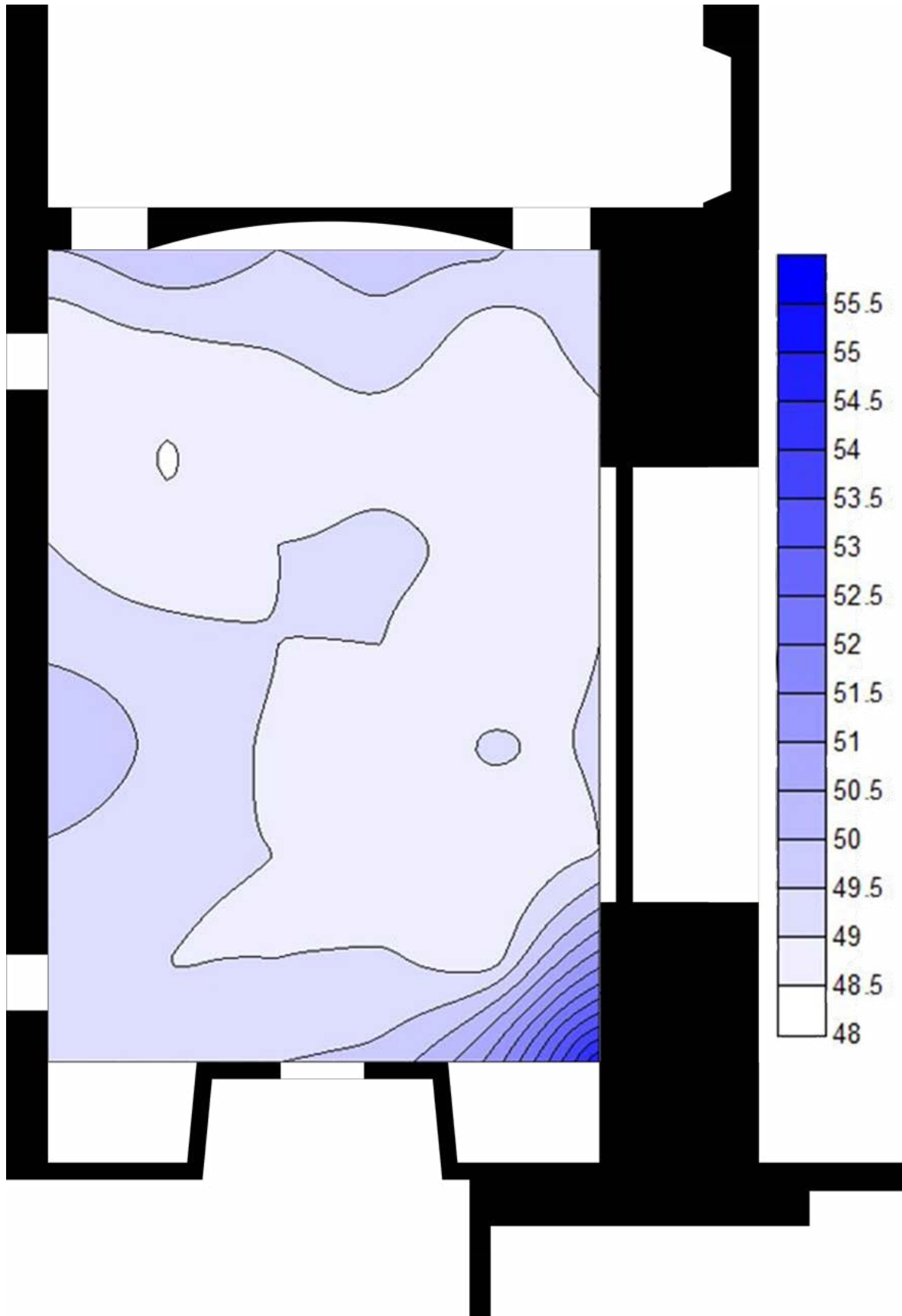


Figure 3.3.20 - Relative humidity on July 22 at 11.00am.

Specific humidity graph has a similar result with relative humidity graph. It gets lower at the parts closer to window and doors.

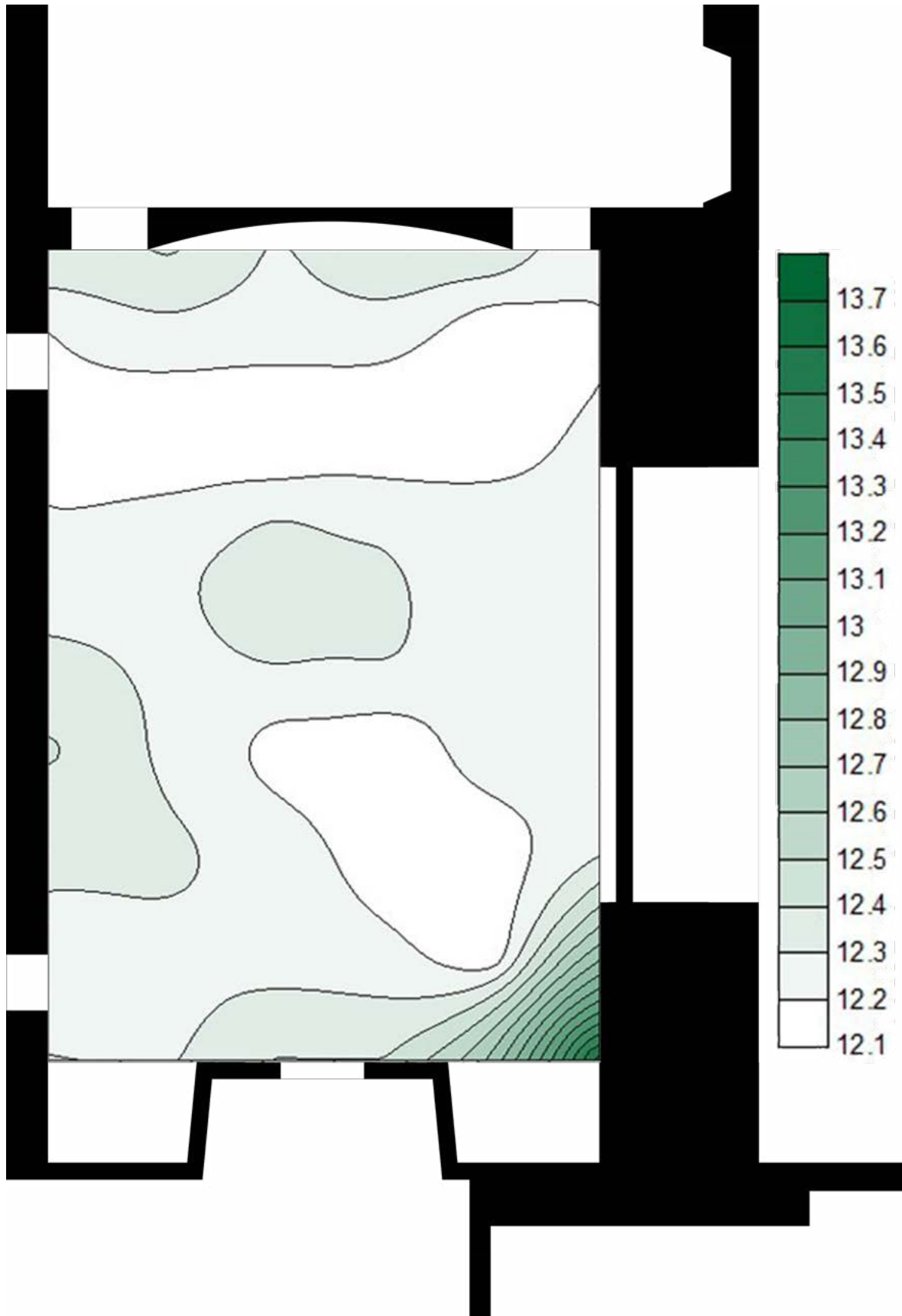


Figure 3.3.21 - Specific humidity on July 22 at 11.00am.

3.3.6 - Psychrometric data on July 22 at 5.00pm

Point on Ground	X axis	Y axis	Temperature	Relative Humidity	Specific Humidity
1	770	0	29,19	55,1	13,93
2	620	0	29,16	49,7	12,55
3	470	0	29,23	48,4	12,27
4	320	0	29,16	47,9	12,09
5	170	0	29,2	47,4	11,99
6	0	150	29,19	46,8	11,82
7	0	150	29,21	46,8	11,84
8	170	150	29,28	46,3	11,76
9	320	150	29,27	46,3	11,75
10	470	150	29,26	46,3	11,74
11	620	150	29,23	46,7	11,82
12	770	300	29,25	46,3	11,74
13	770	300	29,2	46,8	11,83
14	620	300	29,29	46,3	11,76
15	470	300	29,17	46,8	11,81
16	320	300	29,13	46,8	11,78
17	170	300	29,18	46,3	11,68
18	0	450	29,19	46,7	11,80
19	0	450	29,19	46,3	11,70
20	170	450	29,18	46,7	11,79
21	320	450	29,2	46,7	11,80
22	470	450	29,16	46,8	11,80
23	620	450	29,16	46,4	11,70
24	770	600	29,26	45,8	11,62
25	770	600	29,24	45,9	11,63
26	620	600	29,28	45,8	11,63
27	470	600	29,2	46,7	11,79

SURVEY AND DIAGNOSTICS

28	320	600	29,16	46,4	11,69
29	170	600	29,22	46,7	11,81
30	0	750	29,22	46,7	11,81
31	0	750	29,22	46,7	11,81
32	170	750	29,25	46,3	11,73
33	320	750	29,16	46,8	11,79
34	470	750	29,11	46,4	11,66
35	620	750	29,1	46,8	11,76
36	770	900	29,04	46,9	11,73
37	770	900	29,13	46,4	11,67
38	620	900	29,17	46,8	11,80
39	470	900	29,06	46,9	11,75
40	320	900	29,13	46,4	11,67
41	170	900	29,13	46,4	11,67
42	0	1050	29,21	46,7	11,80
43	0	1050	29,24	46,4	11,74
44	170	1050	29,13	46,9	11,80
45	320	1050	29,15	46,9	11,81
46	470	1050	29,16	46,8	11,79
47	620	1050	29,2	46,8	11,82
48	770	1050	29,18	47,3	11,93
49	770	1170	29,17	46,9	11,82
50	620	1170	29,32	46,8	11,90
51	470	1170	29,22	47,2	11,93
52	320	1170	29,22	47,2	11,93
53	170	1170	29,14	47,4	11,93
54	0	1170	29,31	46,7	11,87

External Data: temperature 36°C, relative humidity 40%

At night time, colder spots get hotter, yet the north wall side gets colder. This might be related with potential heat loss. The external temperature gets increased during the day, yet the difference is still approximately 4 higher than internal temperature.

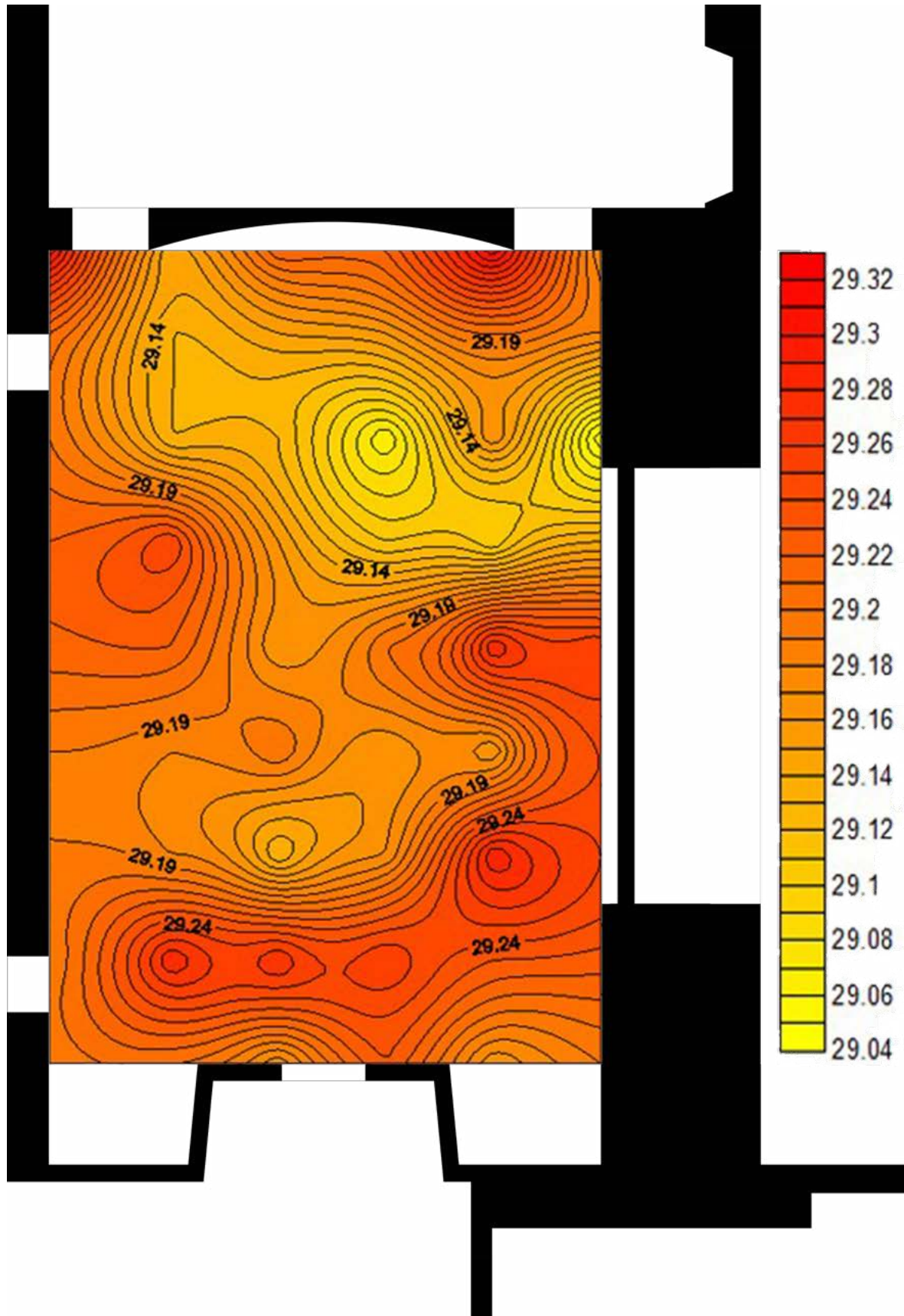


Figure 3.3.22 - Temperature on July 22 at 5.00pm.

Afternoon graph has similar results with morning one, yet the internal relative humidity reduced around 2.5%, while external relative humidity higher around 8% during the day.

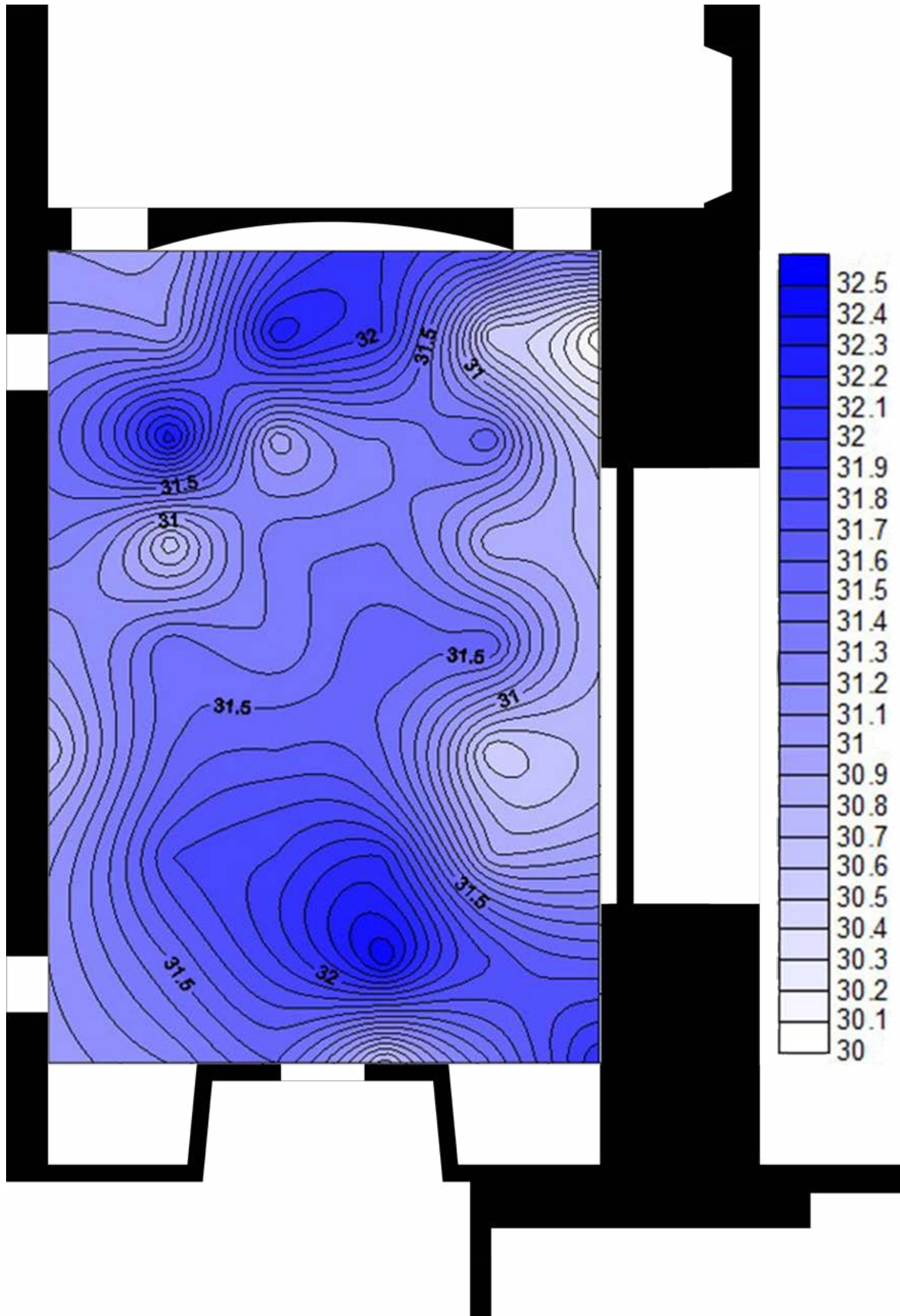


Figure 3.3.23 - Relative humidity on July 22 at 5.00pm.

Specific humidity graph in the afternoon is also similar to the morning graph, yet there are more areas with lower specific humidity compared to the morning graph.

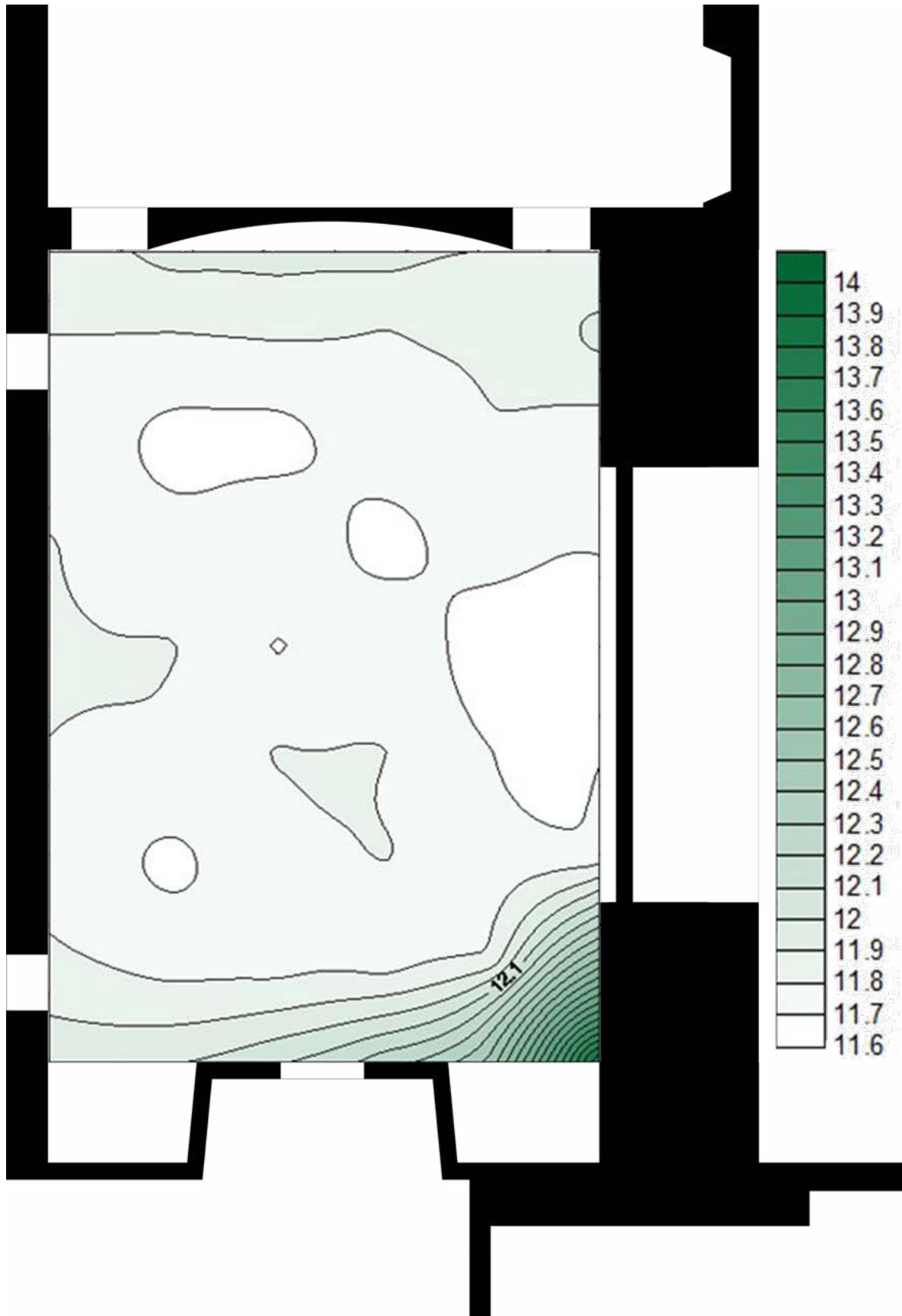


Figure 3.3.24 - Specific humidity on July 22 at 5.00pm.

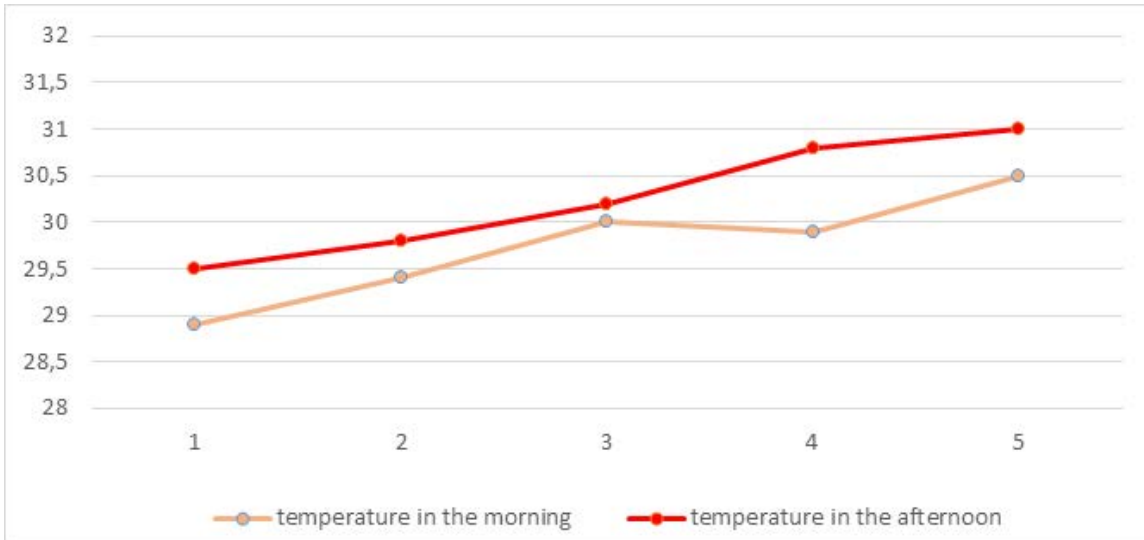


Figure 3.3.25 - Morning and afternoon comparison of temperature on July 22.

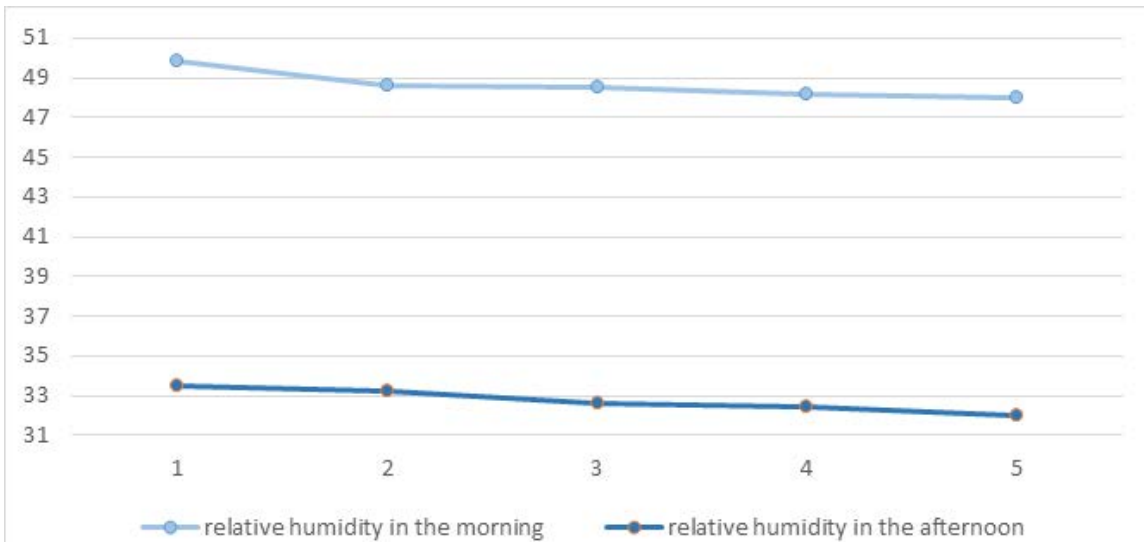


Figure 3.3.26 - Morning and afternoon comparison of relative humidity on July 22.

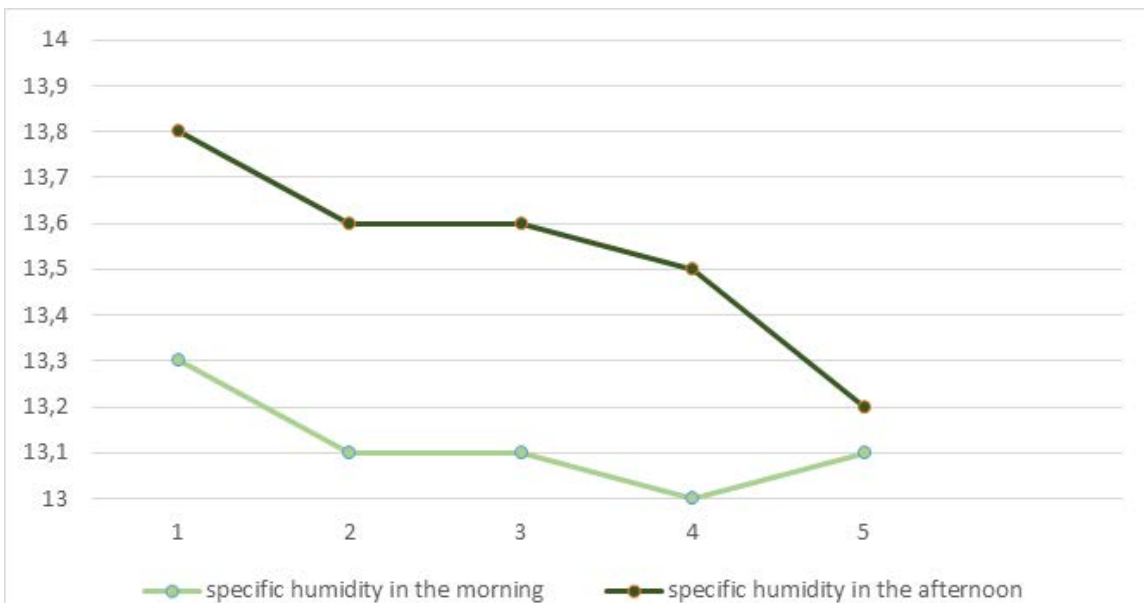


Figure 3.3.27 - Morning and afternoon comparison of specific humidity on July 22.

3.3.7 - Psychrometric data on October 28 at 11.00am

Point on Ground	X axis	Y axis	Temperature	Relative Humidity	Specific Humidity
1	770	0	18,84	52,5	7,01
2	620	0	18,58	54,9	7,21
3	470	0	19,09	52,3	7,09
4	320	0	18,84	53,2	7,10
5	170	0	18,87	53	7,09
6	0	150	18,6	54,7	7,19
7	0	150	18,48	54,8	7,15
8	170	150	18,56	54,1	7,09
9	320	150	18,51	54,8	7,16
10	470	150	18,55	54,7	7,17
11	620	150	18,48	54,8	7,15
12	770	300	18,28	55,7	7,18
13	770	300	18,51	55,3	7,23
14	620	300	18,64	54,6	7,19
15	470	300	18,55	54,6	7,15
16	320	300	18,6	54	7,09
17	170	300	18,71	53,4	7,07
18	0	450	18,95	52,3	7,03
19	0	450	18,98	53,6	7,21
20	170	450	18,75	53,9	7,14
21	320	450	19	52,9	7,12
22	470	450	18,92	53,4	7,15
23	620	450	19,12	52,1	7,07
24	770	600	19,17	51,6	7,02
25	770	600	18,96	53,6	7,20
26	620	600	19,09	52,7	7,14
27	470	600	19,13	52,7	7,15

SURVEY AND DIAGNOSTICS

28	320	600	19,09	52,8	7,15
29	170	600	18,89	54,1	7,23
30	0	750	18,78	55,5	7,37
31	0	750	19,18	52,7	7,18
32	170	750	19,38	51,4	7,09
33	320	750	19,06	53,5	7,23
34	470	750	19,12	53,3	7,23
35	620	750	19,36	52,3	7,20
36	770	900	19,42	51,9	7,17
37	770	900	19,4	52,5	7,25
38	620	900	19,45	52,5	7,27
39	470	900	19,46	52,9	7,32
40	320	900	19,42	52,9	7,31
41	170	900	19,49	52,4	7,27
42	0	1050	19,41	52,6	7,27
43	0	1050	19,21	53,2	7,26
44	170	1050	19,23	53,2	7,27
45	320	1050	19,21	53,2	7,26
46	470	1050	18,93	54,9	7,36
47	620	1050	19,04	54,1	7,30
48	770	1050	19,29	52,7	7,22
49	770	1170	19,35	53	7,29
50	620	1170	19,42	52,5	7,25
51	470	1170	19,39	52,6	7,26
52	320	1170	19,18	54	7,35
53	170	1170	19,13	54,4	7,38
54	0	1170	19,39	52,4	7,22

External Data: temperature 22.5°C, relative humidity 59.2%

This data shows that, there are colder areas near the fresco and near the entrance door. This could be related to damages on fresco and the door. Also internal temperature is approximately 6 higher than external temperature.

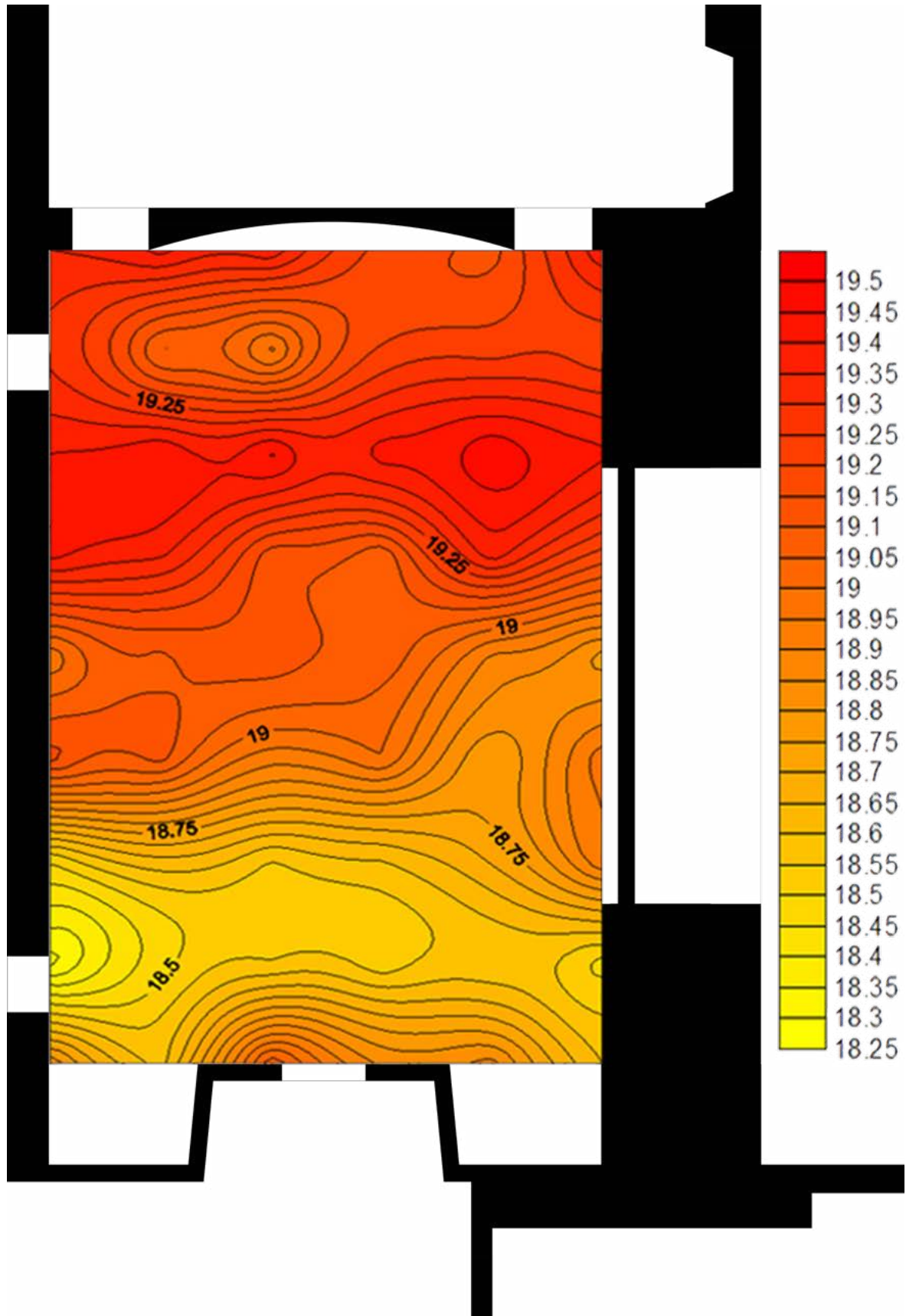


Figure 3.3.28 - Temperature on 28 October at 11.00am.

Relative humidity gets reduced near the window and doors in general. Internal relative humidity is around 9.2% less than external humidity.

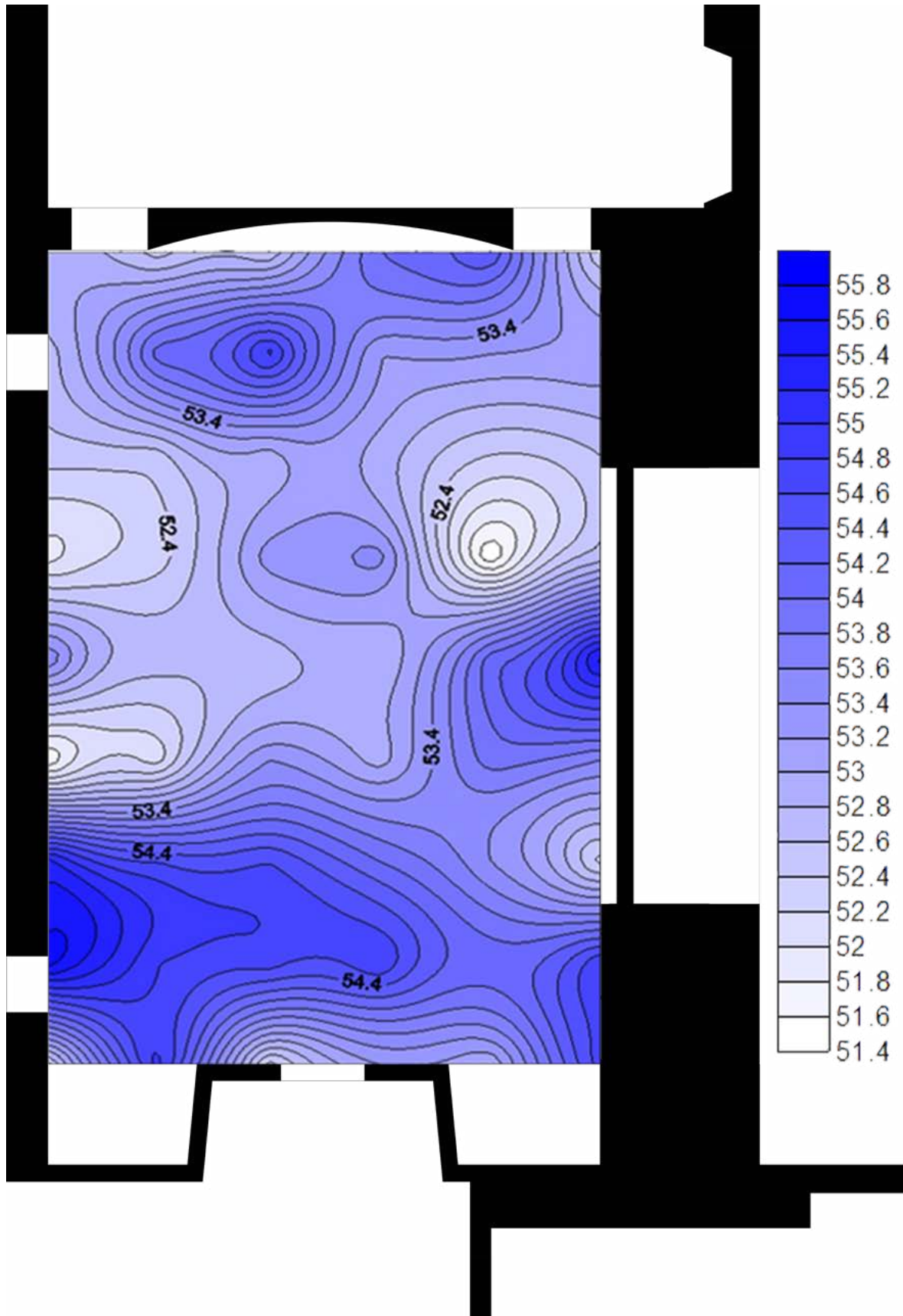


Figure 3.3.29 - Relative humidity on 28 October at 11.00am.

Specific humidity graph has a similar result with relative humidity graph. It gets lower at the parts closer to window and doors

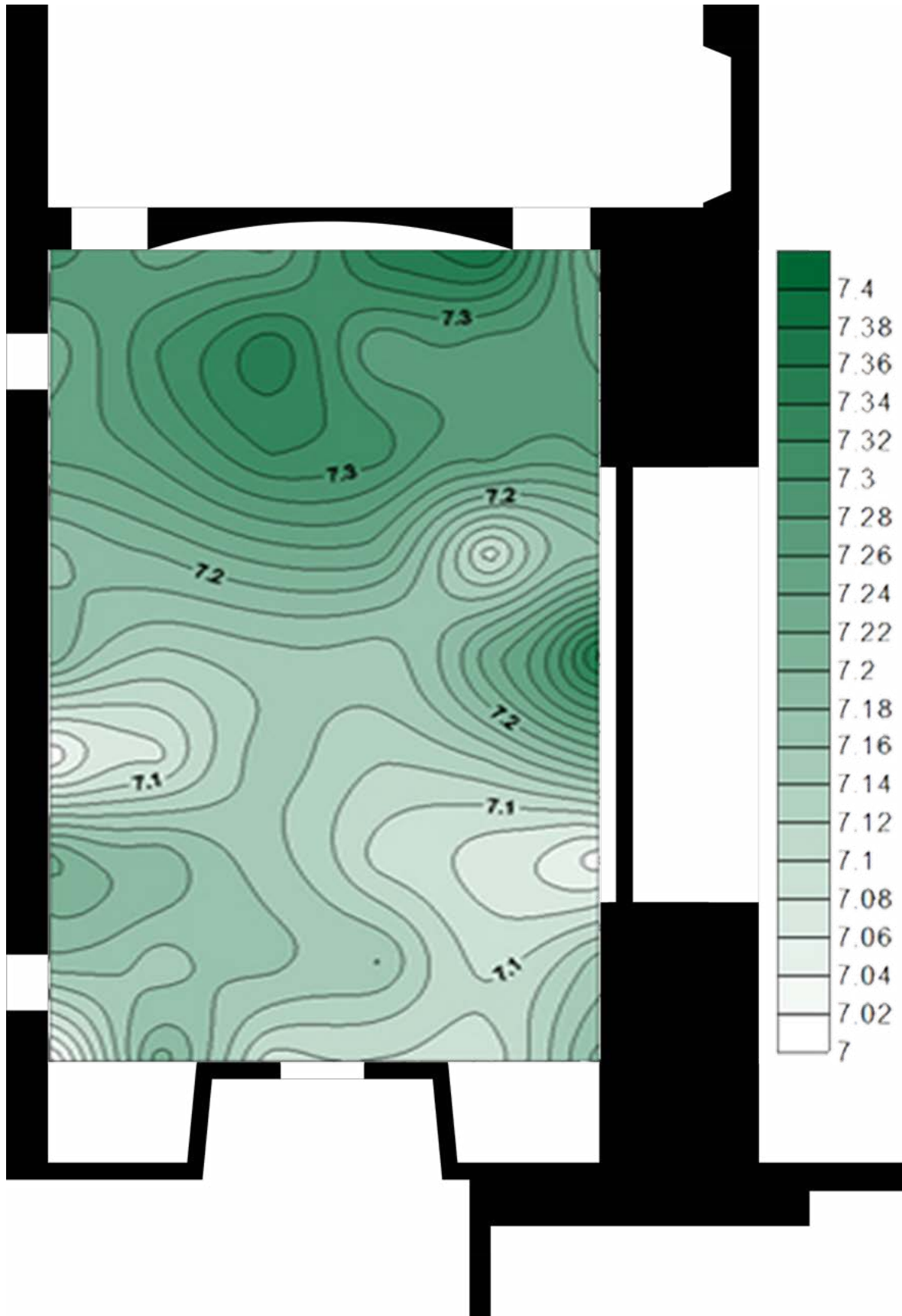


Figure 3.3.30 - Specific humidity on 28 October at 11.00am.

3.3.8 - Psychrometric data on October 28 at 5.00pm

Point on Ground	X axis	Y axis	Temperature	Relative Humidity	Specific Humidity
1	770	0	19,92	55,8	7,99
2	620	0	19,97	50,8	7,29
3	470	0	20,17	46,9	6,81
4	320	0	20,16	46,8	6,80
5	170	0	20,53	45,9	6,82
6	0	150	20,4	46,6	6,86
7	0	150	20,13	47,7	6,91
8	170	150	20,18	46,7	6,79
9	320	150	20,08	46,8	6,76
10	470	150	20,04	46,8	6,74
11	620	150	19,88	47,5	6,77
12	770	300	19,88	47,5	6,77
13	770	300	20,12	46,2	6,69
14	620	300	20,14	46,1	6,68
15	470	300	19,84	47,5	6,76
16	320	300	19,96	46,8	6,71
17	170	300	20,24	46	6,71
18	0	450	19,85	47,6	6,78
19	0	450	19,98	46,8	6,71
20	170	450	19,97	46,9	6,72
21	320	450	19,94	47	6,73
22	470	450	20,07	46,3	6,68
23	620	450	20,1	46,3	6,69
24	770	600	20,05	47,4	6,83
25	770	600	19,91	48	6,86
26	620	600	20,03	47,2	6,79
27	470	600	20,01	47,2	6,79

SURVEY AND DIAGNOSTICS

28	320	600	20,04	46,9	6,75
29	170	600	20,05	46,9	6,76
30	0	750	19,94	47	6,73
31	0	750	19,85	47,6	6,77
32	170	750	19,69	48,6	6,84
33	320	750	20,01	47,2	6,78
34	470	750	20,07	46,8	6,75
35	620	750	19,91	47,9	6,84
36	770	900	19,83	49,4	7,02
37	770	900	19,95	48	6,87
38	620	900	19,87	47,9	6,82
39	470	900	19,76	48,6	6,87
40	320	900	19,66	48,7	6,85
41	170	900	19,67	48,6	6,84
42	0	1050	19,83	48,2	6,85
43	0	1050	19,57	49,4	6,90
44	170	1050	19,68	48,7	6,85
45	320	1050	19,96	47,3	6,78
46	470	1050	19,78	48,6	6,88
47	620	1050	19,86	48	6,83
48	770	1050	19,82	48,7	6,91
49	770	1170	19,88	48	6,84
50	620	1170	19,77	49,1	6,95
51	470	1170	19,79	48,7	6,90
52	320	1170	19,76	48,7	6,89
53	170	1170	19,94	47,5	6,79
54	0	1170	19,90	47,7	6,85

External Data: temperature 18.8°C, relative humidity 43%

At night time, colder spots get hotter, yet the north wall side gets colder. This might be related with potential heat loss. The external temperature gets increased during the day, yet the difference is still approximately 4 less than internal temperature.

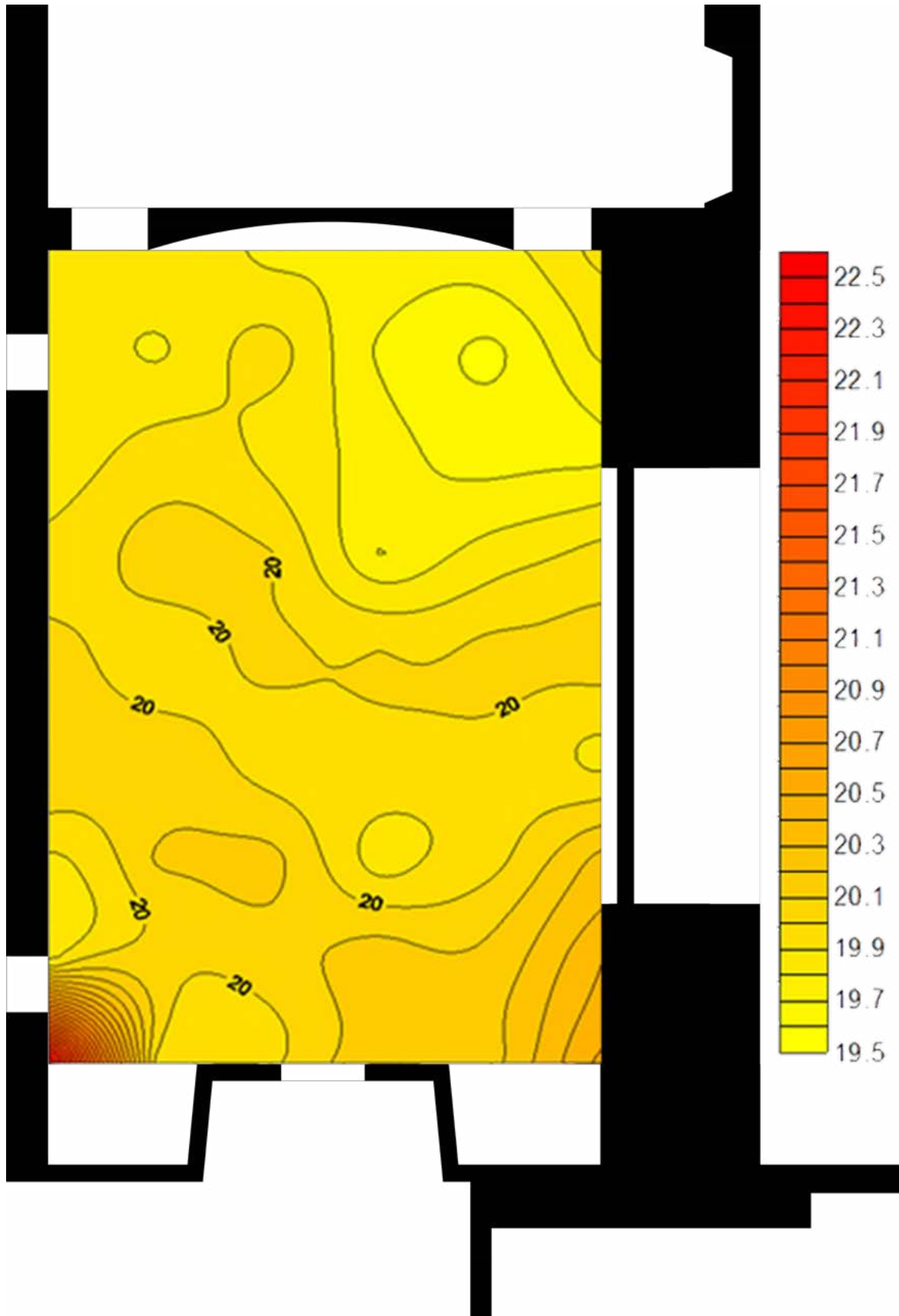


Figure 3.3.31 - Temperature on 28 October at 5.00pm.

Afternoon graph has similar results with morning graph, yet the internal relative humidity reduced around 10%, while external relative humidity reduced around 12% during the day.

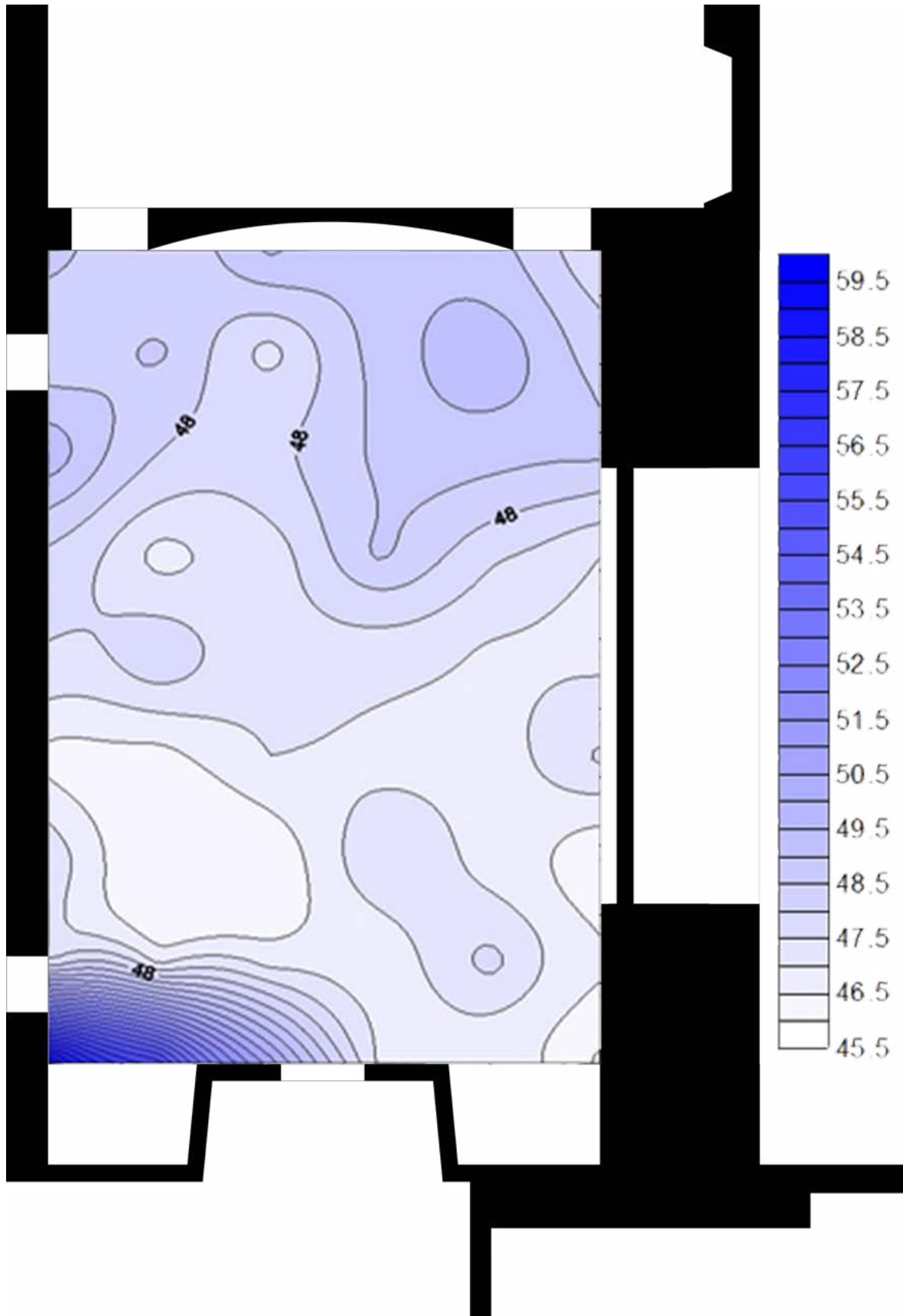


Figure 3.3.32 - Relative humidity on 28 October at 5.00pm.

Specific humidity graph in the afternoon is also similar to the morning graph, yet there are more areas with lower specific humidity compared to the morning graph.

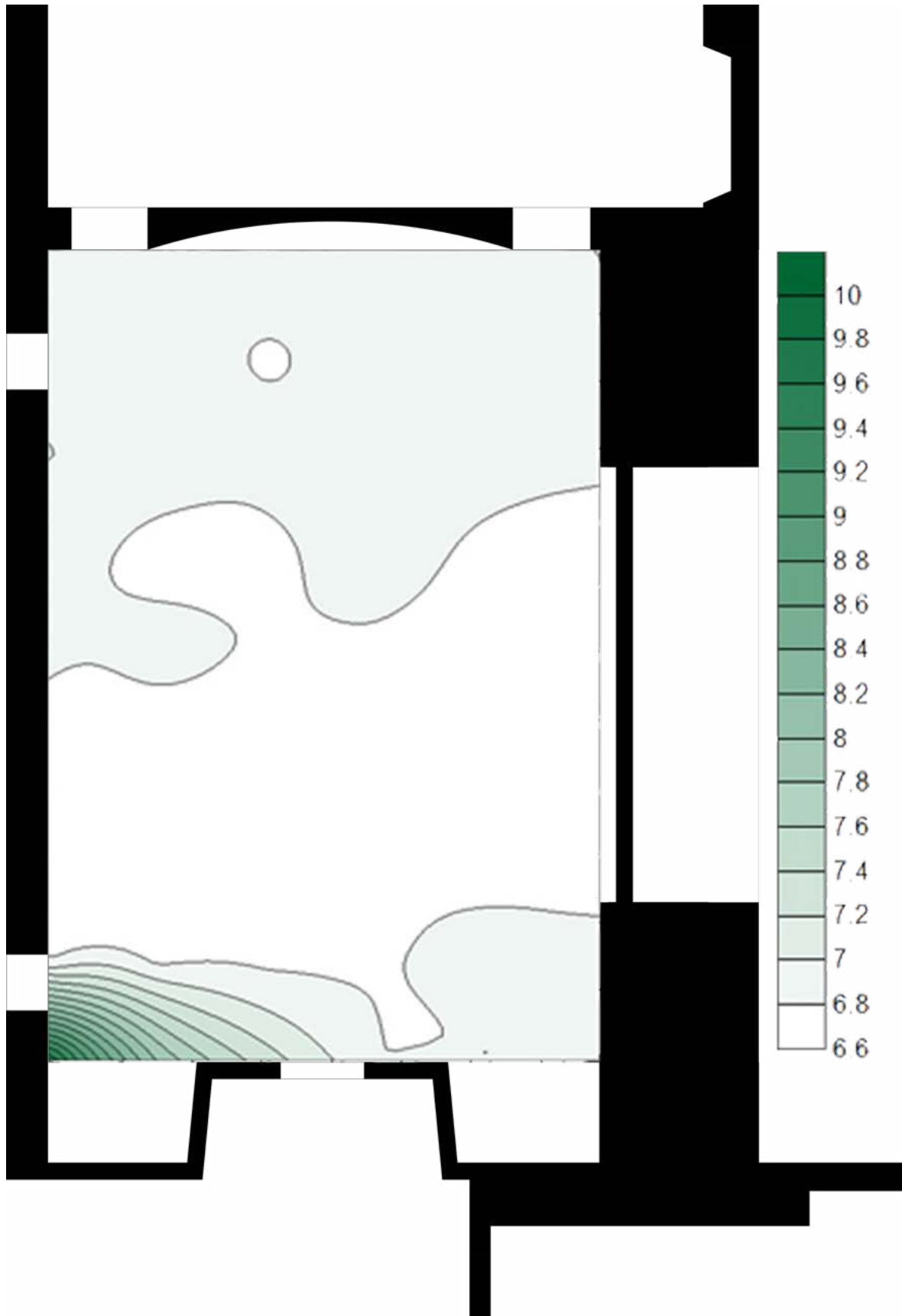


Figure 3.3.33 - Specific humidity on 28 October at 5.00pm.

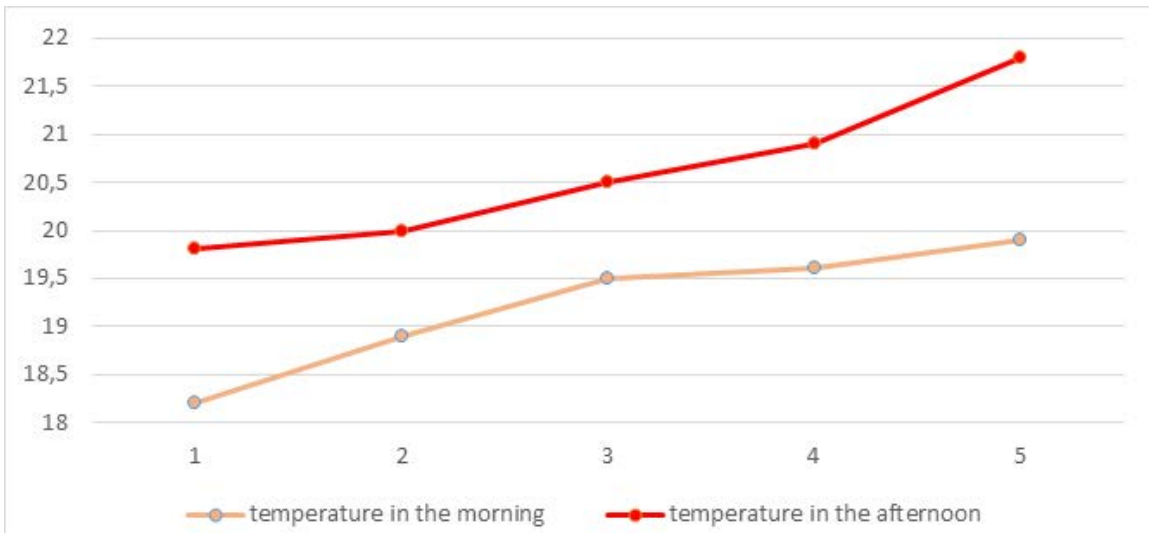


Figure 3.3.34 - Morning and afternoon comparison of temperature on October 28.

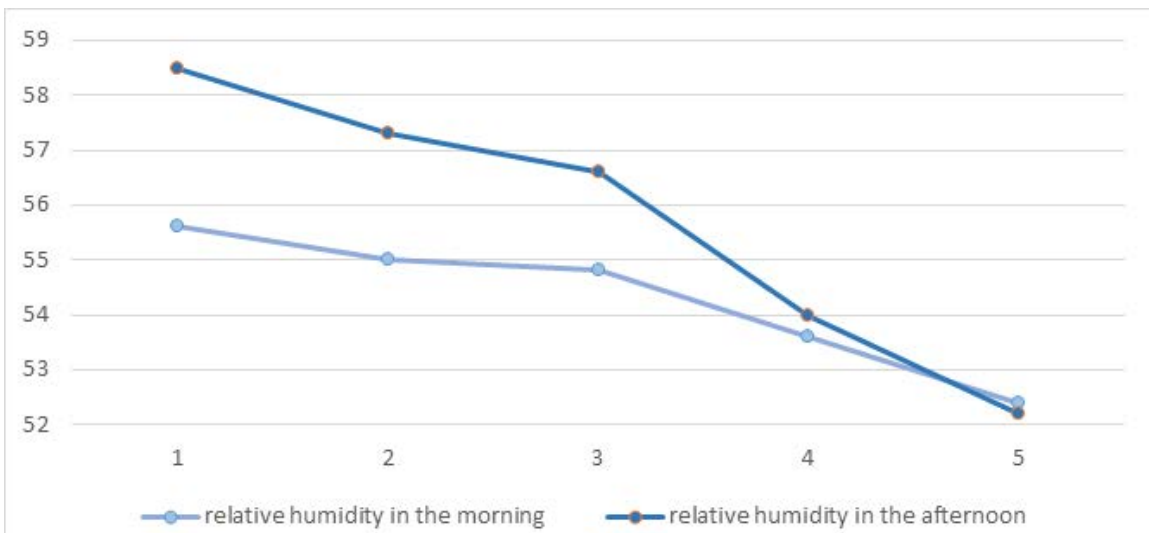


Figure 3.3.35 - Morning and afternoon comparison of relative humidity on October 28.

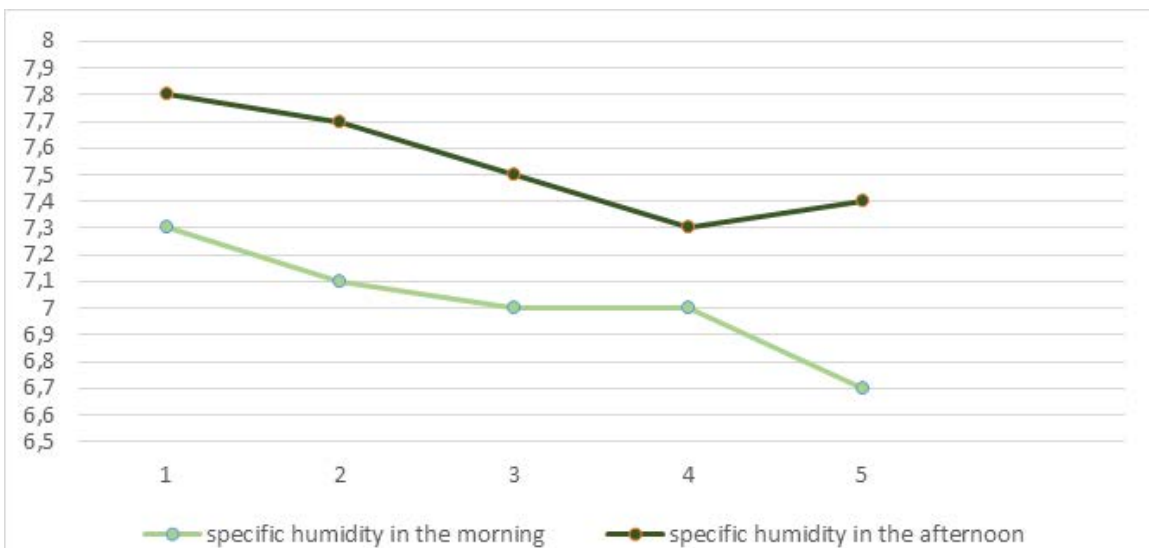


Figure 3.3.36 - Morning and afternoon comparison of specific humidity on October 28.

3.4 - Probe data

	Celsius (°C)	Dew Point (°C)	Humidity (%rh)
Maximum	31	21.2	60.5
Minimum	21.5	0.1	22.5
Average	25.3	12.9	46.8
Std.	2.9	4	7.3

Table 3.4.1 - Probe data from above the door.

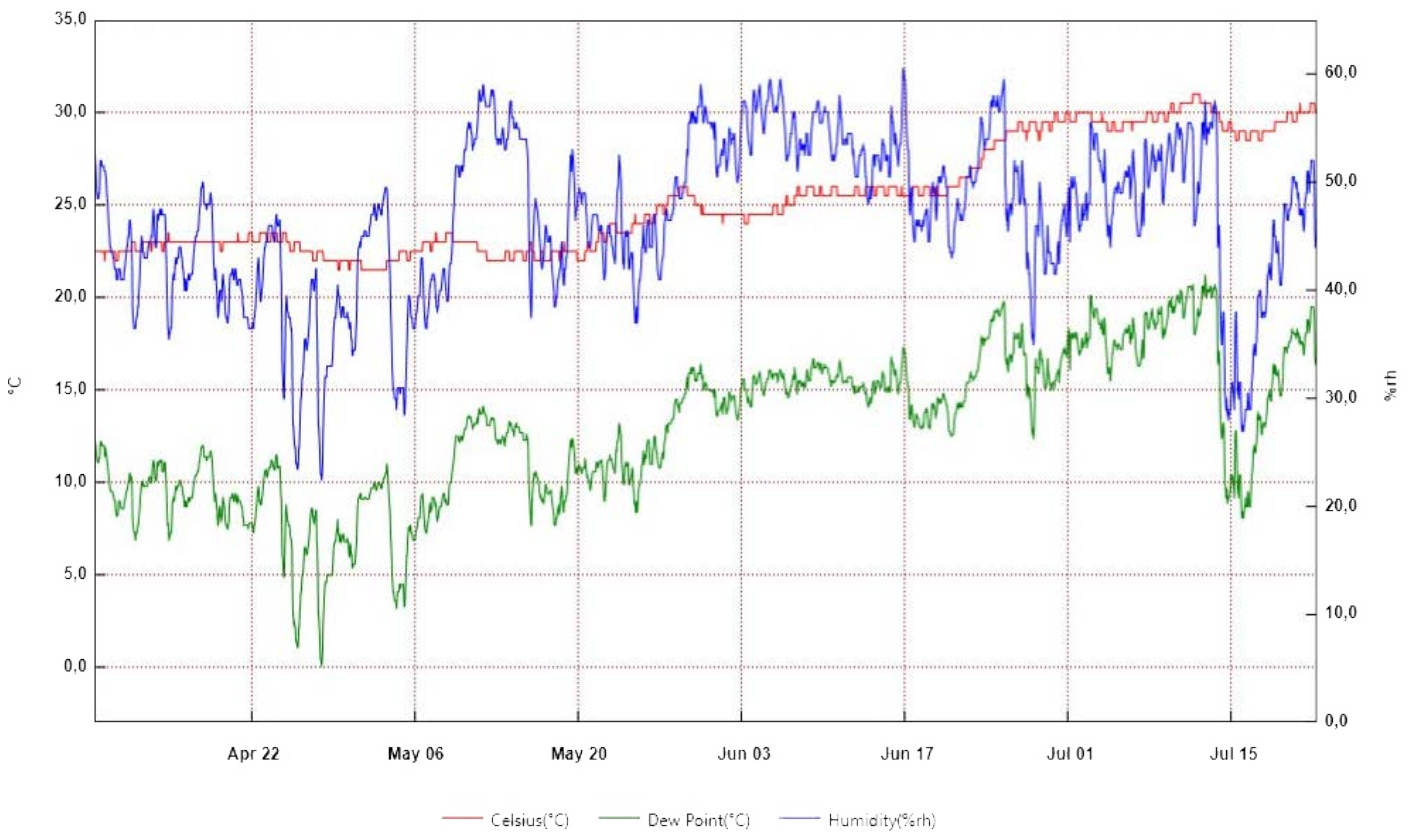


Figure 3.4.1 - Probe data from above the door.

	Celsius (°C)	Dew Point (°C)	Humidity (%rh)
Maximum	30.5	21.4	61
Minimum	21.5	-1.6	20
Average	25.3	12.8	46.6
Std.	2.7	4.3	8.1

Table 3.4.2 - Probe data from the corridor.

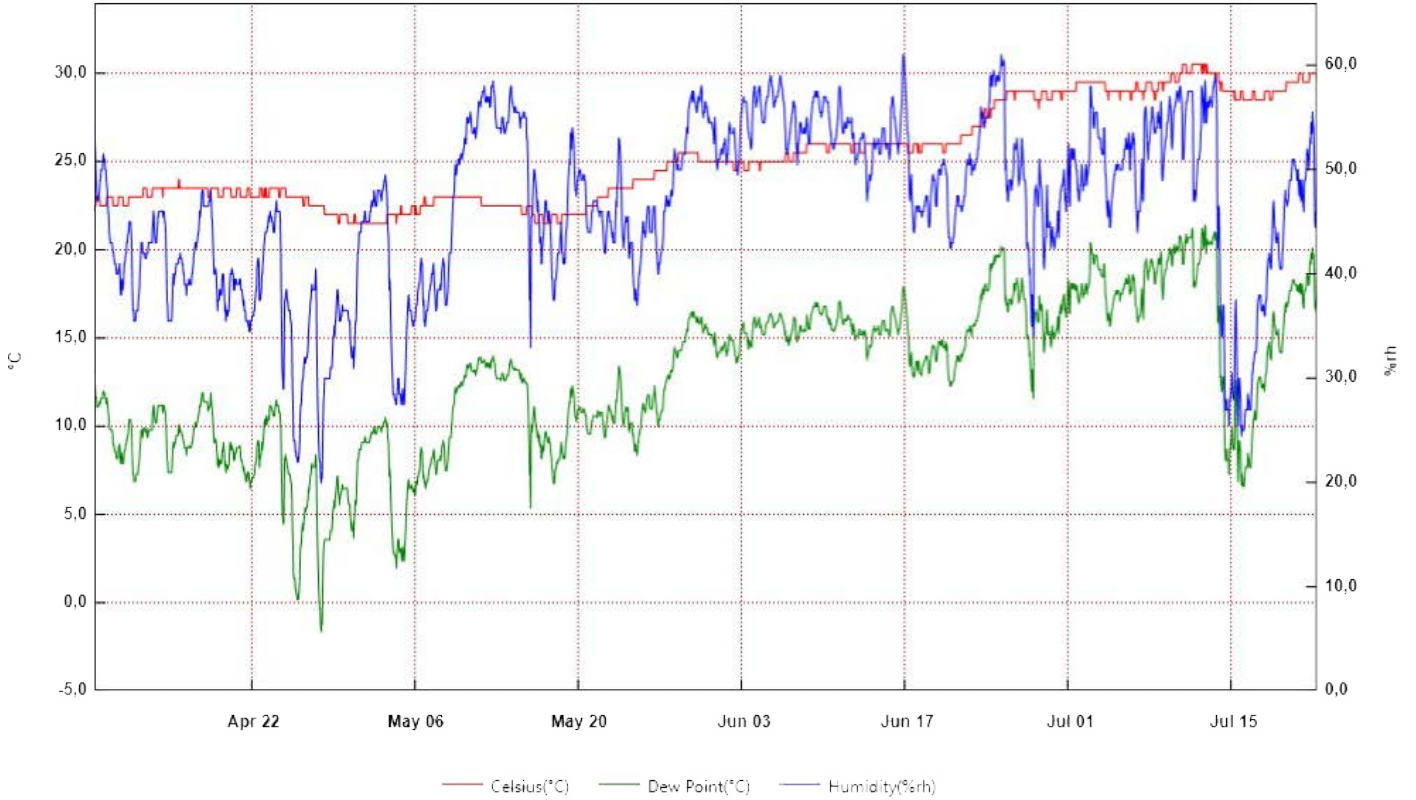


Figure 3.4.2 - Probe data from the corridor.

3.5 - Results

The room with the painting is in the third floor, another room behind the painting without any heating system and air-conditioning system. The south side of the painting room is a big window that without good sealability. For this room, the heating system is working from November until April and in the summer without air-conditioning system.

Compared thermographic survey of different walls, it only consider the temperature about different wall and windows. The temperature of two windows is higher than other walls, the temperature of the painting wall is lower, uneven temperature distribution is one of the reason for damage of the painting. Therefore, it means for south facade need shading system, or it can use air-conditioning system in the summer. In the painting room, heating system only for the south facade, it is better to put a group of heating system on the north facade, and also another room behind the painting. No matter winter or summer, control the temperature around 20-25°C. For the building it can be used the adjustable shading system, avoid direct sunlight while allowing visible light to enter the room.

From psychrometric analysis, now it is considered the temperature of the room for each point in the plan. From the psychrometric data in the March 10 and April 22, the temperature close the south facade is more higher, the relative humidity close the painting is higher than other parts. Because this part without sunlight and ventilation. Natural ventilation is not enough for this room, so no matter which season that mechanical ventilation is important.

From the data in the July, relative humidity and specific humidity change a lot during one day, in the afternoon the data is more higher lower than morning. Relative humidity (RH) is the ratio of the partial pressure of water vapor to the equilibrium vapor pressure of water at a given temperature. Relative humidity depends on temperature and the pressure of this space. From the document and test, if the relative humidity below 65%, most of the mold can not grow normally. If the relative humidity below than 45%, and for a long time, the painting on the wall will be dry and brittle, resulting in physical damage. Control the relative humidity around 50%, is the most suitable for protecting the painting.

From the data in the October, there is not a big difference about the temperature between indoor and outdoor. different values for relative humidity occurred in the corner, temperature almost the same so it can be used the natural ventilation also for save the energy.

Last data collected is probe data, it's done by putting one probe tube on the main door outside of the room and another one put under the window which between the hall and the room. The data begin from 22 March until 30 July, including dry temperature, wet temperature and humidity. All the data is continuous without interruption. This set of data shows the change in the hall which close the room. Compared the data with the data of indoor, try to control the temperature and humidity of the hall as close as possible to the room.

4. PROJECT

The project started with focus on one of the rooms, which we call Stefanini room, inside the courthouse, and then it is expanded with other approaches to have much larger effect to the whole building.

These approaches started from urban scale, to surrounding of the courthouse and finally, become more detailed with our focus to the courtyard. Some of those approaches are basic and minor changes, while some of them are major and requires more detailed design and structural calculations.

These approaches are described as an individual topics in the following pages; architecturally, structurally and technically.

These topics are;

- Project of Conservation
- Urban Relations
- Courtyard Landscape Design
- Courtyard Roof Design
- Courtyard Facade Design

Previous big scale investigations on Milan attracted the focus on the potential of the art gallery. The weakness of this potential was the fact that it has not a well known location by visitors. But this weakness can be turned to an advantage to attract more visitors to the building. Also the location being close to central area is a good advantage.

Smaller scale investigations attracted the focus on weaknesses a little more. First hand experiences of visit to the courthouse caused a realization of how dense the population inside the building during the day. The courthouse has lots of visitors due to their personal reasons, but it is easy to notice that people are waiting for hours in small corridors, without enough seating for them.

On the other hand the central courtyard is completely unused by people, instead it is filled with cars. This area will be even more important considering there will be more visitors to the building for art gallery. Due to this space management problem, main focus on courtyard become more important in order to and make this area for people, not cars.

4.1 - Project of conservation

4.1.1 - Objectives

Project of conservation focuses on the Stefanini room, which located on the third floor of Tribunale di Milano.

After the metric, thermographic and psychrometric surveys done in the room, some observations and results have been acquired.

The heating system was turned off the second half of April and the first thermography data obtained was end of February. There is an interior and exterior probe to understand the temperature outside. Due to this difference, it is possible to see the difference of temperature of the surface in between one and the other. Preliminary assumption is that, the second was really homogeneous.

Possible damage to the painting also must be considered. The idea is not to decrease the temperature as much as possible but to decrease a few celcius degree in order to improve the comfortability inside but it is not exactly the only humidification therefore, don't expect to have a very low temperature and very dry air. This was not the aim of it.

Because there are local machine, they don't use a general plant because of the vasivity of the big system because in case it should be a general condition of the entire block they should use a very big pipes for air for tribunal and the surrounding blocks, they trying to put the small machine one by one in the rooms. Only in the after part of the building, the new addition, there are real air conditioning system with the general conditioning.

Also because of the building technique, the upper part you have a lot of iron, a lot of steel therefore they are on the roof, therefore the solar heating is terrific. The mayor of the municipality established the heat for starting the air conditioning and it is about June, half June, but in that part of the building, early of June, they started to claim to turn on the air conditioning system because the temperature inside was really high.

Also temperature imbalance must be measured. Because it was said that there is an air conditioning system but it is a local one therefore probably the difference of temperature in between the Stefanini room and the office, which is behind, it is 5-7 celcius degree depending on the air temperature inside the Stefanini room, because it is a local air conditioning the one which is in the office so when they are turn on probably it is about 25 celcius degree, not lower.

4.1.2 - Informations

The heater, the central heater is not close, it is at the boundary of the city toward south-east since 1 year ago and they disconnected the local one to connect with this big one, a huge one which is outside of the city, at the border of the city.

There is only one heater in the entire block and service for the urban surroundings including the residential and also especially the big hospital which is connected and then, not only this courthouse, there are other offices in the other buildings and these are connected as well. Almost all public buildings are connected with this kind of heating.



Figure 4.1.1 - Central heater is far from the courthouse.

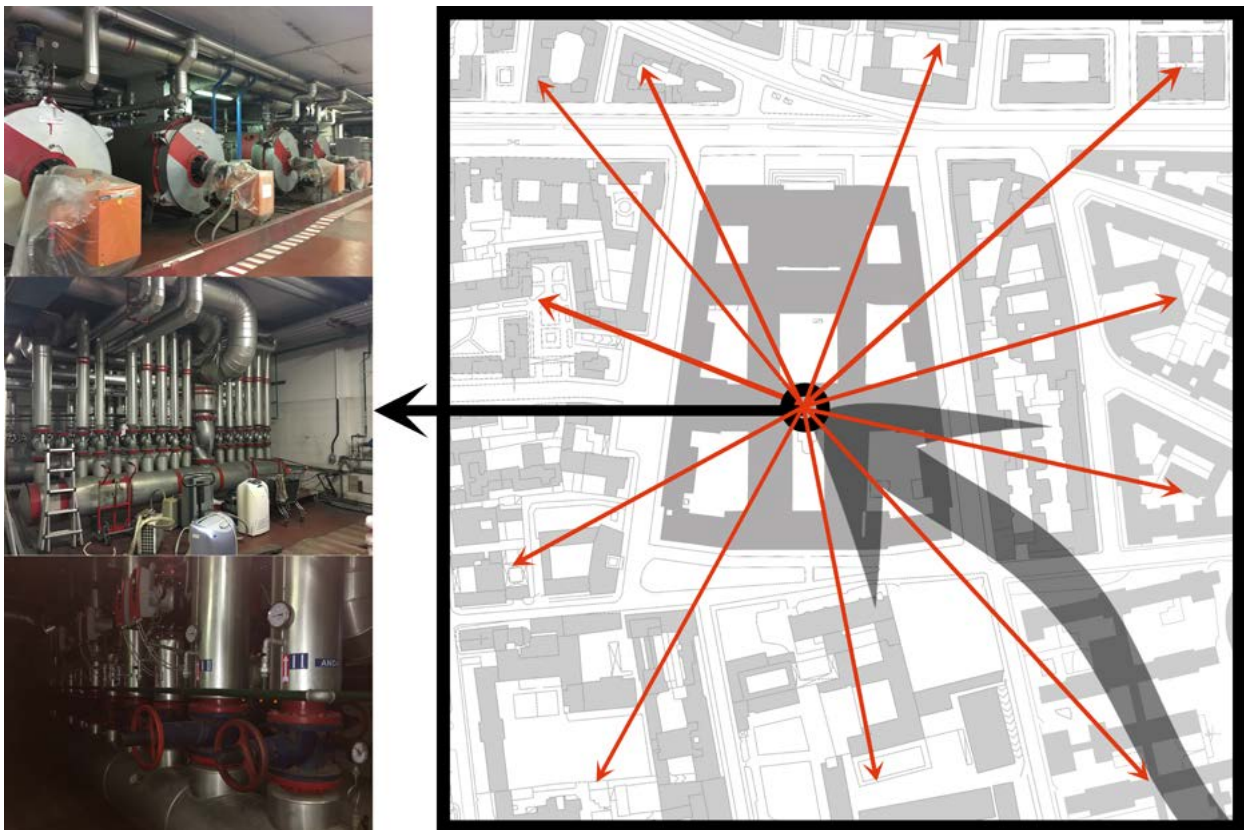


Figure 4.1.2 - Plan of the heating system in surrounding.

They kept the fuel heater, the local one, just in case of emergency.

The current system uses the fluid coming from the central, then through the exchanger of heater (scambiatori) the coming fluid exchanges. Heated water from this exchanger distributed to each room with increased temperature. The water's heat is radiated to these room and then the backwater that become colder goes back to the exchanger with the old pipes. This system circulating continuously.

The pipes are small because in the beginning, the heater was burning coals, and therefore the diameter of the pipe is small. The original scheme is the Piacentini plant and it is a very simple plant because there is only one pipe coming from the room at the first level, which is connected with the cellar, where the distribution starts and then goes up.

The improvement of the energy efficiency is not easy at all, because of the different situations, especially because of the plant and so on. But air-conditioning is provided for a plant also in Stefanini room. There are some copper pipes on the ground as a starter but it is not connected at the moment. It will be built probably one piece after the other in the future.

The downspouts are inside the wall at the corner, the corner with the perpendicular part of the building and the window, on the right. The downspouts are inside the space in-between the different layers of the masonry so it is not possible to inspect them apart from some breakage and leakage they can find on the wall sustains and so use of the probes to see inside.

The original downspouts are in cast iron and probably they are not substituted. They gather the water which are connected to the sewage system, therefore the water and the rainfall does not remain in the basement. So the connection to the sewage is possible to inspect because it is not in the soil but it is in the surface.

The ventilation is natural ventilation by opening the windows and in the beginning it was a manual system to open them then it damages the interior part so they substituted, they had in the 1950s electric device at now is the one that can move the glass panels.

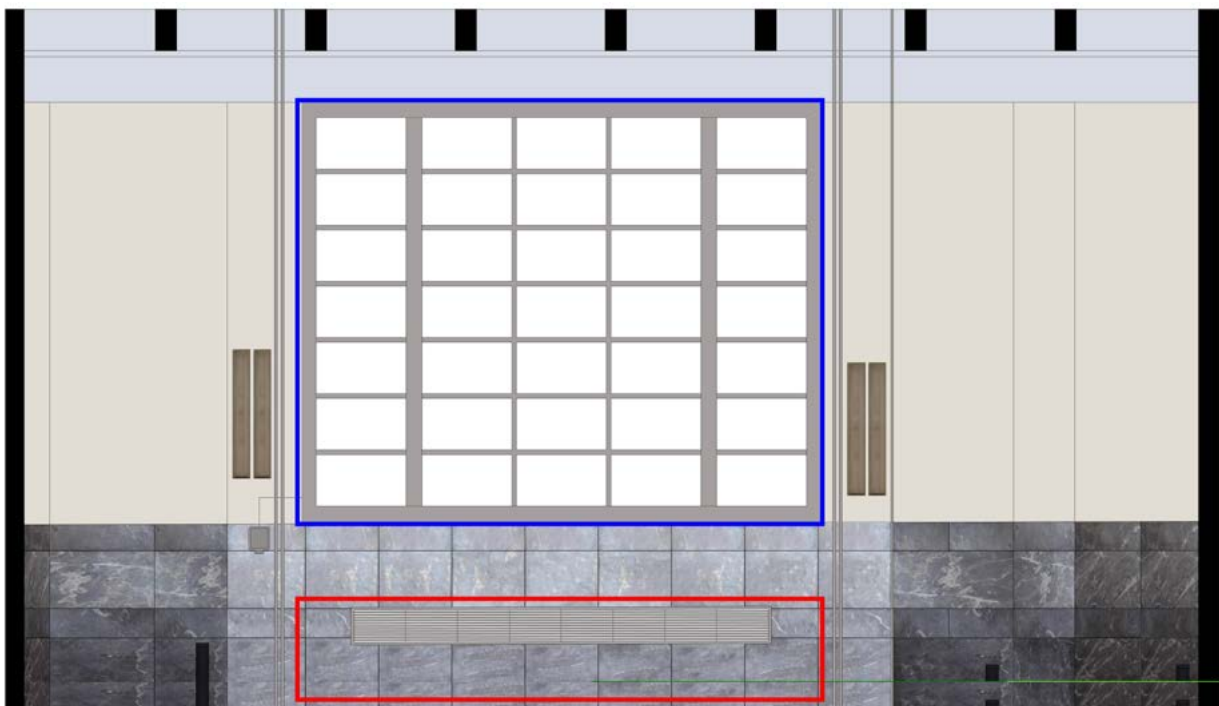


Figure 4.1.3 - The only radiator and ventilation method in the room.

4.1.3 - Interventions

The interventions were divided into four subtopic; Intervention of the painting, heating and air-conditioning system, ventilation and shading system.

4.1.3.1 - Intervention of the painting

Paintings are fragile and changes are to be expected. Many changes do not threaten the stability of a painting and are not considered damage. Physical damage is the most common form of damage to an oil painting. Abrasions and dent-like impressions, tears, holes or punctures in a canvas support can be caused by poor storage or handling, household accidents and natural disasters. Prolonged exposure to extremes of dryness, humidity, heat or cold with little air flow will make a painting susceptible to structural damage.

Interventive conservation refers to the direct interaction between the conservator and the cultural material. This includes cleaning, stabilizing, repair, or even replacement of parts of the original object. Each treatment is done by highly trained and experienced individuals committed to preserving each artist's vision by treating the physical object to insure its long term preservation while staying true to the artist's original intent; the aesthetic and appearance that the original artist desired.



Figure 4.1.4 - Painting inside Stefanini room.

The treatment of each artwork is based on a thorough assessment of its condition and a well thought out treatment plan. Treatments range from simple grime removal and re-varnishing the painted surface to a complete aesthetic and structural treatment including the removal of grime and discolored varnish, reversal of old, poorly done and crude restorations, tear repairs, adhesive consolidation of insecure areas of the paint layer, and reinforcement of the original fabric support as well as filling and inpainting losses and application of new varnish.

There are two methods of repairing a torn or punctured oil painting on canvas. The damaged area of the painting can be patched or the entire painting can be lined (adhered) onto a new supporting canvas. Several factors discussed below should be considered to determine when patching may be a good choice for repairing a damaged oil painting and when a full lining of the entire canvas should be considered instead.

In deciding which repair method to use, bear in mind that a patch may become visible from the front of the painting over time, and can be avoided by lining the entire painting. A patch in a busy part of the painting may be less noticeable than a patch in a solid area.

Generally, patching of an oil painting should only be performed if the tear or puncture is small. Large or multiple tears and punctures usually call for lining the entire canvas to provide the painting with the strength to make the repair successful. It can generally be assumed that the canvas of an old oil painting with multiple tears is in a fragile state and susceptible to additional damage if it is not reinforced with a new supporting canvas. Lining a damaged oil painting onto a new canvas rather than patching is advisable if the canvas is in a weakened condition: brittle and fragile canvas, thinning areas of the canvas, torn where it wraps around the stretcher frame, flaking paint, cracks in the paint, or multiple tears and punctures.

If the damaged oil painting is in good condition other than the tear or puncture, patching offers a quick, easy, and less expensive alternative to repairing a damaged canvas, while keeping the rest of the painting in its original condition. A patch can easily be removed if lining the painting to a new canvas is desired at some point in the future. However, the filled-in and inpainted area will be damaged during the process and will have to be re-applied.

Patching may be preferable to lining if a tear or puncture occurs in a relatively new oil painting, because the paint and varnish are still soft. During the lining process, fresh paint and varnish can stick to the paper, impasto can be flattened, and varnish and paint can be removed while removing excess Lining Compound.

When a tear or puncture occurs in a very large painting, patching may be the only viable solution due to the size of the piece.

4.1.3.2 - Heating and air-conditioning system

First we only consider the temperature about different wall and windows. The temperature of the wall with windows is more higher than other walls, the temperature of the wall with the painting is more lower, uneven temperature distribution is one of the reason for damage of the painting. therefore, it means for south facade we need shading system or we can use air-conditioning system in the summer. In the painting room, heating system only for the south facade, we can put a group of heating system on the north facade, and also another room behind the painting. no matter winter or summer, control the temperature around 20-25°C.

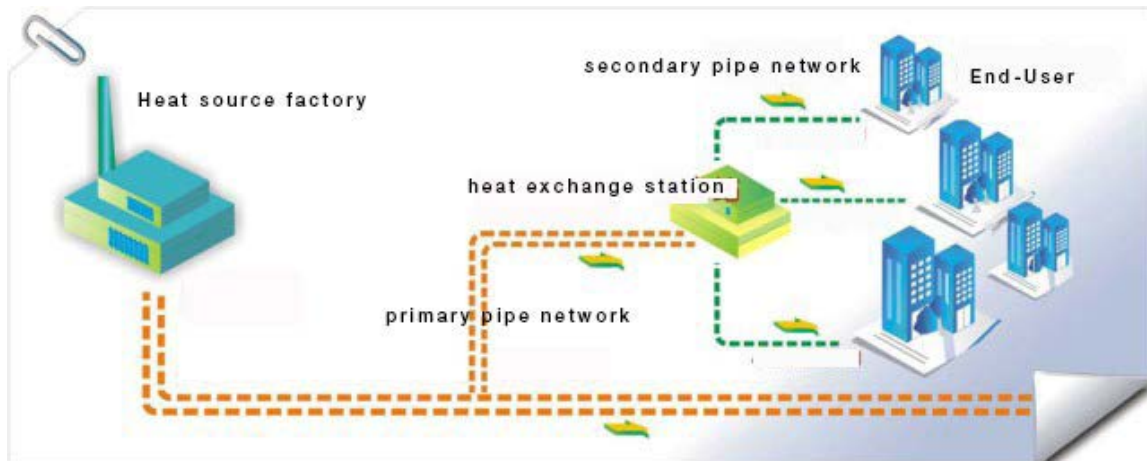


Figure 4.1.5 - Distribution of the heating in urban scale.

There is only one heater in the entire block and service for the urban surroundings including the residential and offices in the other buildings, not only this courthouse, and all of these buildings are connected as well and connected with this kind of heating.

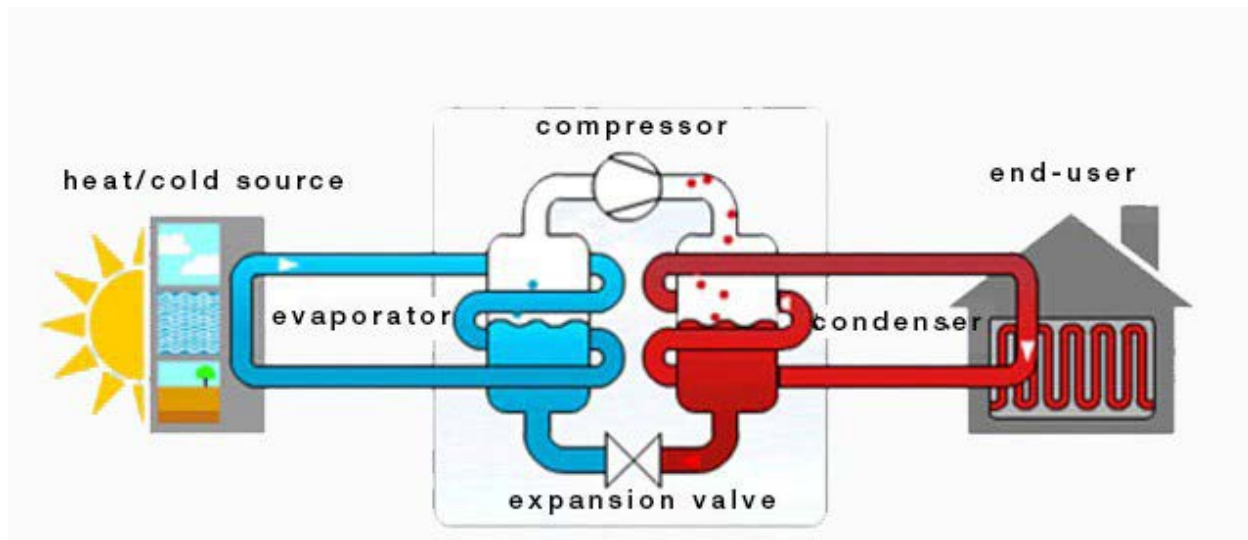


Figure 4.1.6 - Regulation of the temperature.

The current system uses the fluid coming from the central, then through the exchanger of heater the coming fluid exchanges. Heated water from this exchanger is distributed to each room with increased temperature. The water's heat is radiated to these rooms and then the backwater that becomes colder goes back to the exchanger with the old pipes, this system circulating continuously. So it's possible to put one more heat exchanger also on the north wall, and the room behind the painting.

4.1.3.3 - Ventilation

Now we consider the temperature of the room for each point in the plan. From the psychrometric data in the march 10 and april 22, the temperature close the south facade is more higher, the relative humidity close the painting is higher than other parts. Because this part without sunlight and ventilation. The ventilation is natural ventilation by opening the windows and in the beginning it was a manual system to open them then it damages the interior part so they substituted, they had in the 1950s electric device at now is the one that can move the glass panels. But natural ventilation is not enough for this room, so no matter which season that mechanical ventilation is important.

From the data in the July, relative humidity and specific humidity change a lot during one day, in the afternoon the data is more higher lower than morning. Relative humidity (RH) is the ratio of the partial pressure of water vapor to the equilibrium vapor pressure of water at a given temperature. Relative humidity depends on temperature and the pressure of this space. From the document and test, if the relative humidity below 65%, most of the mold can not grow normally. If the relative humidity below than 45%, and for a long time, the painting on the wall will be dry and brittle, resulting in physical damage. Control the relative humidity around 50%, is the most suitable for protecting the painting.

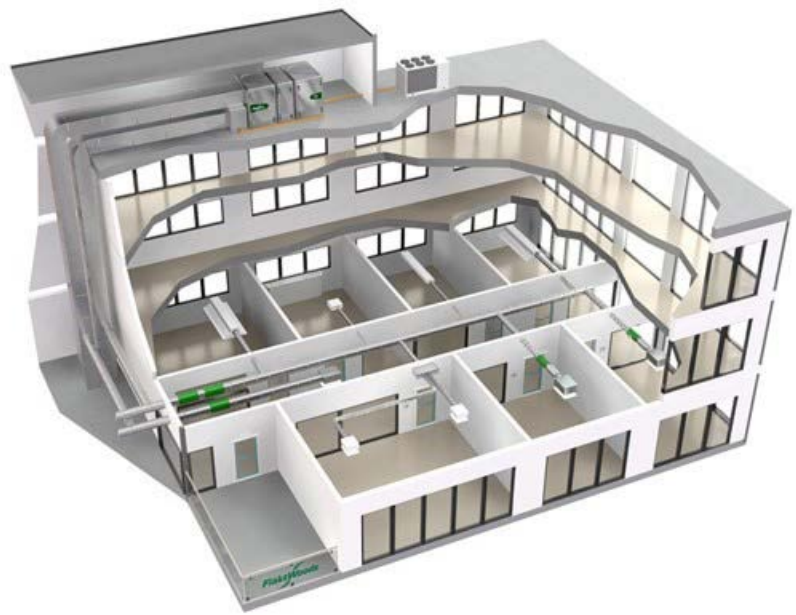


Figure 4.1.7 - Ventilation of a whole building.

From the data in the October, there is not a big difference about the temperature between indoor and outdoor. different values for relative humidity occurred in the corner, temperature almost the same so we can use the natural ventilation also for save the energy.

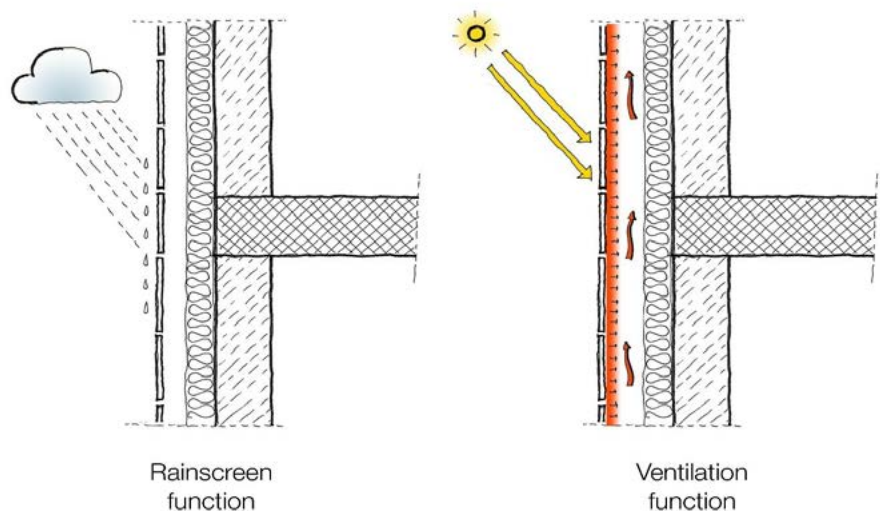


Figure 4.1.8 - Rainscreen cladding functions.

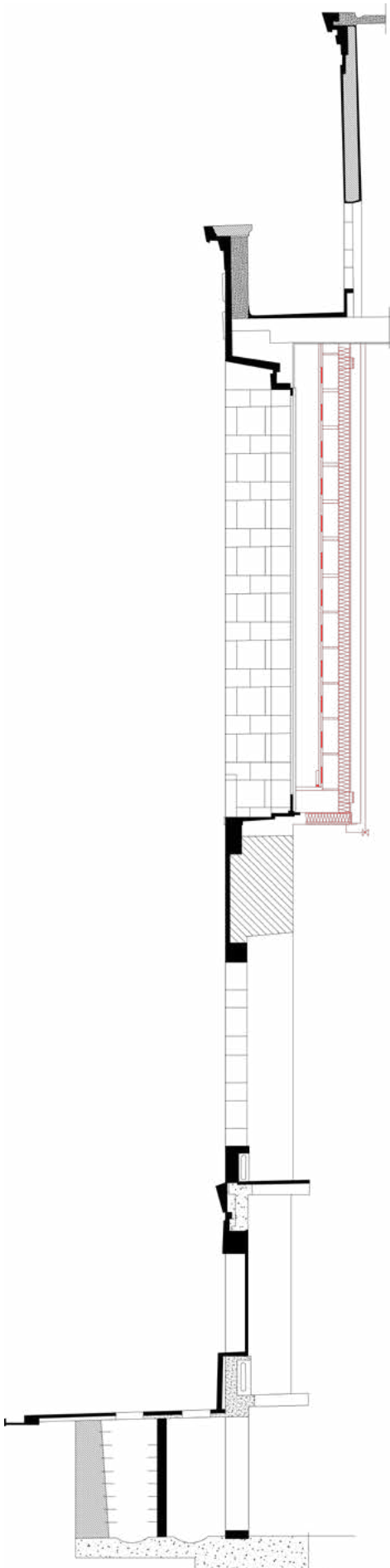


Figure 4.1.9 - Rainscreen cladding applied on the existing wall.

Rainscreen cladding is a kind of double-wall construction that utilizes a surface to help keep the rain out, as well as an inner layer to offer thermal insulation, prevent excessive air leakage and carry wind loading. The surface breathes just like a skin as the inner layer reduces energy losses.

The ventilated Rainscreen Cladding system is effective in dealing with moisture management and temperature regulation. An architectural design with the use of fiber cement panels in a rainscreen application is the perfect solution for designers looking to achieve an energy efficient building utilizing exterior insulation to prevent thermal bridging and reduce condensation.

Some benefits of rainscreen cladding systems;

Preventing thermal bridges

As the insulating material is on the outside of the structural wall, it can easily be mounted without interruptions caused by floor slabs. In this way, any thermal bridges that occur at each floor slab can be prevented. These thermal bridges are also the cause of surface condensation that may result in fungus growth.

Dissipating heat from the sun

The ventilated rainscreen cladding system has a cooling effect when temps outside are high. Most of the sun's rays are reflected away from a building. Heat passing through the exterior wall panel is partially dissipated by the ventilating effect of the space between the exterior cladding panel and the structural wall. Any residual heat managing to penetrate buildings is minor.

Rainscreen Cladding

Architectural wall-cladding panels act as a rainscreen on the outside of the building and keep the structural wall absolutely dry. The air space connected to the outside air evacuates water and humidity that might have penetrated behind the wall-cladding panels through its horizontal or vertical joints. This water will never reach the load bearing wall and/or the thermal insulation.

Protecting the basic structure and load-bearing wall against temperature variations

In view of the fact that the insulation material is applied to the outside of the building, changes in temperature are very minor compared with those found in conventional constructions where insulation is applied on the interior. This principle works in summer and winter in both hot and cold climates.

Prevention of internal condensation

Insulation material can be applied to the outside of the structural wall because it is protected effectively by the architectural exterior wall panel. Because of differences in vapor pressure and temperature passing through the wall, condensation has been shown to occur close to the ventilated area and not in the structural wall itself. As a result, the ventilating effect is easily sufficient to dry out the thermal insulating material.

In order to connect the rainscreen cladding with the existing wall, the method is to only connecting at the bottom and the top of the wall, while trying not to damage the existing wall. The individual system can either be fixed direct to a backing wall. The fixings to the wall will normally have combined load bearing and restraint capabilities.

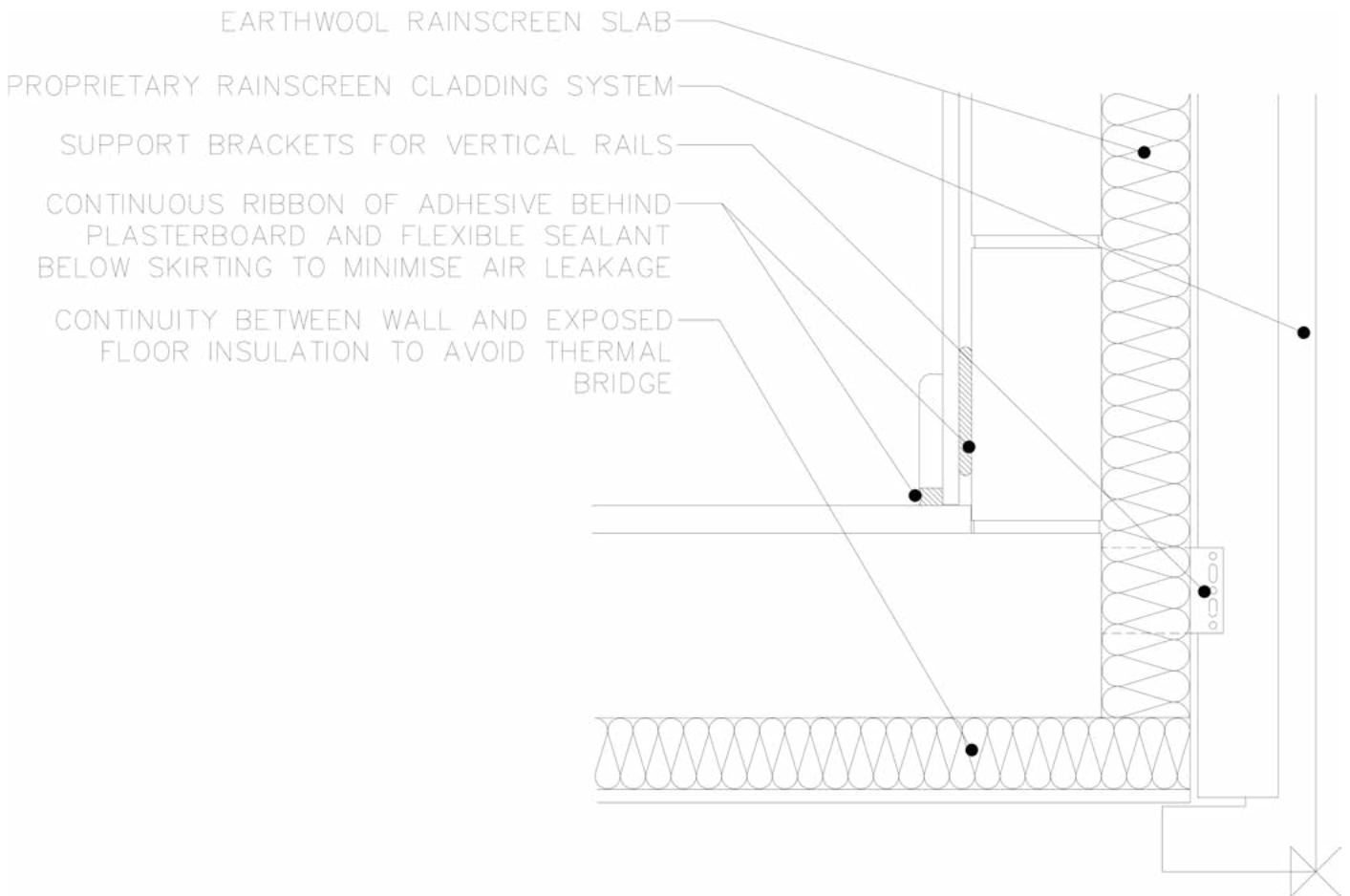


Figure 4.1.10 - Rainscreen cladding details.

4.1.3.4 - Shading

The south wall is facing the yard, and without any shading system outside, so the temperature of this wall is always higher than other walls, especially in the summer. We can use the adjustable shading system, avoid direct sunlight while allowing visible light to enter the room.

Shading systems have one main function. They should protect a room from overheating or glare. There are many different shading systems available such as overhangs, venetian blinds, louvers, fins, awnings, screens, and shutters and they can be fixed or movable. The system should be chosen depending on the requirements of the specific project, considering the location, the building type, orientation, predominant sky conditions, wind sensitivity and influences of the environment. It can be focused on one or more of the following parameters: blocking of direct solar radiation, the control of diffuse solar radiation, the prevention of glare and the distribution of daylight.

Following are the various exterior shading options for the windows:

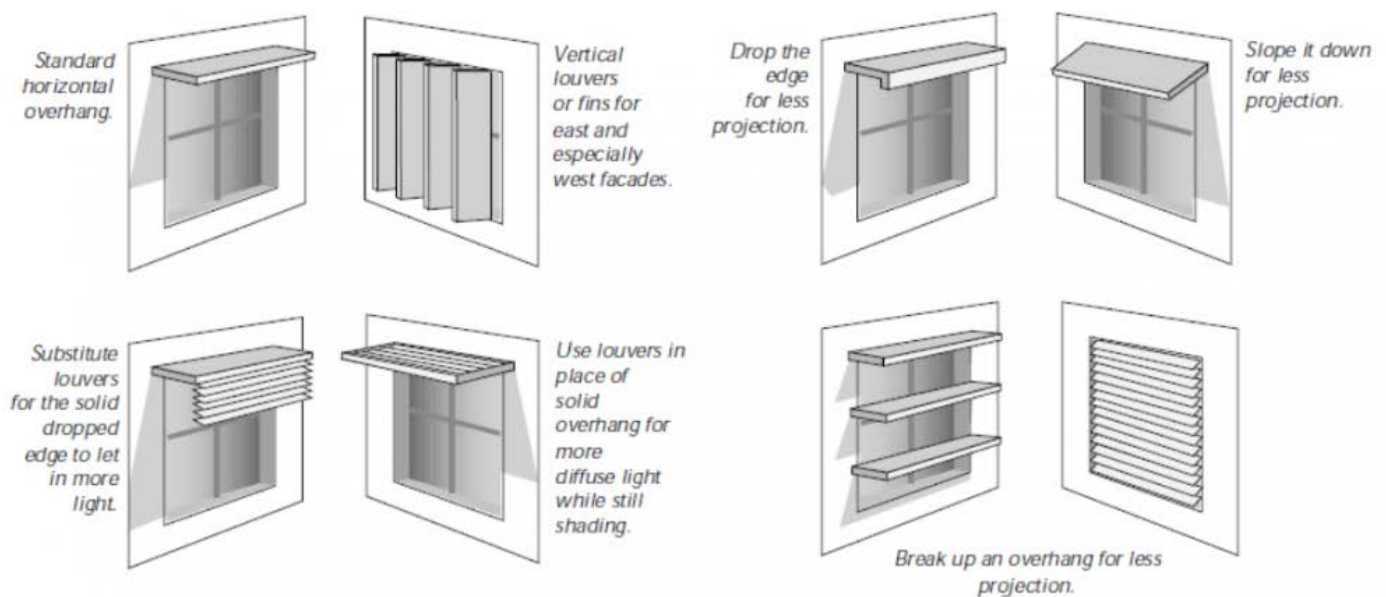


Figure 4.1.11 - Different shading types.

The idea is that this tool could be used to determine shading device depth for the critical time periods of the year. In Milan the hot climate is from July to September, choose the lowest solar angle and design the shading systems.

Next image shows the existing installation on one of the other rooms. Obviously it's not a good way to protect the indoor environment. When it was used the inner shade (blinds, curtains, etc.), only part of the sun radiation can be blocked, because the sun shines on the windows to heat the glass, visible and ultraviolet light that make the temperature of the shading material more and more higher, the temperature of the air between the inner shade and the window is also rising.

So now try to put the roller blind for the exterior, can be blocked before the sun reaches your window, and because there is flowing air between the outer shading and the window so that to take away the heat, the heat will not have the opportunity to enter your room, or even sun to your windows. Make the room as cool as the shade of the tree.

Roller blind for the exterior is an effective shading measure for all facing windows. When the shutter is completely lowered, it is possible to block almost all of the solar radiation, and the heat entering the outer window is only the part of the sun's radiant energy that is absorbed by the roller.

Window glass, inner shade and the air between the two is like a radiator that keeps your house warm. However, the outer sunshade shutter window is very different, it can stop the sunshine throw the window at first time. As the shutter window is installed outside the house, the continuous flow of air can take the heat away at any time, the heat will not have the chance to enter into your house, and even the sun does not come to your windows, so that the room temperature 3 Big heat source: window glass, inside shade facilities, and the air layer between the two does not exist. So the external sunscreen shutter window of the energy-saving effect is much better than the inside shade. In some areas outside the shade of the summer energy efficiency rate of up to 45% or even better than the effect of external wall insulation board.

Elevation and plan of the window was provided from sources.

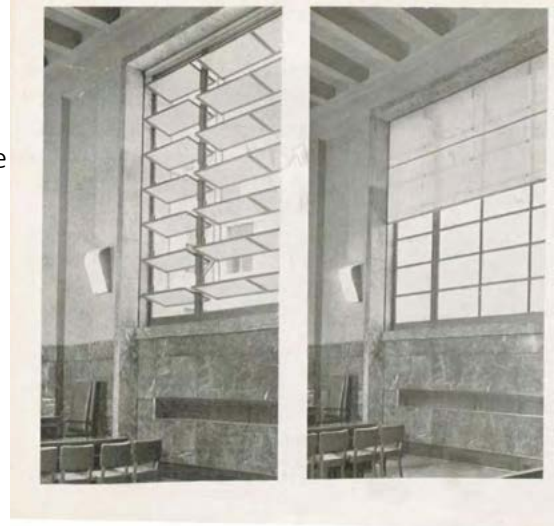


Figure 4.1.12 - Existing installation from another room.



Figure 4.1.13 - Example of new installation.

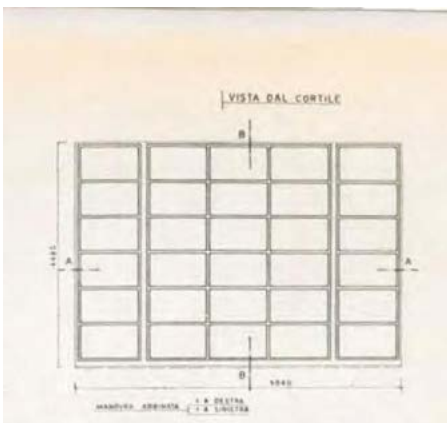


Figure 4.1.14 - Elevational view of the window.

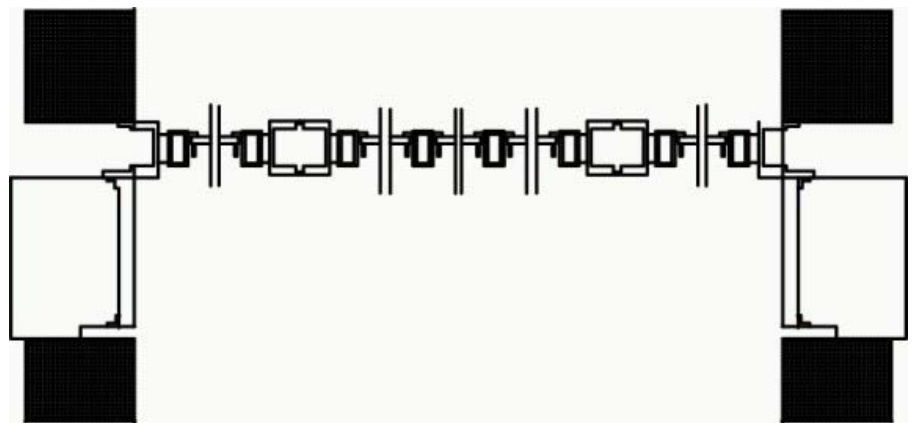


Figure 4.1.15 - Plan drawing of the window.

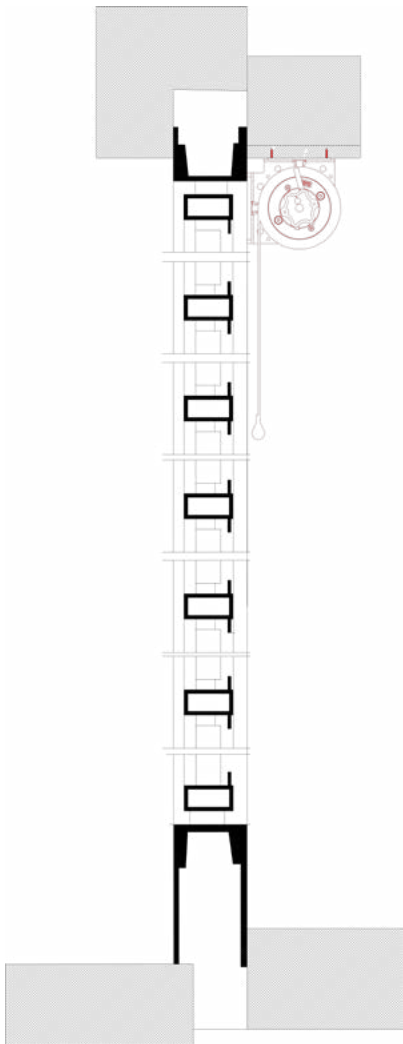


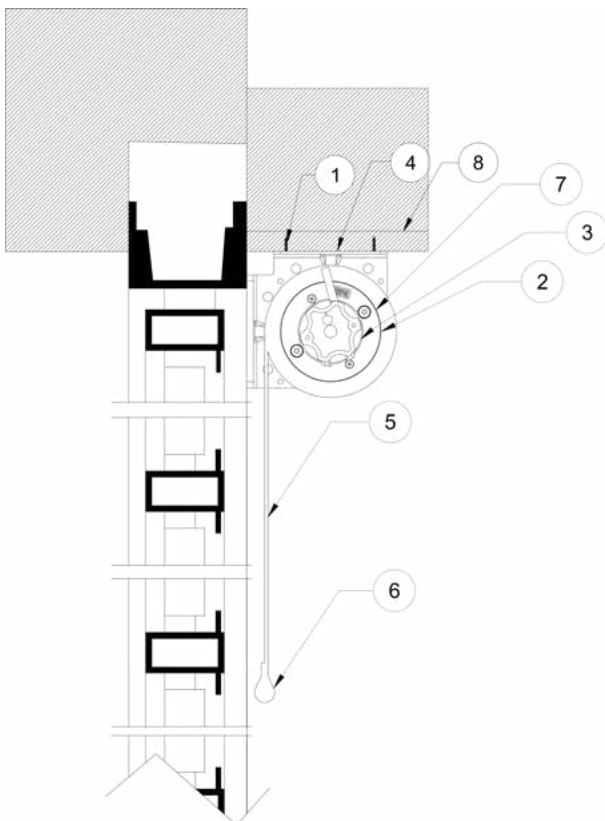
Figure 4.1.16 - Sectional view of the window.

The window shading can be outside the window frame and on the ceiling. When measuring and installing shades, it is required to make sure that there is a "play" between the roller and the brackets. Shades mounted too tight in the brackets will not function properly.

The blinds act as a barrier on windows, helping the building save on energy costs and making the inside heating and cooling work more effectively. The exterior blinds come in roll up, retractable and entertainer styles and there's a wide range of colours and sizes to choose from.

Installation is simple and easy to look after, the blinds can be customised to any height. It keeps the inside environment cooler in the summer and warmer in the winter.

Brackets attached to outside of casing and on the ceiling. Shading is hold to desired position, making sure it is in level, and place pencil marks at each end of the roller. Then, brackets are secured. For ceiling mount, the pin is inserted into the outer hole. Then other end of the shade is inserted into the slot of the left bracket.



ITEM	DESCRIPTION
1	Fasteners By Others
2	Tube, Roller
3	115 VAC Motor
4	Bracket, Mounting
5	Shade Fabric
6	Hem Pocket
7	Adaptor Assembly, 4" OD Tube Motor
8	Blocking By Others Level and Plumb

Figure 4.1.17 - Detail of the window.

4.2 - Urban relations

4.2.1 - Concept

"An unusual itinerary between history and culture inside the theatre of justice."

The concept of Milan's Court Building as an Art Gallery requires an urban approach to attract more visitors to the site.

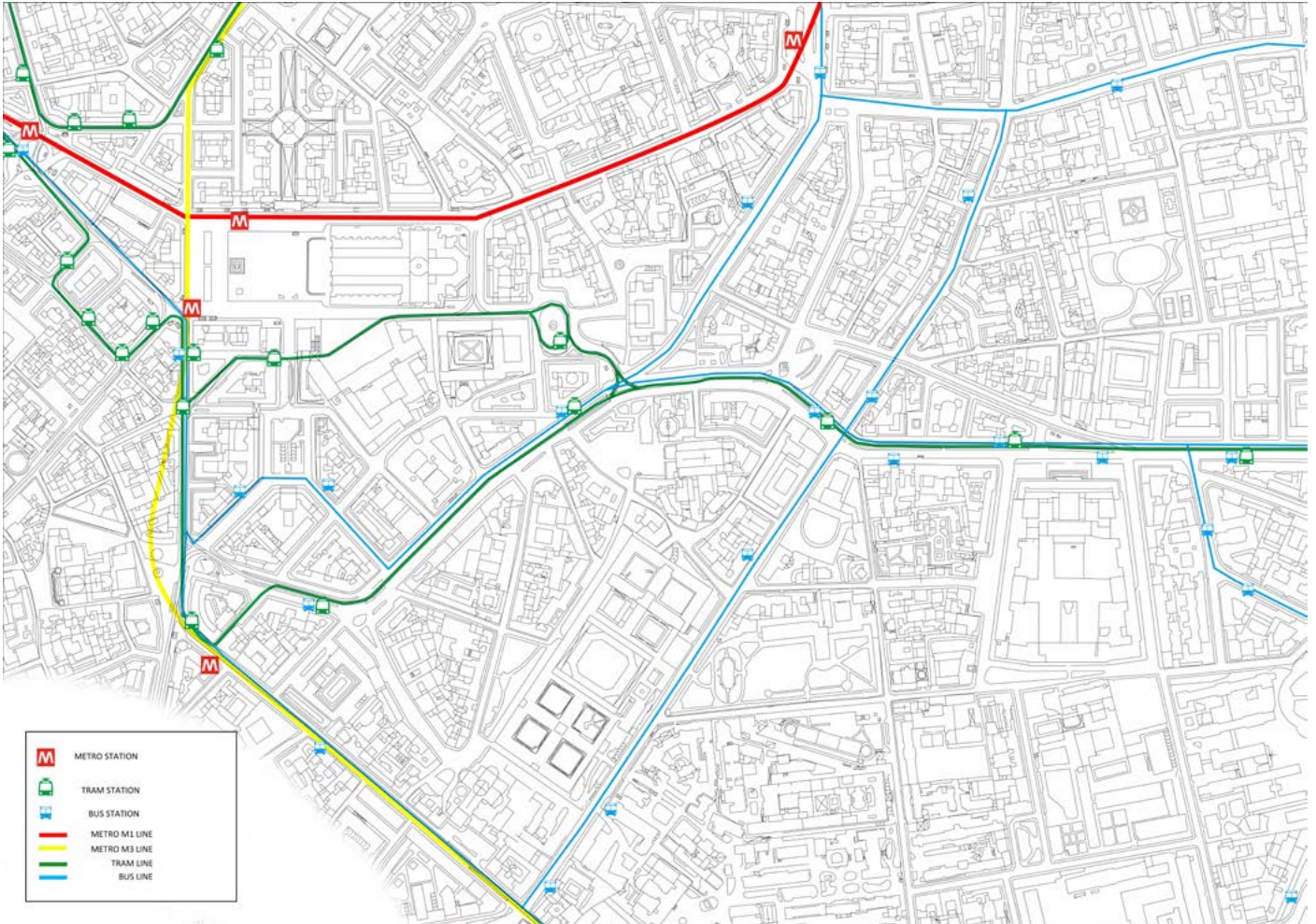


Figure 4.2.1 - Transportation analysis of Milan.

Considering the transportation methods to the courthouse is an important approach. Even though the courthouse does not have the best location in terms of going there by public transportation, it is still fairly good.

In current condition, public transportation is limited to trams and buses in close distance. There are bus and tram stops right in front of the courthouse.

Arriving more further distance is possible through metro, when it is considered, nearest metro is not that close to the courthouse, but still considering that people can walk from duomo in 10 minutes, it is fine.

herbs.

2) Milano Centrale Stazione: Milan Central Railway Station is the main railway station in Milan, Italy's second largest railway station, is also one of Europe's leading railway station. Located in Piazza Duca d'Aosta, Milan's central railway station was built in 1864 and was designed by Ulisse Stacchini and completed and put into use in 1931. Milan Central Station has 24 stations, about 320,000 passengers for one day, and 500 trains, about 120 million passengers each year to use.

3) Porta Garibaldi: The Porta Garibaldi, is a city gate located in Milan 200 years before. The Neoclassical arch was built to commemorate the visit of Francis I of Austria in 1825. It was reconstructed from 1826 to 1828 by Giacomo Moraglia and dedicated to Garibaldi in 1860. Built in the Doric style, the gate is flanked by two portals overlooking the street. now it's the new city and one of the important landmarks.

4) Arco della Pace: In 1807, Napoleon in order to celebrate the victory of his war in Europe and the construction of the Arc de Triomphe, the door has not yet completed the construction, take Boren in Waterloo in the defeat. In 1826 the Milan ruler Felicia changed the Arc de Triomphe to the Peace Gate, which was a bronze statue of peace goddess with an olive branch, standing on a chariot with six horses.

5) Giardini Pubblici Indro Montanelli: A forest park in the city center, let people relax and rest in the city life, breathe fresh air.

6) Parco Sempione: Sempione Park is a large urban green space in Milan, located behind the Castello Sforzesco. The park was built in 1888 and was planned to become a public space for a walk and revolutionary celebration. After the completion of the park, in order to highlight its the center of Milan and its close relationship with the arts, the park also held many exhibitions, such as the 1906 EXPO.

7) Castello Sforzesco: Castello Sforzesco is one of the most important buildings in Milan, is the history of Milan vicissitudes witness. The building was built in the 14th century by the Earl of Sforzesco as a castle and then became the residence of the Sforzesco family. The castle was square with a large park and surrounded by high walls. Today, the castle is used as a visit, and the interior museum has a collection of works of great artistic and historical value, including Michelangelo's final sculptures, "Madonna Mourning" and Da Vinci's Codex Trivulzianus Original.

8) Brera Picture Gallery: The Brera Gallery was founded in 1809 by Napoleon I. Originally exhibited for the Milan Academy of Fine Arts collection of paintings, after the exhibits have increased, mainly in the Renaissance painting works, and some of the Dutch painter works. G.

Beline's "Madonna", A. Mantelia's "Mourning for Christ", Piero de la Francesca's "Brera House", Raphael's "Our Lady Of the wedding ", Tintoretto's " San Marco's miracle "are collected here. The site is built in the 17th century palace, designed by F.M. Rikini, a total of 38 exhibition rooms, is one of the most important collection of Italian painting.

9) Santa Maria delle Grazie: The monastery of Santa Maria is a Catholic building in Milan, which includes a church and a multi-ming hall. The monastery is known for its "Last Supper" by the Da Vinci Church in the cafeteria, listed as a World Heritage in 1980.

10) Teatro alla Scala: The Scala Opera House is the hallmark of the Italian opera and one of the world's famous opera houses.

11) Galleria Vittorio Emanuele II: The Galleria Vittorio Emanuele II is a covered arcade street. It is located in the prominent position on the north side of Milan's Cathedral Square and connects to Scala Square. The arcade street was named after the reunification of the first king of King Emmanius II, originally designed in 1861 and built by Giuseppe Mengoni between 1865 and 1877.

12) Via Montenapoleone: The luxury goods of Milan's Montenapoleone street is the paradise of shoppers.

13) Duomo di Milano: Duomo di Milano is Italy's most famous Catholic Church, the scale ranks is the second in the world. The cathedral is not only a symbol of Milan, but also the center of Milan. The characteristics of the church is its shape - pointed arch, pilaster, flower window lattice. There are 135 miners outside the church, like a dense Tallinn stabbed into the sky, in each spire has a statue of God, plus the statue inside the church decoration, a total of more than 6,000 statues, the world's largest statue of Gothic Chapel. Boarded the roof of the cathedral platform, you can see the city center of Milan, three ring road and dense as the spider web. Napoleon held a coronation ceremony in Milan Cathedral in 1805.

14) Leonardo da Vinci Museum of Science and Technology: The Da Vinci Museum of Science and Technology mainly shows the scientific developments since the 15th century, including transportation, metallurgy, physics and navigation. Among them, Leonardo da Vinci's hall shows the creation of countless achievements in science and technology, including in-kind, model, design, sketch and so on. Not as an artist, but as a scientist, here more to show the genius in the field of science and technology outstanding achievements.

15) Chiesa di San Bernardino alle Ossa: In the 17th century, the people of Milan built the Bernardino church in honor of the innocent children who died in the plague in the early seventeenth century. The church is famous for the human skeleton inside the church, and the human bone is located in a side hall of the church, decorated with human bones.

4.2.2.2 - Realization of the boards

Here, it is possible to see how to implement these boards to all around Milan. These images are from Teatro alla Scala, Duomo and Castello Sforzesco, respectively.



Figure 4.2.3 - Visualization of information boards around Milan.

These locations already have boards located on the walkways to advertise various activities all around Milan. Considering this, the implementation of the information boards for the courthouse is easily acceptable by the municipality.

As it is visible on the images, a lot of people walk past by these boards every day. These boards will be located in points where it will inform people while does not occupy a lot of space to disturb the walking areas.

4.2.3 - Parking areas

As part of our focus, the big courtyard in the middle is used as a car parking at the moment. It is a very ineffective area for people. But before focusing on that, the parking around the courthouse must be considered.

Existing parking areas outside of the courthouse are disorganized and without any design for landscape or pedestrian path.



Figure 4.2.4 - Existing outdoor parking area.

Only one of the facades, the facade faces the main street, has a properly designed landscape. On the other hand, three of the four facades are filled with cars as the area attracts a lot of people. Specially one of the facade, has cars parked next to the building, seems that it visually blocks the entrance.

The aim here is to modify the parking area on the south facade. Considering the area gets a lot of direct sunlight during the day, trees help shading the pedestrian paths, while making the scene more pedestrian friendly and visually pleasing.



Figure 4.2.5 - Realization of the new parking area plan in comparison to the existing.

4.2.4 - Art gallery

The courthouse is hosting a lot of artwork from history and considering there will be a lot of visitors, the path for visiting should be also designed.

Because of this, possibility of people visiting the courthouse is a way to expand and increase the value of a unique artistic heritage, which has resulted in Milan becoming a top cultural reference point in Europe and one of the main cities in Italy and in the world.

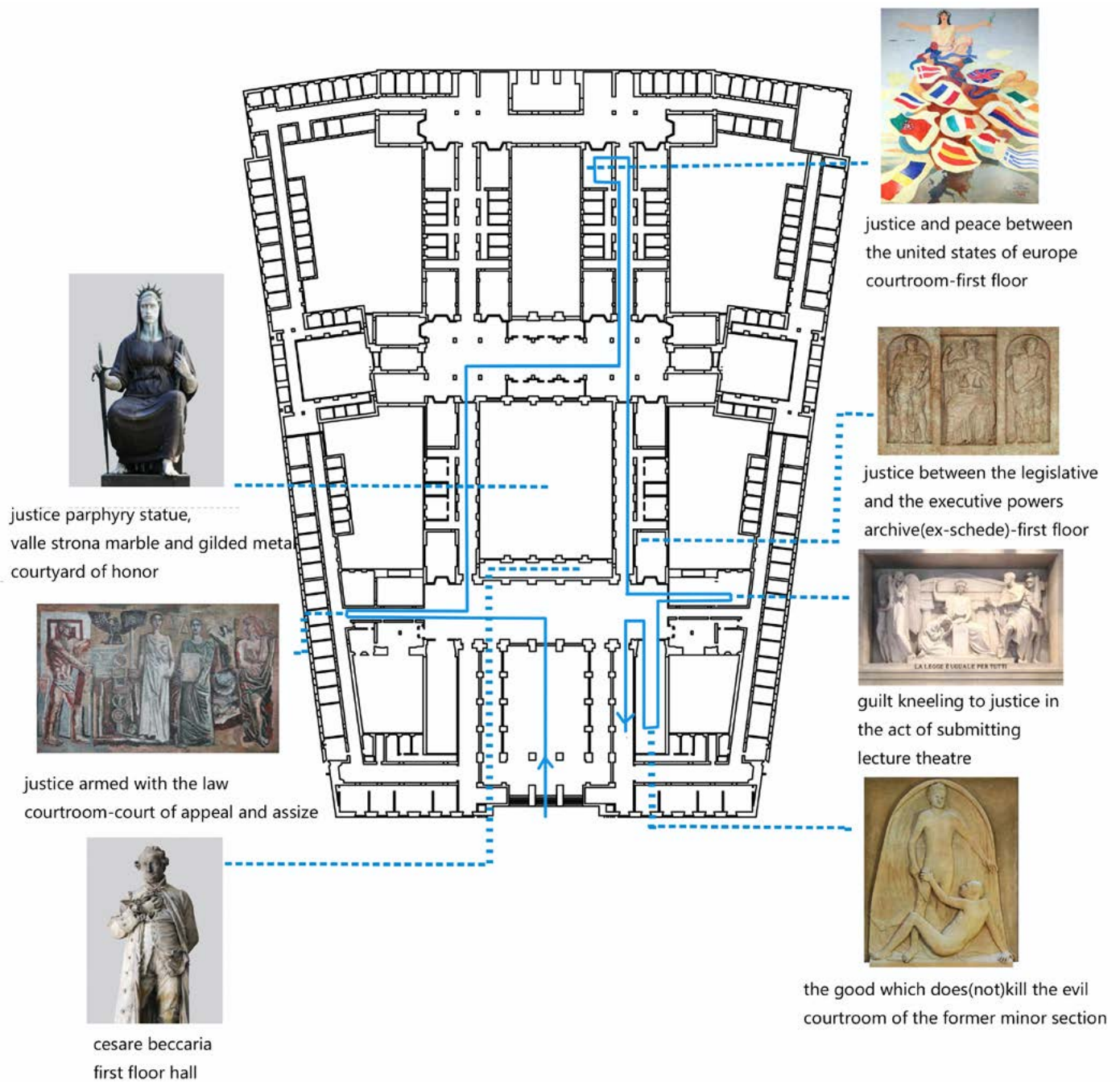


Figure 4.2.6 - Art gallery path - Ground Floor.

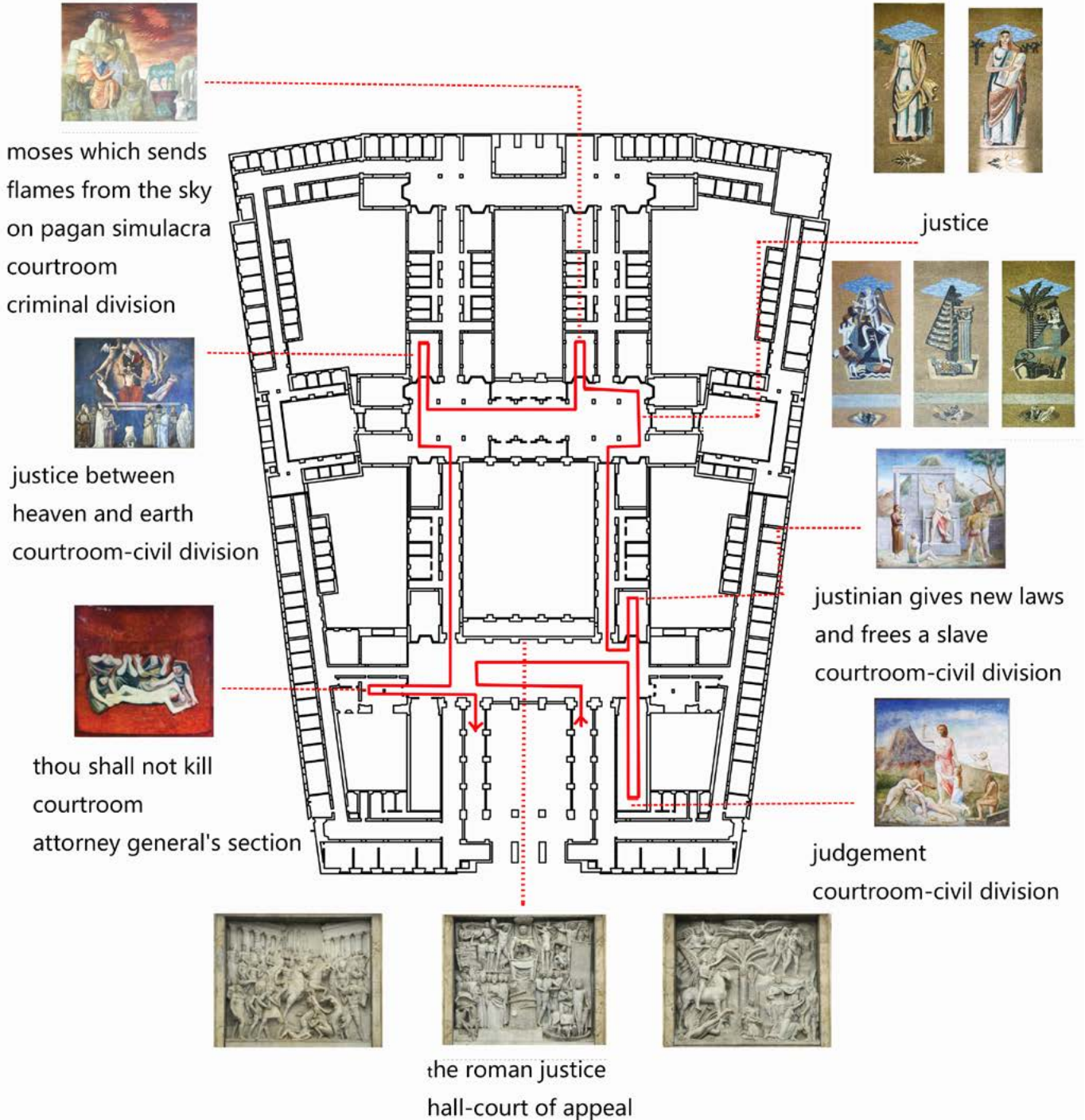


Figure 4.2.7 - Art gallery path - First Floor.

4.3 - Courtyard landscape design

4.3.1 - Concept

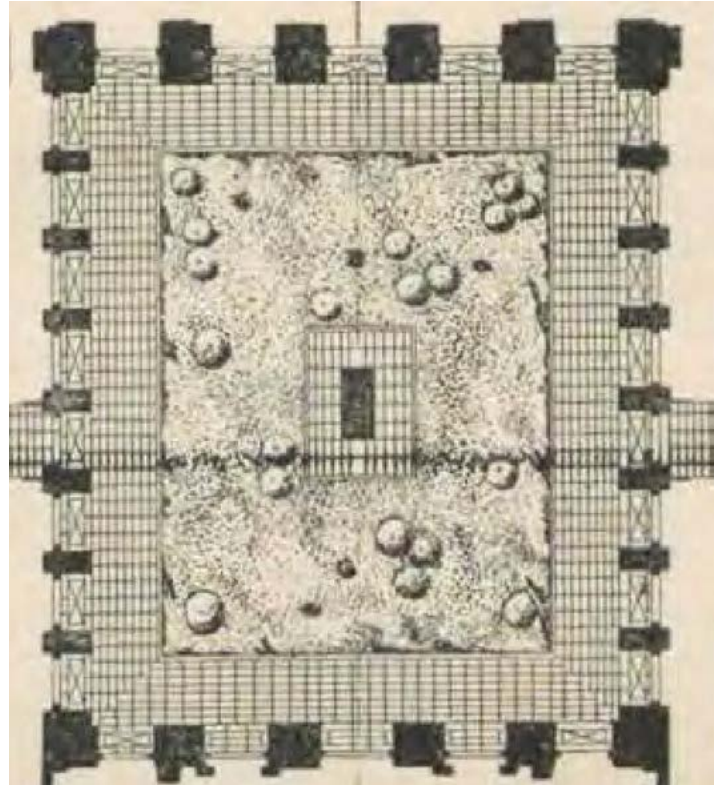
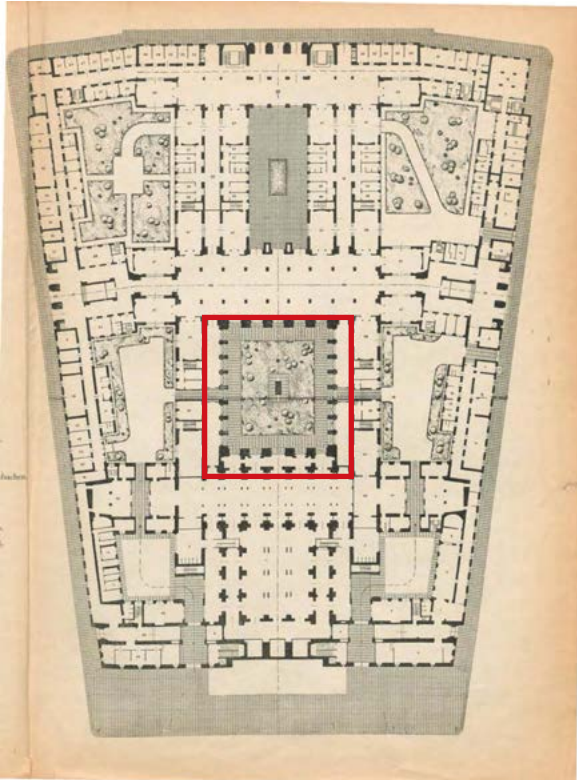


Figure 4.3.1 - Courtyard plan from original drawings.

According to the original historical drawings from the construction of the courthouse, the courtyards of the courthouse are planned with a landscape design, specially the central courtyard. These drawing indicates the central courtyard was planned with a designed walking path around the corners and green part in the middle of the courtyard, surrounding the statue.



Figure 4.3.2 - Situation in the courtyards today.

On the other hand, today, the courtyard is being used as car parking area and sometimes also for storing scraps. These open areas should be used by people. To achieve that, the courtyard needs a redesign.

4.3.2 - The modular platform

One of the approaches to improve the landscape of the courtyard is the modular platform idea. Also due to the platform itself, indirectly, accessibility will be improved as well.

The modular platform is a reversible idea to improve the ground condition with changable design. This design aims to integrate and implement new outdoor functions. In order to do that, addition of a reversible light structure considered.

As the process of this platform, the courtyard will divided as a grid configuration, and each part of the grid is interchangeable. So it is possible to remove one square, and change it with another. This way, the landscape is not permanent, it is reversible, and also it is possible to rearrange the organization of the landscape in request.

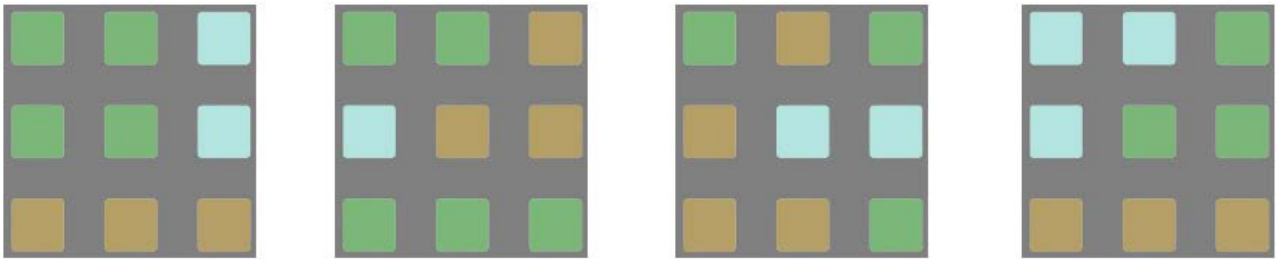


Figure 4.3.1 - Different pattern examples.

Due to this changable organization it is possible to see different patterns all around the courtyard.

Each one of these modular squares can contain different materials, such as wood, grass, plants, and even glass with other stuff behind to show.

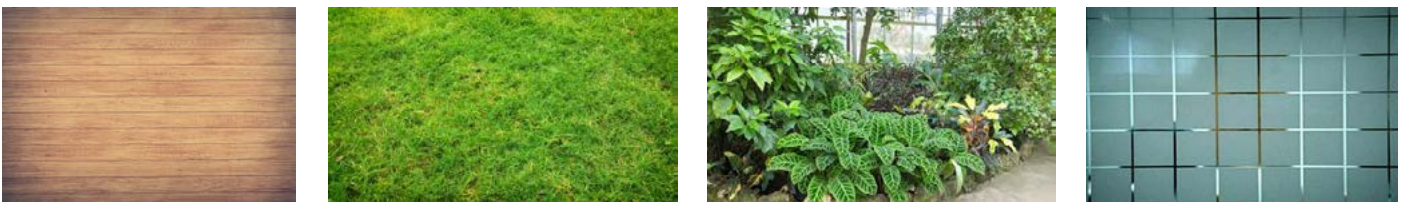


Figure 4.3.2 - Different material examples.

Depending on the material, the platform might have differences, mainly the depth of the box. If the material is required a certain depth, for example the earth for the plants, the box can be change with 2 different options.

Another alternative to this is the appearance. For example, for the wooden platform, smaller box thickness is suggested, but if the opening under of the platform is an issue, deeper boxes can be used instead.



Figure 4.3.3 - Wooden deck platform.

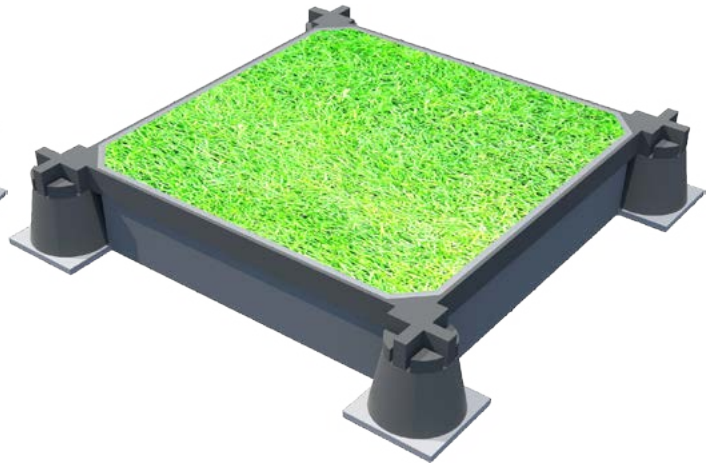


Figure 4.3.4 - Grass platform.

Each piece of the platform has 60x60 cm dimension with very small gap between them. This gap is completely open for air flow that helps with certain materials.

Each platform has a concrete footing that is not connected to the ground in any way, so it is easy to remove if needed. It is supported with steel base pieces that connect each box together. Each box has a connection frame and a thin box plate on top. The preferred material comes top of this plate and can be changed as preferred. Deeper box is an alternative option as mentioned before, in case of different materials or preferences.

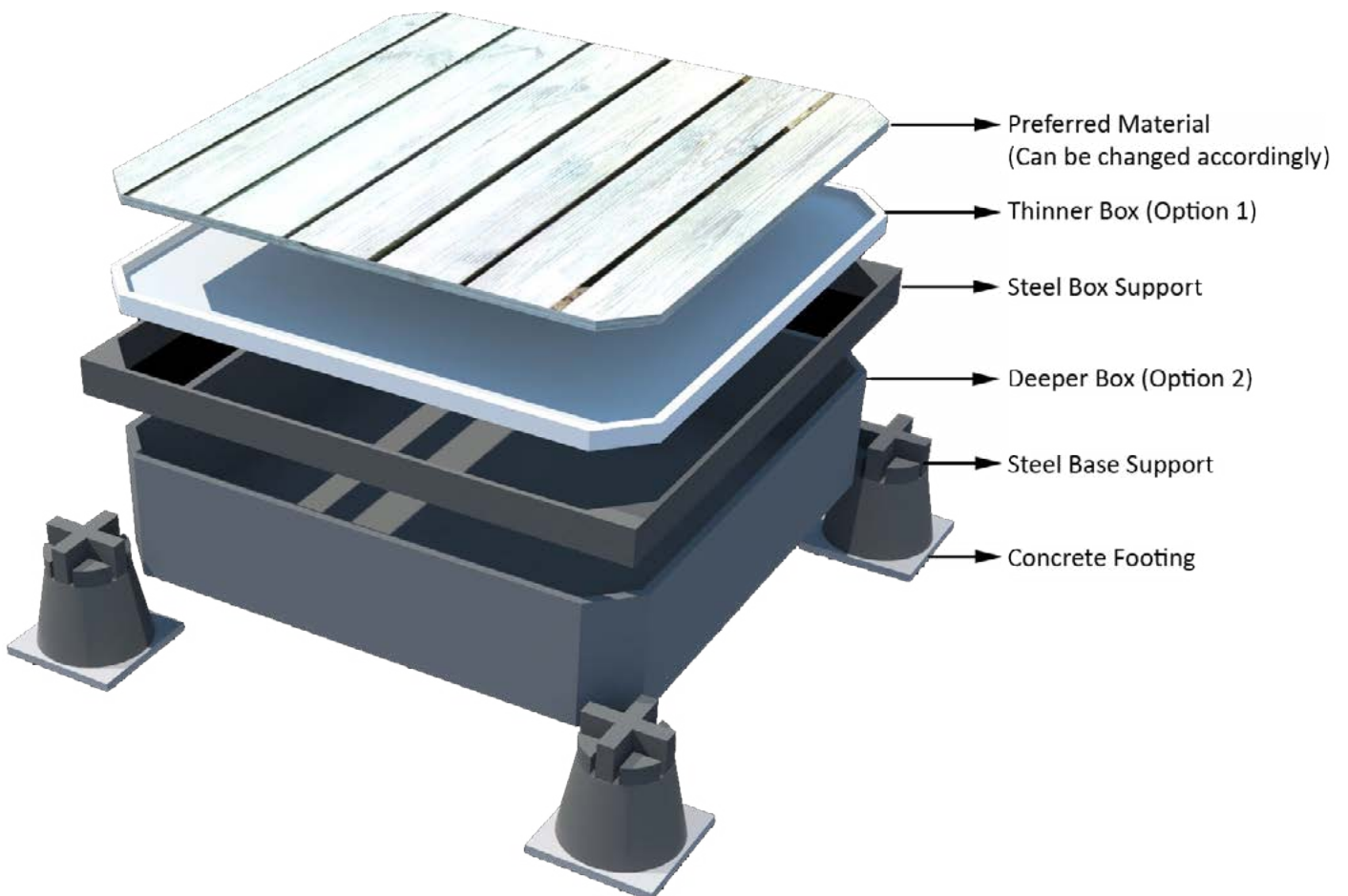


Figure 4.3.5 - Exploded view to the platform.

PROJECT

Following original drawings from construction for the courtyard, and considering circulation between other parts of the courthouse, the plan below is suggested. This plan can be changed according to the preferences, but the aim is to improve variety for the people who will use this courtyard.

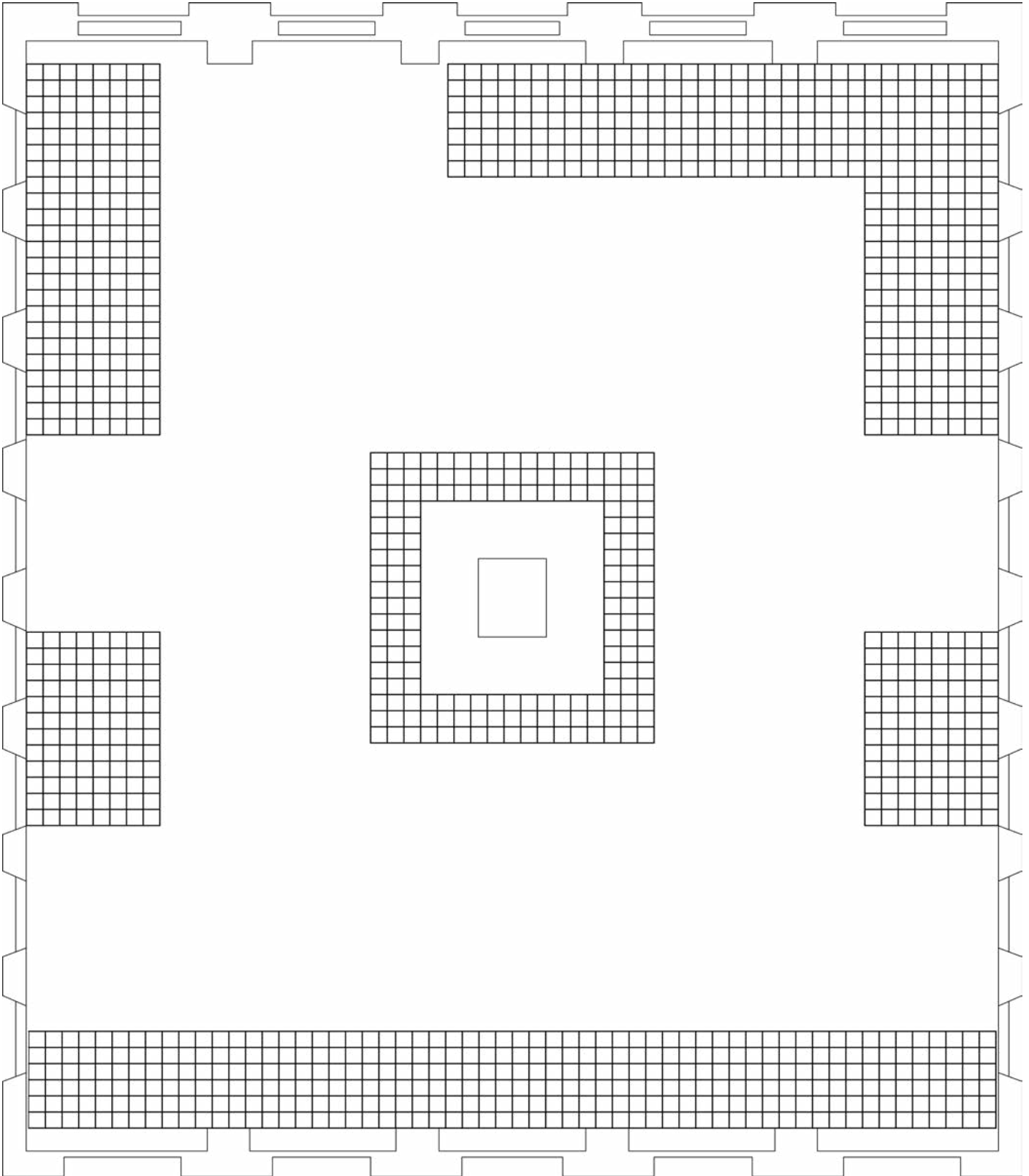


Figure 4.3.6 - Plan view, showing the arrangement of the platform in the courtyard.

4.4 - Courtyard facade design

4.4.1 - Concept

As we know from the historical background, the building was completed in 1930s but years later they added additional 2-3 floor on top of the existing structure. This addition created a distinctive vision with the existing facade.



Figure 4.4.1 - View to the existing facade.

For the project of the facade, there are 3 main considerations; unifying the facade, controlling the air flow and provide shading for the additional floors.

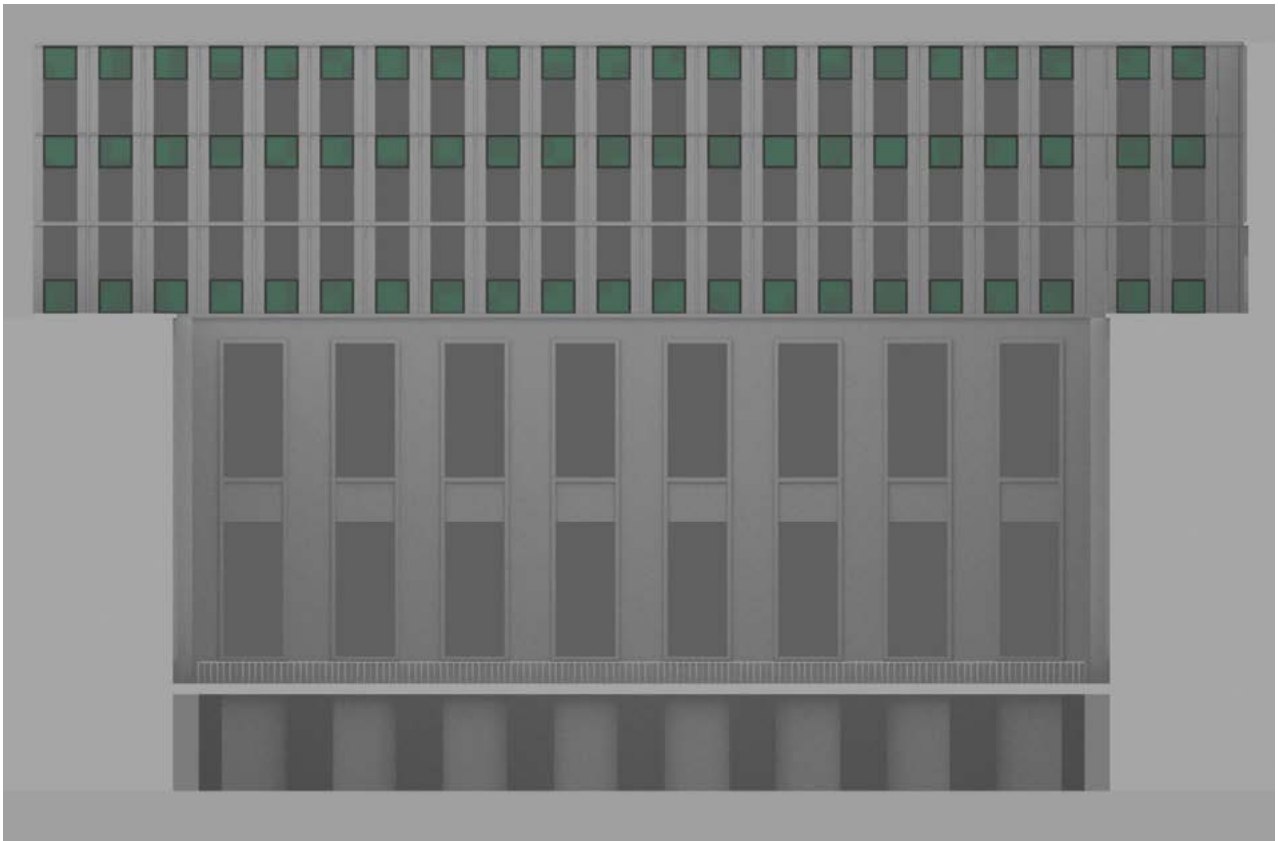


Figure 4.4.2 - Elevation of the existing facade.

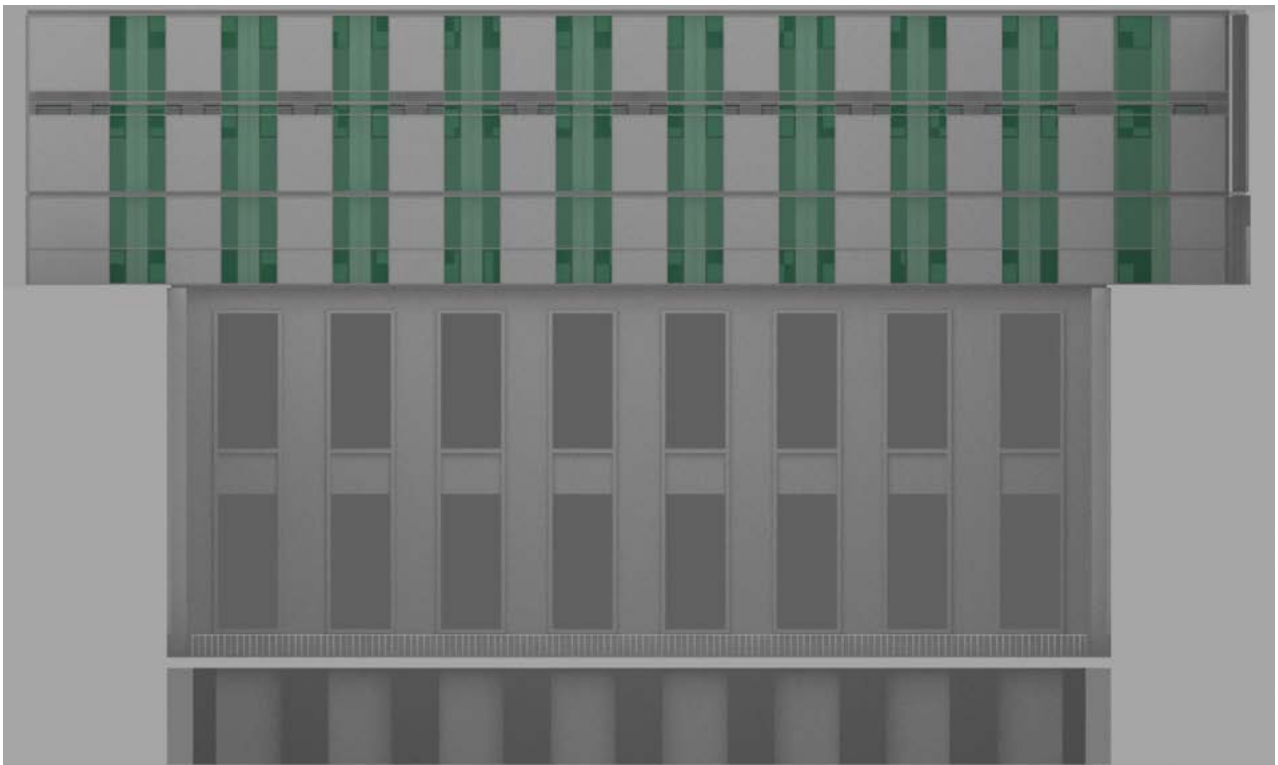


Figure 4.4.3 - Elevation of the proposal facade.

4.4.2 - Design

Proposed facade is a double glazed facade, extending around 50cm outside of the existing facade. This facade is only on the additional facade that added to the courtyard in later years following it's construction.

The design of the new facade aims to keep the old part as it is, improve the continuity of the new and old parts of the courtyard facades, creating more continuous and single unified facade.

The new facade has a separate structure design compared to the new roof. The facade is self-supported. On the other hand, this secondary facade is working together with the proposed roof, providing openings for air flow through the whole courtyard.

The facade is creating a chimney effect and taking the hot air and moving it through horizontal and vertical air ventilation openings to the outside of the courtyard and the building.

Part of the horizontal air ventilations are also horizontal shading devices with no openings. Also there are vertical panels in between glazing to provide optimum sunlight and shading balance for all the offices in the additional levels of the courtyard.

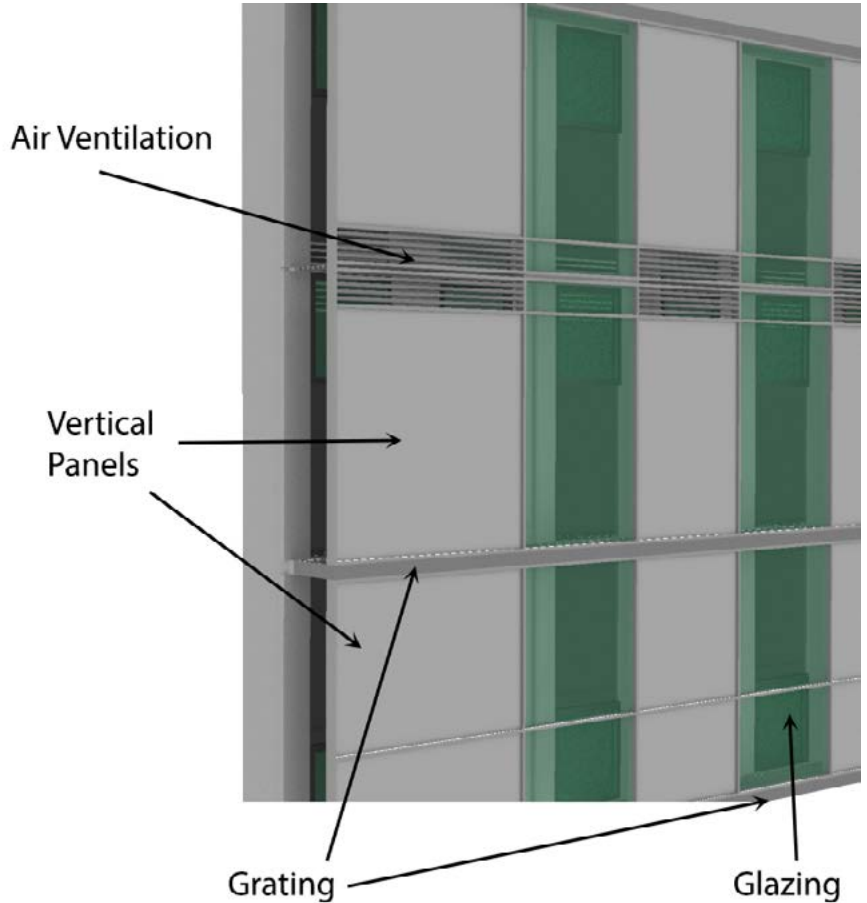


Figure 4.4.4 - New facade details.

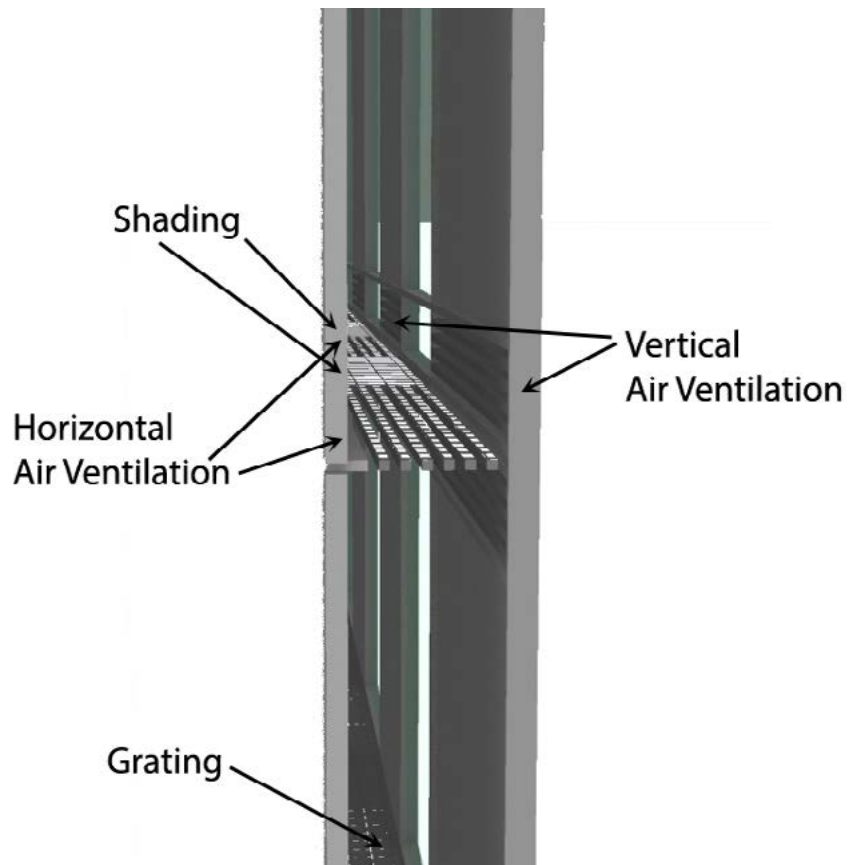


Figure 4.4.5 - New facade details.

4.5 - Courtyard roof design

4.5.1 - Investigations

4.5.1.1 - Objectives

Following the idea of enhancing the courtyard for people to use, the idea of a roof emerged. Because of the size and dimensions of the courtyard, a big part of it gets direct sunlight all day. This does not only have an effect for the courtyard itself, but also courthouse itself due to the existence of big windows.

The main goal here is to provide shading to the certain areas of the courtyard to improve the quality of life. The roof is mostly glass, but in certain areas, it is aimed to prevent direct sunlight for both outside and inside.

The size of the courtyard is 43 meter to 37 meter and this is a huge distance to have a roof without supporting by adding pillars inside the courtyard. Due to this dilemma, couple of options are laid out to decide the best.

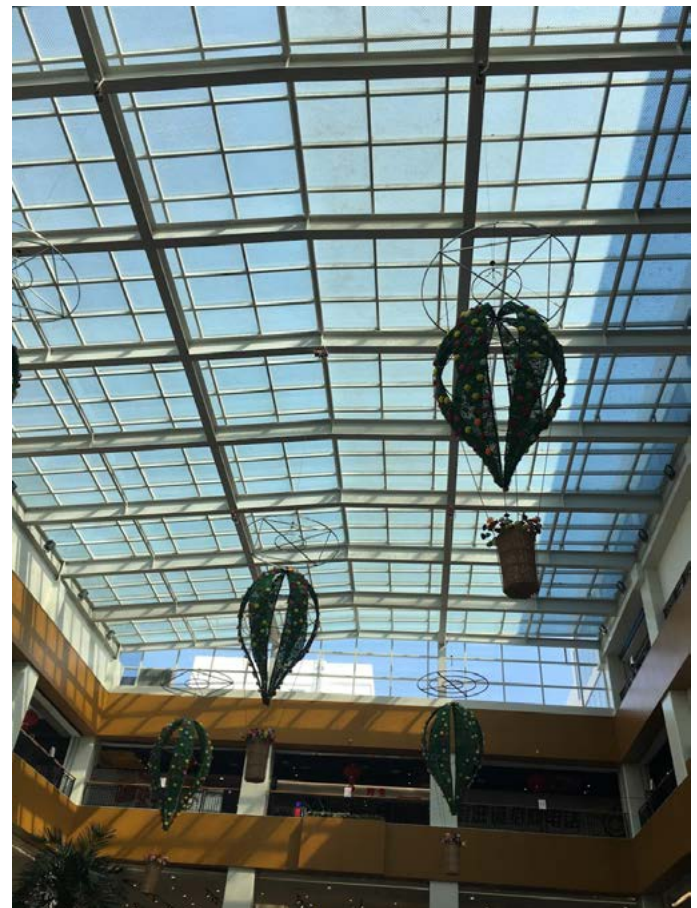


Figure 4.5.1 - Roof examples.

4.5.1.2 - Classification of earthquake level



Figure 4.5.2 - Earthquakes of the last 2 years near Milano, Lombardy, Italy.



Figure 4.5.3 - Earthquakes of the last 2-4 years near Milano, Lombardy, Italy.

Earthquake level is always an important consideration during the structure design and structural analysis. We shall all remember the earthquake that struck in central Italy months ago had killed hundreds of people, not only the innocent people lost their lives but also the historic buildings can not survive in the disaster.

So any intervention you do to the historic building maybe not enhance the earthquake resistance, but never reduce it. As for Milan area, the frequency map shows that Milan is not in a very frequent earthquake area but still gets some impact from the surrounding areas.

Another things is the building itself is nearly 100 years old and the maintenance might not be perfect, earthquake risk must exist.

So the earthquake level is defined as 3, which means the Milan may be subject to strong earthquakes but rare.

The seismic classification of the national territory has introduced technical regulations specific to the construction of buildings, bridges and other works in geographical areas by the same seismic risk.

Below shows the seismic zone to the area of Milan, he stated in the Ordinance of the President of the Council of Ministers no. 3274/2003, updated by Resolution of the Regional Council of Lombardy on 11 July 2014 n.2129 entry into force April 10, 2016.

Seismic zone: 3

Zone low seismic hazard, which may be subject to moderate quakes.

AgMax: 0.054655

Maximum acceleration inside the municipal area.

The criteria for updating the map of seismic hazard have been defined in the Ordinance PCM n. 3519/2006, which has divided the whole country into four seismic zones on the basis of the 'value maximum horizontal acceleration (in g) on a rigid or flat ground, which has a 10% chance of being exceeded in 50 years.

Zone Earthquake	Description	acceleration with probability of exceedance of 10% in 50 years	Conventional maximum horizontal acceleration (Technical Standards)	common number with territories falling in the area (*)
1	It indicates the most dangerous area, where strong earthquakes may occur.	in g > 0.25 g	0.35 g	703
2	Zone where strong earthquakes may occur.	0.15 <a g ≤ 0.25 g	0.25 g	2,230
3	Zone that may be subject to strong earthquakes but rare.	0.05 <a g ≤ 0.15 g	0.15 g	2,815
4	And 'the least dangerous area, where earthquakes are rare and faculty of the Regions lay down a requirement of seismic design.	to g ≤ 0.05 g	0.05 g	2,235

Table 4.5.1 - Earthquake Classification.

(*): The territories of some common fall into several seismic zones (eg. The municipality of Pescorocchiano).

4.5.2 - Structural form selection

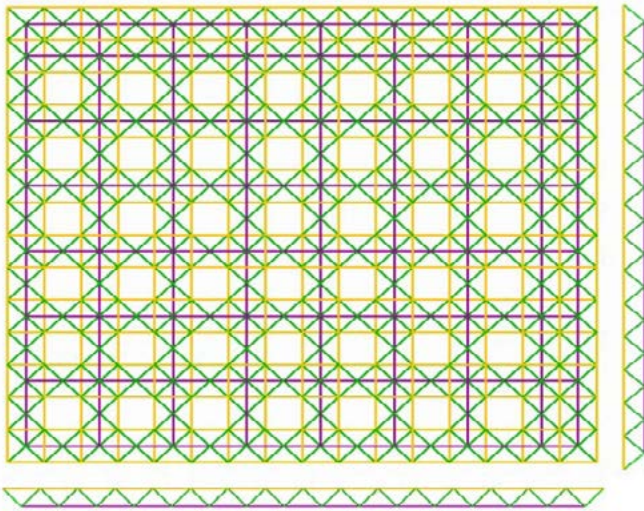


Figure 4.5.7 - Pyramid grid steel truss structure.

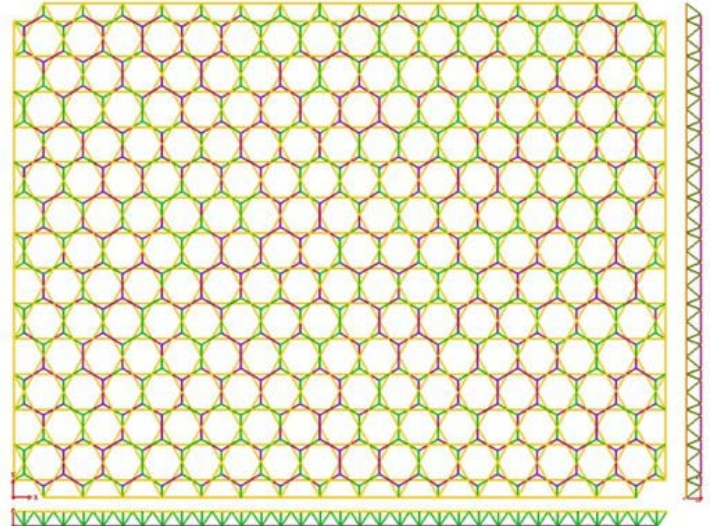


Figure 4.5.8 - Double hexagon grid steel truss structure.

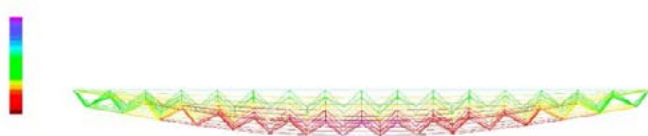


Figure 4.5.9 - Pyramid grid deformation under full load.



Figure 4.5.10 - Double hexagon grid deformation under full load.

Those are two schemes we were planning to make for the roof.

At the beginning, we planned to use the classical pyramid grid as the main structural form, then we realized the span is much larger than the normal condition and we did the initial analysis for the deflection of the roof under full loads.

Even it might fit the requirement of a steel structural roof on deflection, but we still want to find a better form to reduce the deflection and the self-weight.

Then we made this triangular pyramid space grid of hex-plane honeycomb pattern on the right, which has much lower deflection and less self-weight and can easily tell from the displacement nephogram comparison.

4.5.2.1 - The result of reaction support at supports

The standard value of support under single condition

Node	Px	Py	Pz	Node	Px	Py	Pz
1	10.96	29.89	13.02	2	19.28	2.48	-0.90
3	46.95	27.03	-8.23	4	42.84	-4.43	-9.91
5	59.11	22.29	-11.54	6	56.62	-10.60	-12.18
7	62.01	16.64	-12.65	8	62.02	-16.63	-12.65
9	56.63	10.61	-12.18	10	59.02	-22.28	-11.53
11	42.85	4.44	-9.91	12	46.88	-27.03	-8.23
13	19.28	-2.48	-0.90	14	10.97	-29.91	13.03
22	11.66	2.38	-42.88	35	11.68	-2.39	-42.89
36	22.02	29.67	12.17	43	22.03	-29.69	12.16
79	19.35	43.58	-6.36	86	19.36	-43.60	-6.36
122	17.56	52.74	-11.01	129	17.57	-52.74	-11.01
165	15.15	60.36	-13.34	172	15.16	-60.36	-13.34
208	12.31	66.52	-14.86	215	12.32	-66.52	-14.86
251	9.34	70.76	-15.88	258	9.35	-70.75	-15.88
294	6.77	72.09	-16.52	301	6.78	-72.08	-16.52
337	2.55	73.91	-16.82	344	2.55	-73.90	-16.82
380	-2.55	73.96	-16.82	387	-2.55	-73.96	-16.82
423	-6.78	72.22	-16.52	430	-6.79	-72.22	-16.52
466	-9.40	70.86	-15.87	473	-9.41	-70.86	-15.87
509	-12.41	66.69	-14.86	516	-12.42	-66.69	-14.86
552	-15.28	60.50	-13.34	559	-15.29	-60.51	-13.34
595	-17.69	52.76	-11.01	602	-17.70	-52.77	-11.01
638	-19.46	43.63	-6.36	645	-19.47	-43.64	-6.36
681	-22.06	29.76	12.15	688	-22.07	-29.78	12.15
689	-11.82	2.33	-42.84	702	-11.84	-2.33	-42.85
710	-10.99	29.93	12.99	711	-19.28	2.48	-0.90
712	-46.93	27.03	-8.22	713	-42.74	-4.46	-9.91
714	-58.98	22.30	-11.53	715	-56.46	-10.64	-12.18
716	-61.83	16.66	-12.65	717	-61.84	-16.66	-12.65
718	-56.47	10.65	-12.18	719	-58.89	-22.29	-11.52
720	-42.75	4.48	-9.91	721	-46.86	-27.04	-8.22
722	-19.28	-2.48	-0.90	723	-11.00	-29.94	13.00

Table 4.5.12 - Support reaction under constant load(kN).

PROJECT

Node	Px	Py	Pz	Node	Px	Py	Pz
1	2.69	7.40	3.23	2	4.83	0.61	-0.32
3	11.67	6.73	-2.19	4	10.61	-1.16	-2.61
5	14.58	5.58	-3.01	6	13.92	-2.71	-3.17
7	15.23	4.20	-3.28	8	15.23	-4.20	-3.28
9	13.93	2.71	-3.17	10	14.56	-5.58	-3.01
11	10.61	1.16	-2.61	12	11.65	-6.73	-2.19
13	4.83	-0.61	-0.33	14	2.69	-7.41	3.23
22	2.95	0.61	-10.99	35	2.96	-0.61	-10.99
36	5.44	7.29	3.00	43	5.44	-7.29	3.00
79	4.71	10.77	-1.72	86	4.71	-10.77	-1.72
122	4.23	13.02	-2.89	129	4.23	-13.02	-2.89
165	3.62	14.87	-3.46	172	3.62	-14.88	-3.46
208	2.92	16.37	-3.82	215	2.92	-16.37	-3.82
251	2.21	17.40	-4.06	258	2.21	-17.40	-4.06
294	1.61	17.72	-4.21	301	1.61	-17.72	-4.21
337	0.61	18.17	-4.28	344	0.61	-18.17	-4.28
380	-0.61	18.19	-4.28	387	-0.61	-18.19	-4.28
423	-1.61	17.76	-4.21	430	-1.61	-17.76	-4.21
466	-2.22	17.43	-4.06	473	-2.22	-17.43	-4.06
509	-2.95	16.42	-3.82	516	-2.95	-16.42	-3.82
552	-3.65	14.91	-3.46	559	-3.65	-14.91	-3.46
595	-4.26	13.02	-2.89	602	-4.26	-13.02	-2.89
638	-4.74	10.78	-1.72	645	-4.74	-10.78	-1.72
681	-5.45	7.31	3.00	688	-5.45	-7.31	3.00
689	-2.99	0.60	-10.98	702	-3.00	-0.60	-10.98
710	-2.69	7.41	3.22	711	-4.83	0.61	-0.33
712	-11.66	6.73	-2.19	713	-10.59	-1.17	-2.61
714	-14.55	5.59	-3.01	715	-13.89	-2.72	-3.17
716	-15.19	4.21	-3.28	717	-15.19	-4.21	-3.28
718	-13.89	2.72	-3.17	719	-14.53	-5.58	-3.01
720	-10.59	1.17	-2.61	721	-11.65	-6.73	-2.19
722	-4.83	-0.61	-0.33	723	-2.70	-7.41	3.22

Table 4.5.13 - Support reaction under live load(kN).

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Maximum design value of combined internal force support reaction

Node	Px	Py	Pz	Node	Px	Py	Pz
1	17.43	47.61	20.74	2	30.77	3.95	-1.53
3	74.82	43.08	-13.25	4	68.23	-7.11	-15.94
5	94.09	35.57	-18.53	6	90.08	-16.96	-19.55
7	98.64	26.58	-20.29	8	98.65	-26.57	-20.29
9	90.10	16.98	-19.55	10	93.95	-35.55	-18.51
11	68.25	7.14	-15.94	12	74.71	-43.08	-13.25
13	30.77	-3.95	-1.53	14	17.44	-47.63	20.75
22	18.63	3.82	-68.66	35	18.67	-3.82	-68.67
36	35.06	47.20	19.37	43	35.07	-47.23	19.36
79	30.74	69.39	-10.27	86	30.76	-69.41	-10.27
122	27.86	83.95	-17.69	129	27.87	-83.96	-17.69
165	24.00	96.06	-21.39	172	24.02	-96.07	-21.39
208	19.48	105.85	-23.80	215	19.50	-105.84	-23.80
251	14.77	112.57	-25.42	258	14.78	-112.56	-25.42
294	10.71	114.69	-26.42	301	10.72	-114.68	-26.42
337	4.04	117.59	-26.91	344	4.04	-117.58	-26.91
380	-4.03	117.67	-26.91	387	-4.04	-117.66	-26.91
423	-10.73	114.91	-26.42	430	-10.74	-114.90	-26.43
466	-14.87	112.75	-25.41	473	-14.89	-112.74	-25.41
509	-19.64	106.13	-23.80	516	-19.66	-106.12	-23.80
552	-24.21	96.29	-21.39	559	-24.22	-96.30	-21.39
595	-28.06	83.99	-17.69	602	-28.07	-84.00	-17.69
638	-30.92	69.46	-10.28	645	-30.93	-69.48	-10.27
681	-35.12	47.34	19.35	688	-35.14	-47.37	19.34
689	-18.89	3.73	-68.60	702	-18.93	-3.74	-68.61
710	-17.48	47.66	20.69	711	-30.77	3.95	-1.53
712	-74.78	43.09	-13.25	713	-68.08	-7.17	-15.93
714	-93.88	35.58	-18.52	715	-89.82	-17.03	-19.54
716	-98.35	26.62	-20.29	717	-98.37	-26.61	-20.29
718	-89.84	17.05	-19.54	719	-93.74	-35.56	-18.50
720	-68.10	7.20	-15.93	721	-74.68	-43.09	-13.25
722	-30.77	-3.95	-1.53	723	-17.49	-47.69	20.71

Table 4.5.14 - Horizontal maximum combination of internal force support reaction (unit: kN).

4.5.2.2 - Component stress ratio statistical results

Component stress ratio	Quantities of the elements	Percentage
0 - 0.1	1102	% 31.6
0.1 - 0.2	1024	% 29.3
0.2 - 0.3	432	% 12.4
0.3 - 0.4	281	% 8.0
0.4 - 0.5	135	% 3.9
0.5 - 0.6	78	% 2.2
0.6 - 0.7	106	% 3.0
0.7 - 0.8	170	% 4.9
0.8 - 0.9	163	% 4.7
0.9 - 1.0	0	% 0.0
> 1.0	0	% 0.0

Table 4.5.15 - Stress interval, element number and percentage for the whole structure.

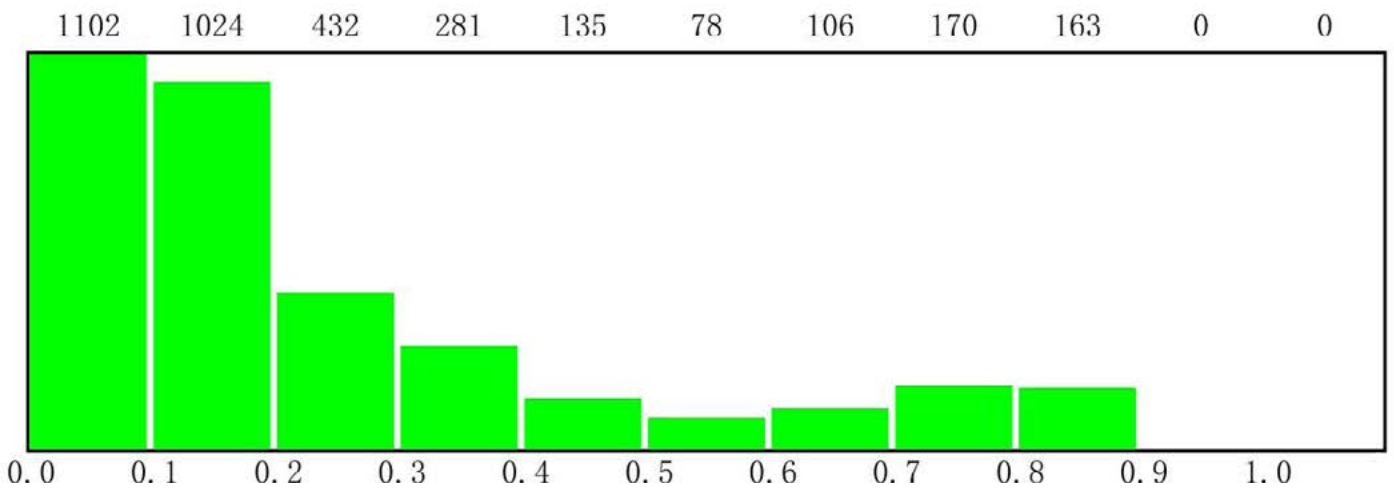


Figure 4.5.11 - Component stress ratio statistical results.

4.5.3 - Calculations

Assuming the edges of the roof are all established on the existing concrete columns of the building itself.

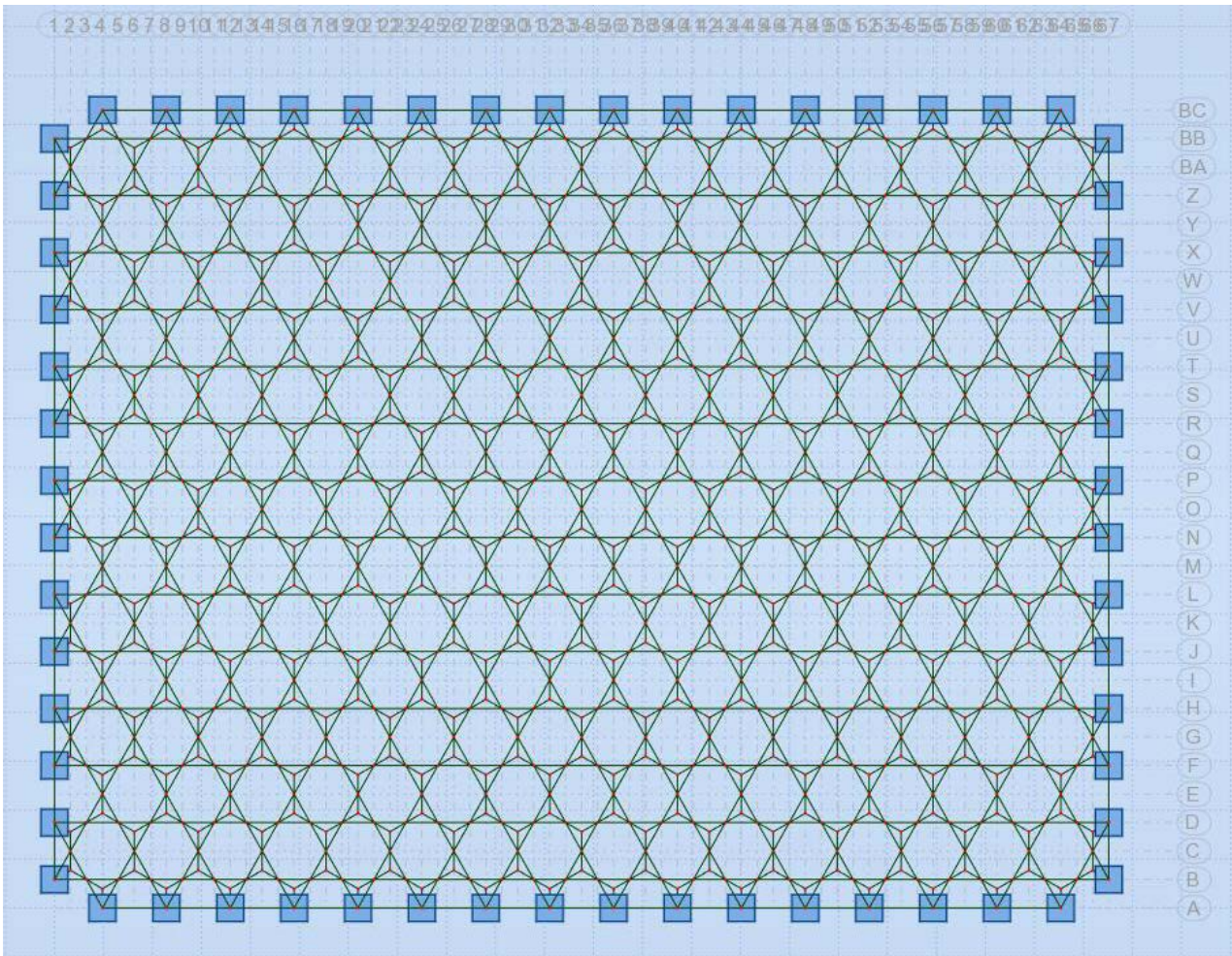


Figure 4.5.12 - Roof attached to the supports.

The additional columns are mostly depended on the deflections of the steel truss roof.

We search the Deflection Limit State:

The maximum deflection calculated must not exceed the deflection limit.

But the deflection limits are not given directly in Eurocode 3

In the absence of more specific criteria, criteria for structures with brittle finishes (as found in code documents for years) is frequently used. This simplistic criteria puts a limit of the span divided by 360 on the incremental deflection due to live (or transient) load only and a limit of the span divided by 240 on deflection under total load. These limit states are mathematic expressed as:

$$\Delta_{LL} < L/360$$

$$\Delta_{TL} < L/240$$

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Use Classification	Applied Load Only	Applied Load + Dead Load
Roof Beams		
- Industrial	L/180	L/120
- Commercial and institutional		
Without plaster ceiling	L/240	L/180
With plaster ceiling	L/360	L/240
Floor Beams		
- Ordinary usage	L/360	L/240
Highway bridge stringers	L/200 to L/300	
Railway bridge stringers	L/300 to L/400	

Table 4.5.16 - AITC Recommended Deflection Limits.
References according to the National Annex.

Design Situation	Deflection limit
Cantilever	Length/180
Beams carrying plaster of other brittle finish	Span/360
Other beams (except purlins and sheeting rails)	Span/200
Purlins and sheeting rails	To suit the characteristics of particular cladding

Table 4.5.17 - Vertical Deflection Limits from NA 2.23 Clause 7.2.1(1) B.

The nodes' deflections will mainly be showed by Z direction, and we made descending order by the Z direction.

The maximum deflection is no more than 133.6mm and we make it as 140mm to guarantee the result. The shorter side of the roof is 37.5m.

The result is $0.140\text{m}/37.5\text{m} \approx 1/267$ which is far from the limitation. So it could be possible to make a roof without any supporting pillars inside the yard.

About the self-weight of the roof

Height of the truss	Usage of steel (kg)
500	28269.6
600	28632.4
700	277111.4
800	26092.7
900	25447.4
1000	25235.5
1100	25291.9
1200	25497.9
1300	25752.5
1400	26137.0
1500	26590.6

Table 4.5.18 - About the self-weight of the roof.

From the table we can see, the weight is not simply change with the same directions of the height of the truss, because when the height of the truss is too short, the steel elements will need more area of the sections, which will cause more self-weight of the roof.

Weight statistic (KN): (regardless of eccentricity caused by component length changes)

Brackets in the statistics of steel weight, the first number of steel components, the second number of steel in the steel.

Bulk density (KN / m³), concrete: 25, steel: 78.5

The floor weight is not counted.

Steel: 0.0, 0.0), column: 0.0 (steel: 0.0, 0.0), support: 237.2 (steel: 237.2, 0.0), wall: 0.0, plate: not counted

Point constant: 0.0, point live: 0.0, pole constant: 0.0, rod live: 0.0, wall top constant: 0.0, wall top live: 0.0, face constant: 350.1, live: 175.1

Total constant: 587, total live: 175

The total weight of the layer: 675 (kN)

(Steel: 0, 0), column: 0 (steel column: 0, 0), support: 237 (steel: 237, 0), wall: 0, plate: not statistics

Structure total constant: 587, total live: 175 (* 0.5) = 87.57

Total weight of structure: 675 (kN)

Rectangular column

B = 1200 mm, h = 1200 mm

Calculate length L = 28.75m

Concrete strength grade C30, $f_c = 14.30\text{N} / \text{mm}^2$ $f_t = 1.43\text{N} / \text{mm}^2$

Longitudinal reinforcement level HRB400, $f_y = 360\text{N} / \text{mm}^2$, $f_y' = 360\text{N} / \text{mm}^2$

Stirrup level HPB300, $f_y = 270\text{N} / \text{mm}^2$

Axial design value N = 100.00kN

Moment Design $M_x = 500.00\text{kN.m}$, $M_y = 0.00\text{kN.m}$.

The shear design value $V_y = 200.00\text{ kN}$, $V_x = 0.00\text{ kN}$

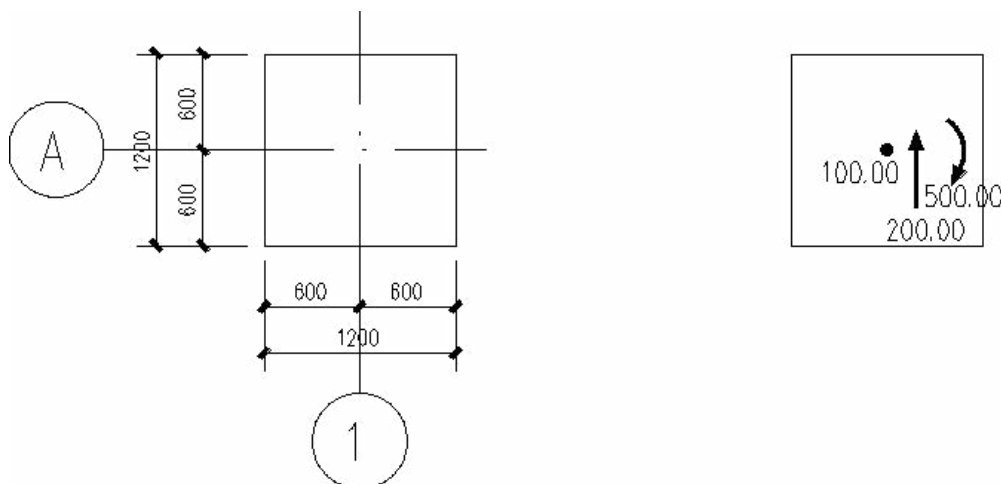


Figure 4.5.13 - Calculation of the column thickness.

4.5.4 - Analysis

4.5.4.1 - Roof supporting system analysis

Share the columns with the existing building, there will be no additional columns in the yard.

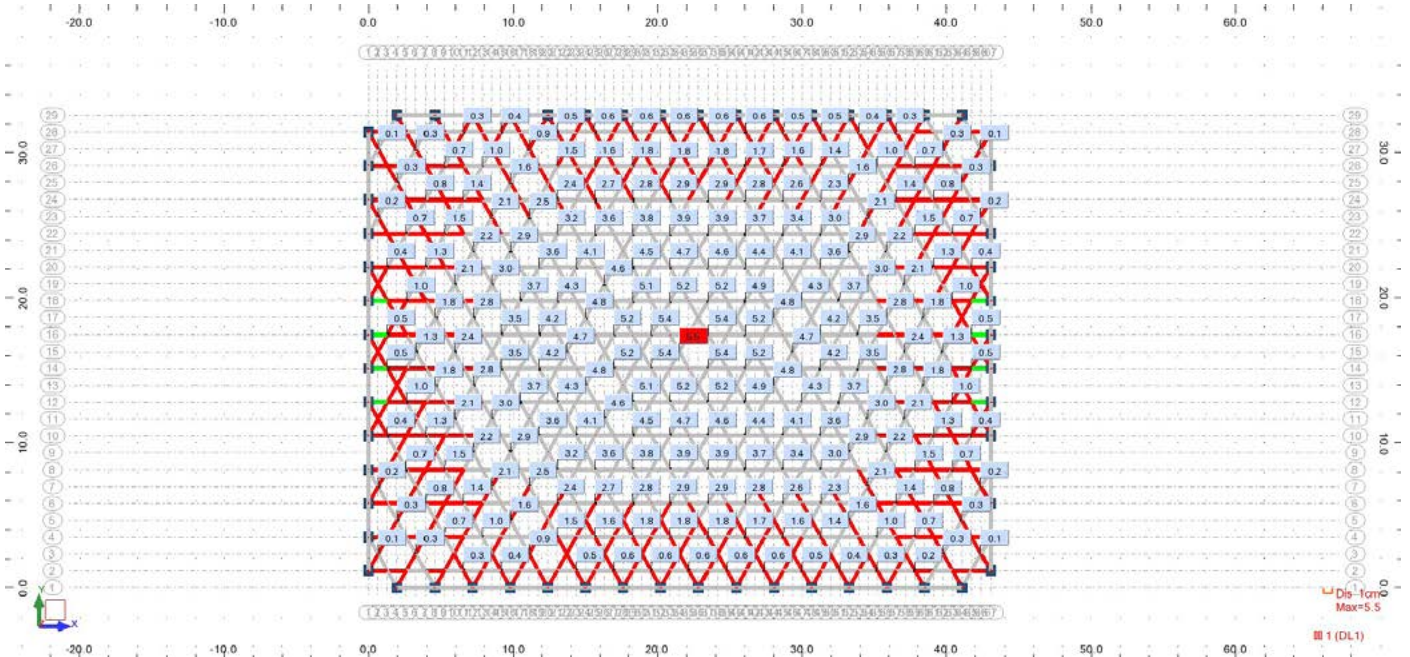


Figure 4.5.14 - The top layer's frames' deformation by Fx(kN).

For the height of the roof from the ground is 28.52m.

The slenderness ratio for concrete column is between 8~28, the minimum size for the additional columns will be 1.2x1.2 (m).

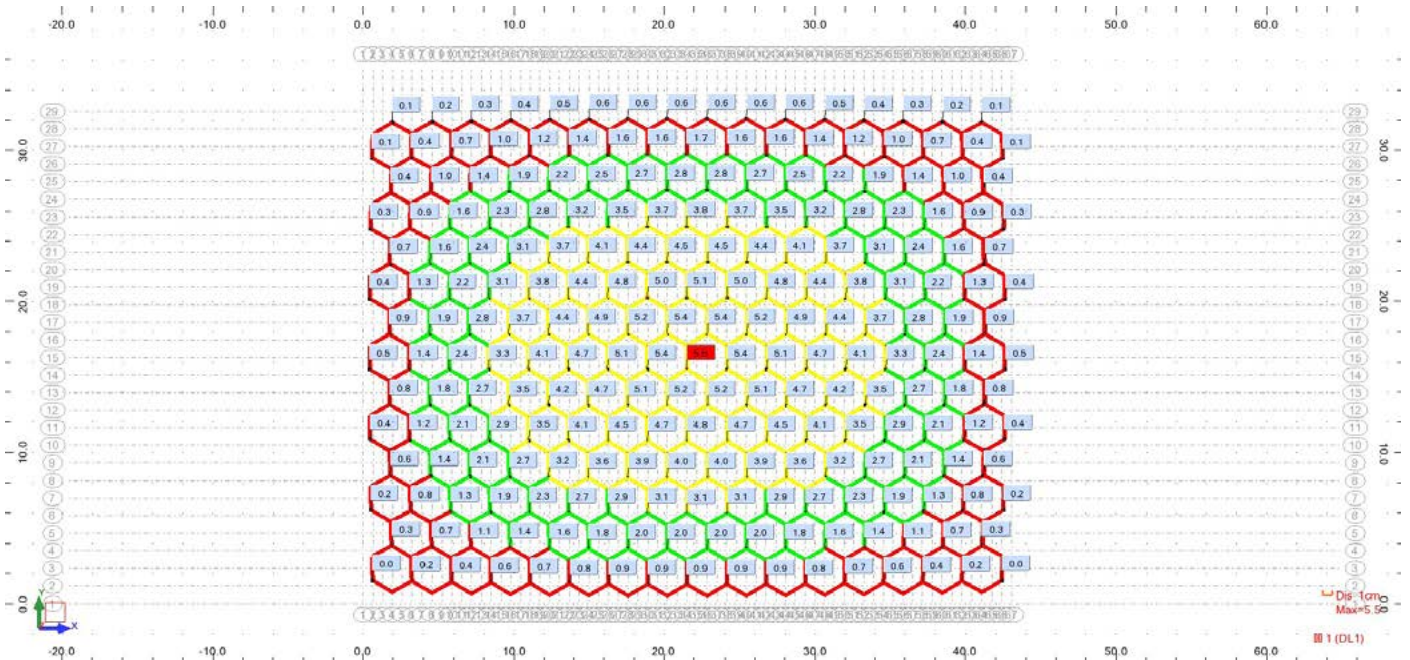


Figure 4.5.15 - The bottom layer's frames' deformation by Fx(kN).

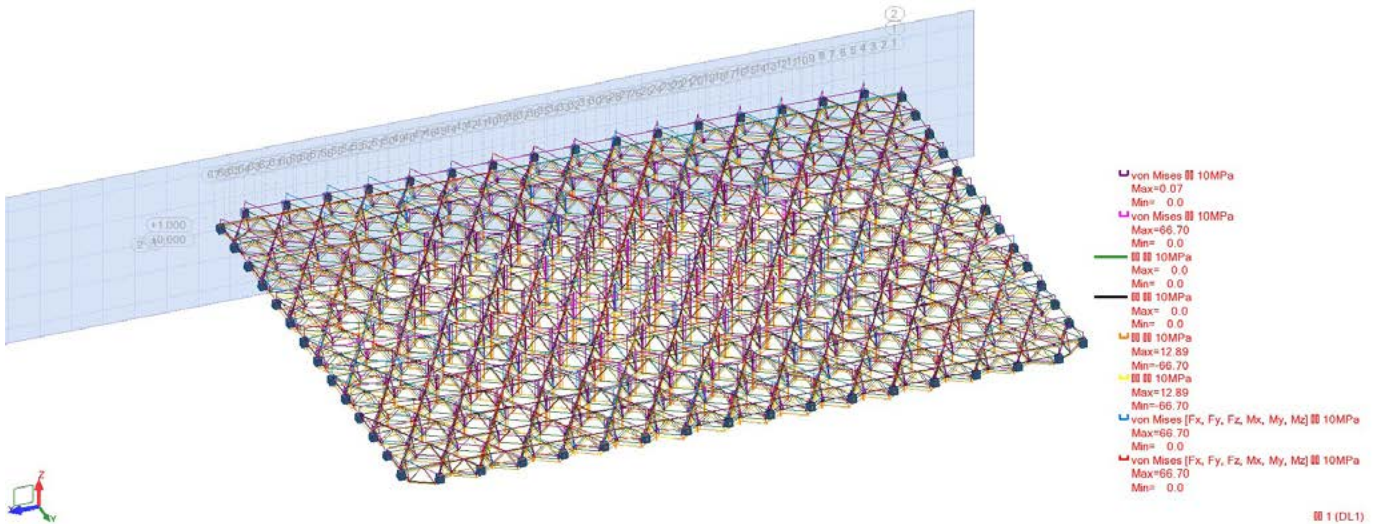


Figure 4.5.16 - The whole truss as an analysis object by the moments.

For the connection elements of the roof, we chose the bolted-sphere, it has many advantages comparing with the traditional welded-sphere:

Most elements can be prefabricated in the factory.

Only working on the site saves a lot of time.

Construction should be accurate following the design.

Table of the bolted-sphere		
Diameter	Quantity	Percentage
100	789	66.358%
105	58	4.89%
110	57	4.81%
115	17	1.43%
120	34	2.87%
125	31	2.62%
130	53	4.47%
140	36	3.04%
150	66	5.57%
160	18	1.52%
170	19	1.60%
180	3	0.25%
190	4	0.34%

Table 4.5.19 - Table of the bolted-sphere.



Figure 4.5.17 - Bolted vs welded sphere.

4.5.4.2 - Grid design information

General information

Main sphere node type: bolt sphere.

Default terminal type: cone-shaped connectors.

When the diameter is less than 60 mm, designing according to the sealing plate.

Bolt design method: 1 - take the maximum internal force of the rod end.

Bolt sphere collision test basis on: the actual depth into the screw. Bolt sphere cutting calculation: according to the maximum cutting of each ball to determine.

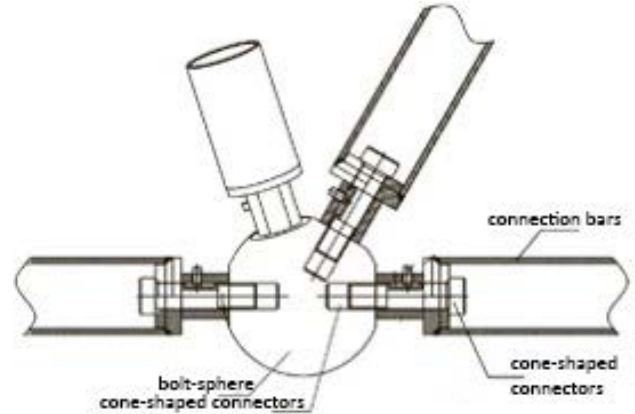


Figure 4.5.18 - Detail on bolted sphere.

No.	Diameter	Type	Ribbed information
1	100	Bolt-sphere	Without ribs
2	105	Bolt-sphere	Without ribs
3	110	Bolt-sphere	Without ribs
4	115	Bolt-sphere	Without ribs
5	120	Bolt-sphere	Without ribs
6	125	Bolt-sphere	Without ribs
7	130	Bolt-sphere	Without ribs
8	140	Bolt-sphere	Without ribs
9	150	Bolt-sphere	Without ribs
10	160	Bolt-sphere	Without ribs
11	170	Bolt-sphere	Without ribs
12	180	Bolt-sphere	Without ribs
13	190	Bolt-sphere	Without ribs

Table 4.5.20 - Summary of node-sphere check results (unit: mm).

Diameter	Thickness	Type of the end	No. of the end	24Bolt Diameter	Maximum Pressure	Maximum Tension
114.00	4.00	Cone-shaped connectors	12	27	0.00	197.08
			13	30	0.00	215.09
89.00	4.00	Cone-shaped connectors	7	27	0.00	184.38
76.00	4.00	Cone-shaped connectors	2	22	0.00	129.40
			3	24	0.00	151.75
			0	27	0.00	156.83
60.00	3.50	Sealing plate	15	16	42.38	67.18
			16	20	0.00	102.74
			19	27	0.00	106.79

Table 4.5.21 - Summary of rod end information (unit: mm; kN).

4.5.4.3 - Sun exposure percentage analysis

This analysis was done by using the Ecotect software. The analyzed surfaces are divided by 1 meter to 1 meter grids. Each square in the grid is represented with a color range which indicates the percentage of exposed sunlight from sunrise to sunset each day.

This analysis was helpful in order to determine a certain point on the yard, and how much of a direct sunlight that point gets during a full day. With this analysis, it is possible to estimate shading required places more clearly.

Considering these analyses, it is possible to layout a pattern to provide optimum glass/panel ratio to control the direct sunlight while provide shading where necessary.

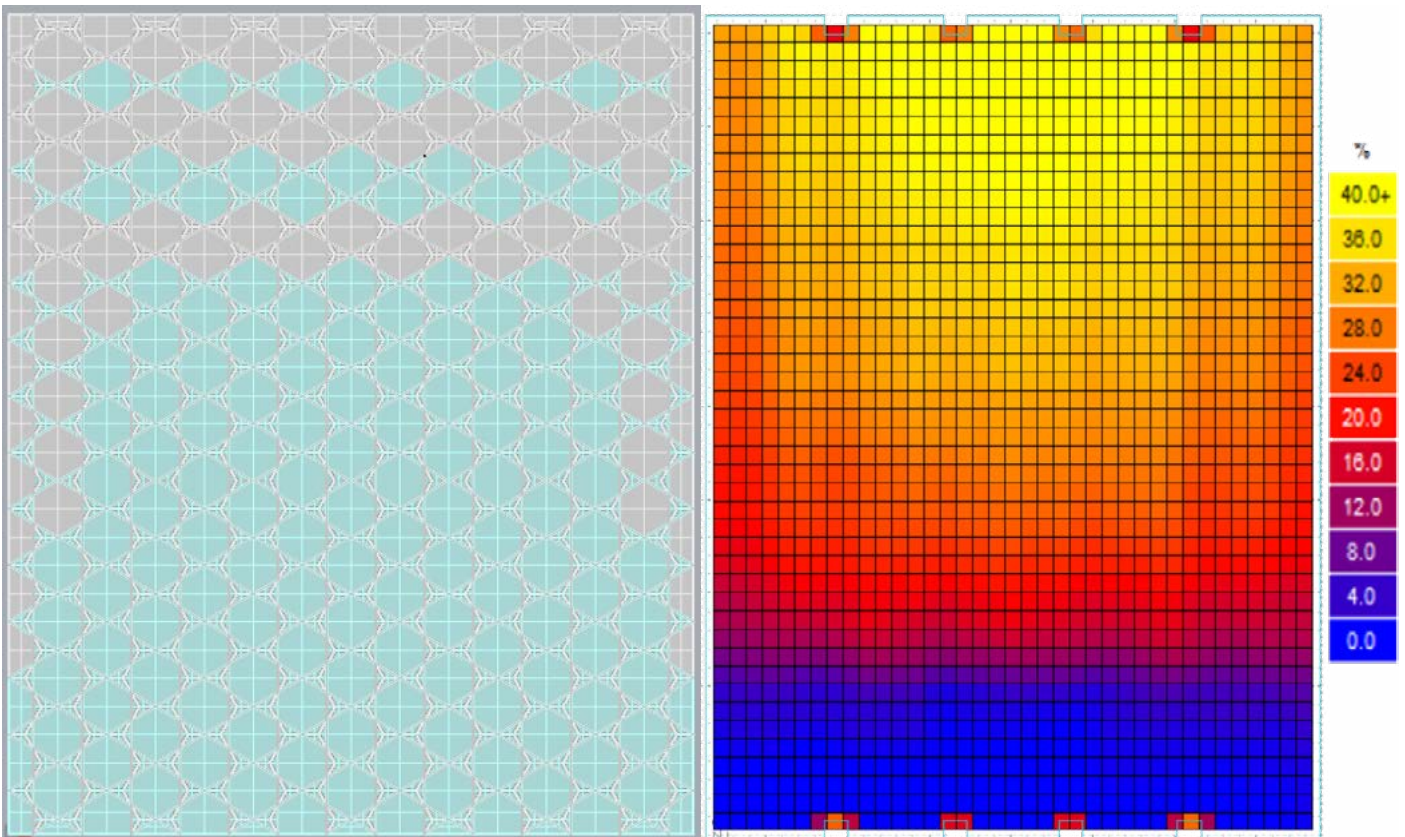


Figure 4.5.19 - Roof Plan showing the pattern.

Figure 4.5.20 - Analysis on the yard plan.

With this grid analysis on the yard plan, it is visible that areas in the north side gets the most sunlight during the day, while south side is almost shaded all day.

The west and east walls block the corners a little bit in the morning and in the evening, compared to the middle of the yard. Due to this, panels are placed at the corners to provide some sort of extend of the existing walls, in order to give a little more shading to the middle of the yard.

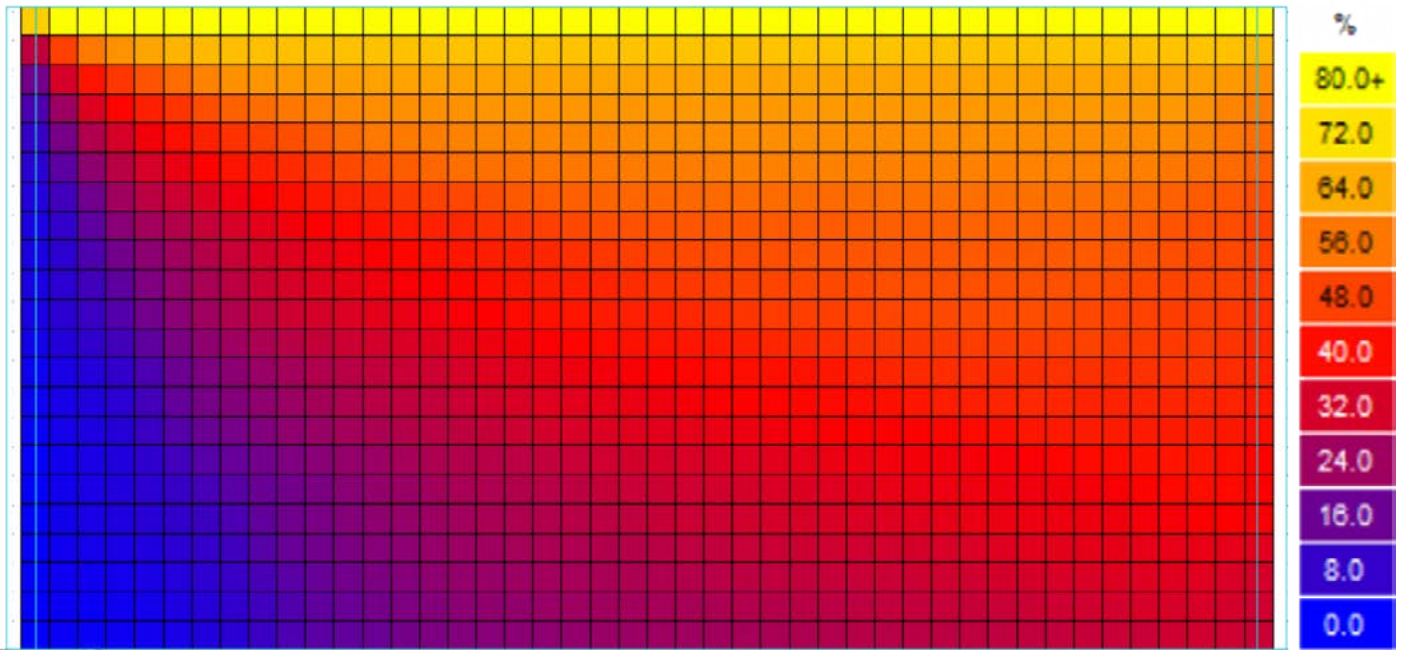


Figure 4.5.21 - Analysis on the west facade of the courtyard.

This analysis grid is located on the west facade. Left side is south, right side is north. The areas gets more shade as it goes to bottom or south.

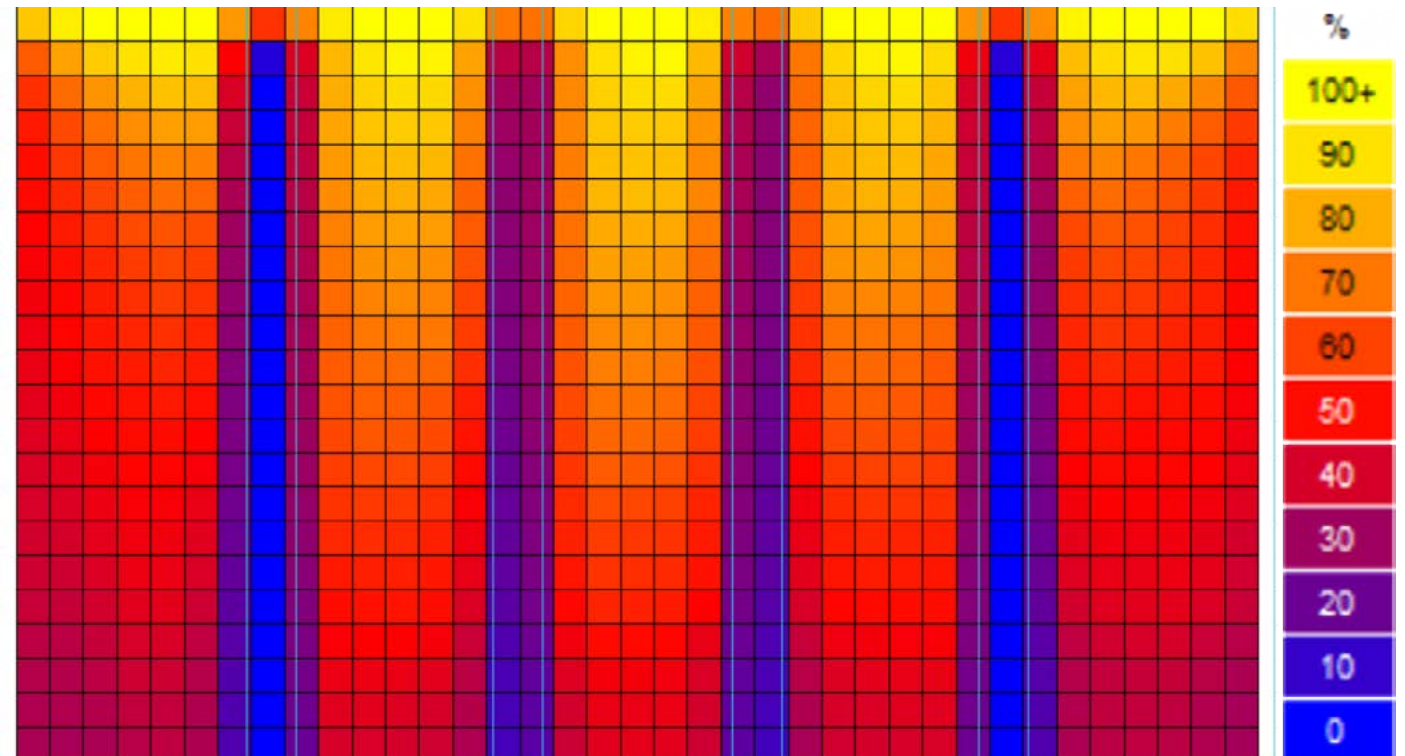


Figure 4.5.22 - Analysis on the north facade of the courtyard.

Same situation is visible on the north facade. The straight lines represents the columns but they are not provide any shading.

After considering the options, the decision was to use existing structure as the support for the roof, in order to avoid adding columns in the middle of the courtyard.



Figure 4.5.23 - Existing columns on the north facade.

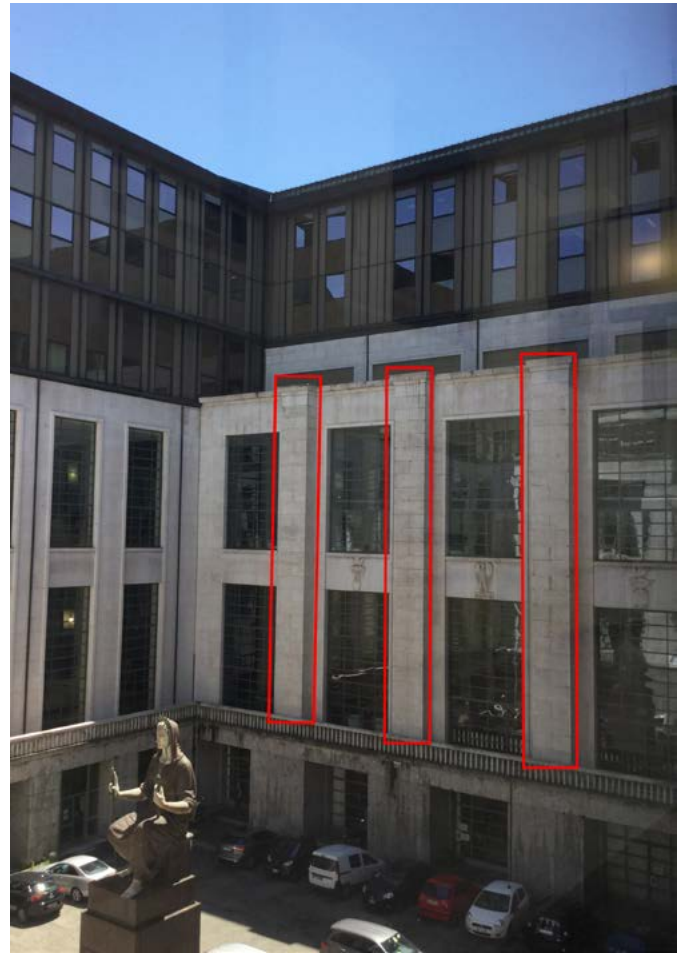


Figure 4.5.24 - Existing columns on the south facade.

The roof is a hexagonal shaped space truss, with mostly glass to give a light appearance. Yet there are areas where panels are used to help shading the existing big windows. To decide best how to do that, sun exposure percentage analysis was done.

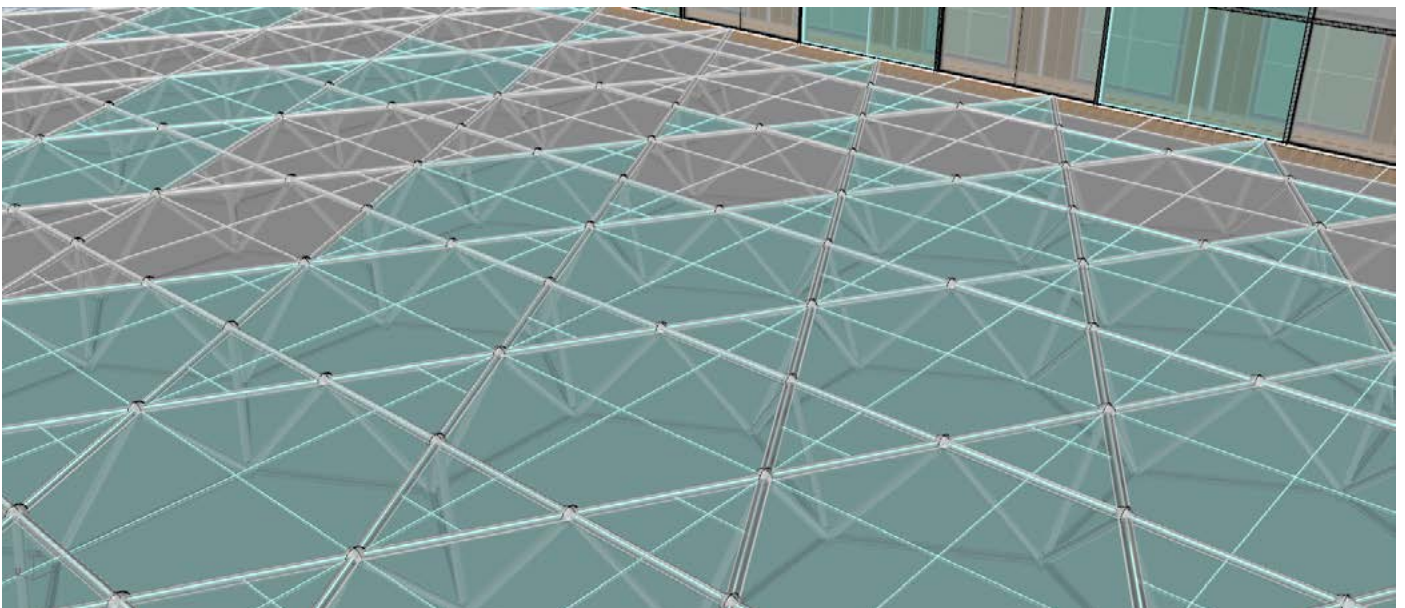


Figure 4.5.25 - Visualization of the roof.

4.5.5 - Results

4.5.5.1 - Detail drawings

The typical detail drawings of the roof connections as follow:

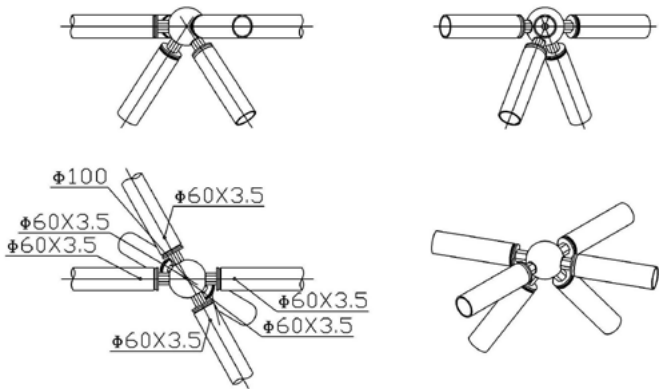


Figure 4.5.26 - Details of the top joint on the support.

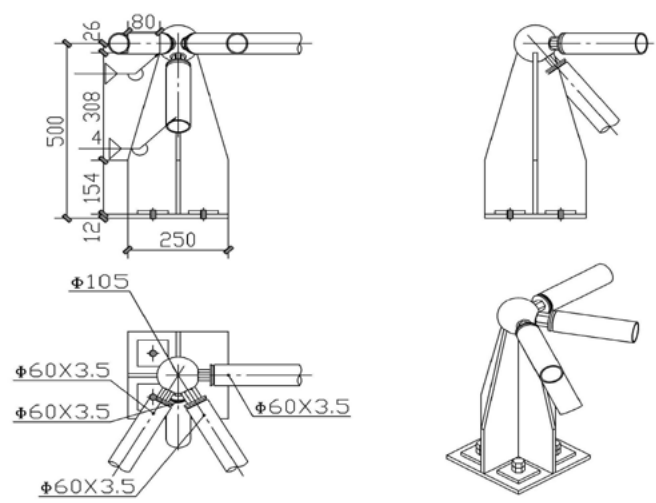


Figure 4.5.27 - Details of the top joint in between.

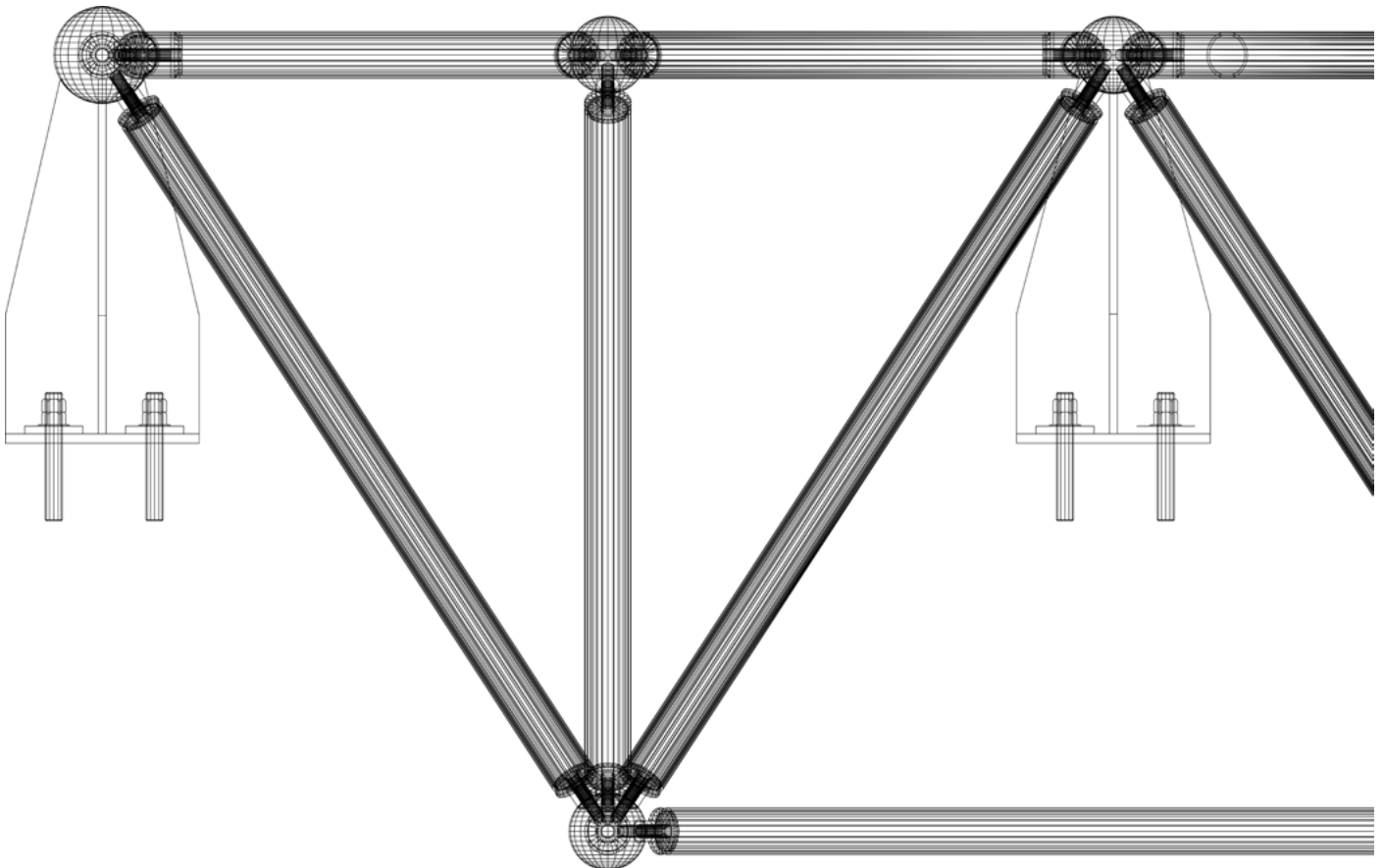


Figure 4.5.28 - Bigger scale detail, showing the connections.

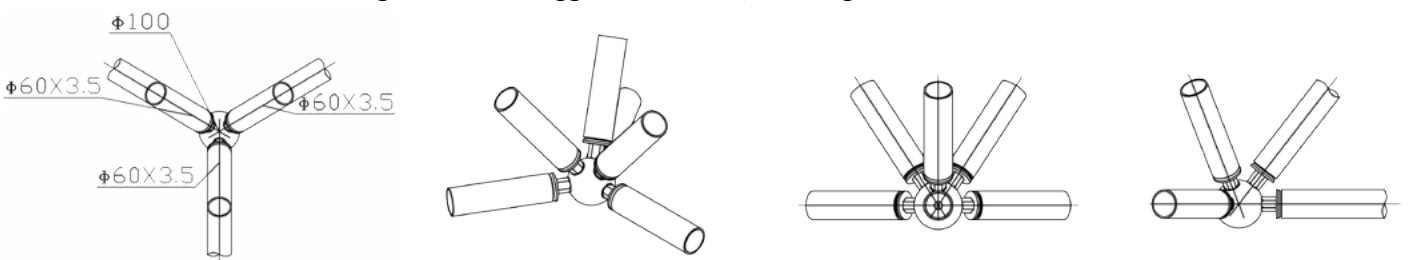


Figure 4.5.29 - Details of the bottom joint in between.

4.5.5.2 - Table of members

No.	Serial number	Section size	Blanking length (mm)	Weld length(mm)	Quantity	Bolt	Sleeve	End socket	Single weight (kg)	Total weight (kg)
1	1	Ø60*3.5	1035.0	1057.0	8	M16	27/30	60x14	5.0	40.4
2	1A		1040.0	1062.0	6	M16	27/30	60x14	5.1	30.4
3	1B		1045.0	1067.0	42	M16	27/30	60x14	5.1	214.0
4	1C		1051.0	1073.0	39	M16	27/30	60x14	5.1	199.9
5	1D		1056.0	1078.0	151	M16	27/30	60x14	5.1	777.6
6	1E		1062.0	1084.0	88	M16	27/30	60x14	5.2	455.8
7	1F		1066.7	1088.7	208	M16	27/30	60x14	5.2	1082.0
8	1G		1070.0	1092.0	68	M16	27/30	60x14	5.2	354.8
9	1H		1072.7	1094.7	68	M16	27/30	60x14	5.2	355.7
10	1J		1075.0	1097.0	114	M16	27/30	60x14	5.2	597.6
11	1K		1076.7	1098.7	129	M16	27/30	60x14	5.3	677.3
12	1L		1079.0	1101.0	205	M16	27/30	60x14	5.3	1078.7
13	1M		1080.7	1102.7	34	M16	27/30	60x14	5.3	179.2
14	1N		1083.2	1105.2	17	M16	27/30	60x14	5.3	89.8
15	1P		1085.7	1107.7	57	M16	27/30	60x14	5.3	301.8
16	1Q		1088.2	1110.2	30	M16	27/30	60x14	5.3	159.2
17	1R		1089.7	1111.7	122	M16	27/30	60x14	5.3	648.3
18	1S		1096.5	1120.5	2	M20	34/35	60x16	5.3	10.7
19	1T		1102.0	1126.0	6	M20	34/35	60x16	5.4	32.2
20	1U		1115.5	1137.5	20	M16	27/30	60x14	5.4	108.8
21	1V		1125.5	1147.5	48	M16	27/30	60x14	5.5	263.5
22	1W		1127.0	1149.0	386	M16	27/30	60x14	5.5	2121.6
23	1X		1140.7	1162.7	2	M16	27/30	60x14	5.6	11.1
24	1Y		1142.7	1166.7	20	M20	34/35	60x16	5.6	111.5
25	1AA		1146.2	1168.2	26	M16	27/30	60x14	5.6	145.3
26	1AB		1156.2	1178.2	56	M16	27/30	60x14	5.6	315.8
27	1AC		1157.7	1179.7	820	M16	27/30	60x14	5.6	4629.6
28	1AD		1274.5	1306.5	4	M27	36/35	60x20	6.2	24.9
29	1AE		1280.5	1312.5	6	M27	34/35	60x20	6.2	37.5
30	1AF		1286.5	1318.5	2	M27	34/35	60x20	6.3	12.5
31	1AG		1299.0	1323.0	2	M20	34/35	60x16	6.3	12.7
32	1AH		1301.5	1325.5	20	M20	34/35	60x16	6.3	126.9
33	1AJ		1305.0	1329.0	2	M20	34/35	60x16	6.4	12.7
34	1AK		1307.5	1331.5	7	M20	34/35	60x16	6.4	44.6
35	1AL		1309.6	1341.6	6	M27	36/35	60x20	6.4	38.3
36	1AM		1310.0	1334.0	1	M20	34/35	60x16	6.4	6.4
37	1AN		1313.0	1337.0	1	M20	34/35	60x16	6.4	6.4
38	1AP		1315.5	1339.5	5	M20	34/35	60x16	6.4	32.1
39	1AQ		1315.6	1347.6	4	M27	36/35	60x20	6.4	25.7
40	1AR		1318.0	1342.0	12	M20	34/35	60x16	6.4	77.1
41	1AS		1320.5	1344.5	23	M20	34/35	60x16	6.4	148.1
42	1AT		1321.6	1353.6	2	M27	36/35	60x20	6.4	12.9
43	1AU		1323.0	1347.0	7	M20	34/35	60x16	6.5	45.2
44	1AV		1332.5	1354.5	3	M16	27/30	60x14	6.5	19.5
45	1AW		1334.0	1356.0	3	M16	27/30	60x14	6.5	19.5

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46	1AX		1334.1	1358.1	2	M20	34/35	60x16	6.5	13.0
47	1AY		1335.0	1357.0	1	M16	27/30	60x14	6.5	6.5
48	1BA		1336.5	1358.5	22	M16	27/30	60x14	6.5	143.4
49	1BB		1336.6	1360.6	2	M20	34/35	60x16	6.5	13.0
50	1BC		1339.0	1361.0	7	M16	27/30	60x14	6.5	45.7
51	1BD		1340.1	1364.1	1	M20	34/35	60x16	6.5	6.5
52	1BE		1340.5	1362.5	112	M16	27/30	60x14	6.5	732.2
53	1BF		1342.6	1366.6	3	M20	34/35	60x16	6.5	19.6
54	1BG		1348.1	1372.1	2	M20	34/35	60x16	6.6	13.1
55	1BH		1350.6	1374.6	4	M20	34/35	60x16	6.6	26.3
56	1BJ		1353.1	1377.1	6	M20	34/35	60x16	6.6	39.6
57	1BK		1355.6	1379.6	14	M20	34/35	60x16	6.6	92.6
58	1BL		1370.1	1392.1	1	M16	27/30	60x14	6.7	6.7
59	1BM		1371.6	1393.6	18	M16	27/30	60x14	6.7	120.4
60	1BN		1374.1	1396.1	3	M16	27/30	60x14	6.7	20.1
61	1BP		1375.6	1397.6	46	M16	27/30	60x14	6.7	308.6
62	1BQ		2122.9	2144.9	4	M16	27/30	60x14	10.4	41.4
63	1BR		2128.4	2150.4	22	M16	27/30	60x14	10.4	228.4
64	1BS		2427.1	2449.1	12	M16	27/30	60x14	11.8	142.0
65	1BT		2428.6	2450.6	12	M16	27/30	60x14	11.8	142.1
66	1BU		2430.1	2452.1	6	M16	27/30	60x14	11.9	71.1
67	2	Φ76*4.0	1178.5	1290.5	3	M24	41/40	76x60/16	8.4	25.1
68	2A		1183.5	1295.5	8	M24	41/40	76x60/16	8.4	67.2
69	2B		1187.5	1299.5	1	M24	41/40	76x60/16	8.4	8.4
70	2C		1194.5	1306.5	1	M24	41/40	76x60/16	8.5	8.5
71	2D		1198.5	1310.5	1	M24	41/40	76x60/16	8.5	8.5
72	2E		1200.5	1312.5	1	M24	41/40	76x60/16	8.5	8.5
73	2F		1204.5	1316.5	6	M22	36/35	76x60/16	8.6	51.3
74	2G		1204.5	1316.5	4	M24	41/40	76x60/16	8.6	34.2
75	2H		1206.0	1318.0	2	M24	41/40	76x60/16	8.6	17.1
76	2J		1206.0	1318.0	2	M22	36/35	76x60/16	8.6	17.1
77	2K		1208.5	1320.5	15	M24	41/40	76x60/16	8.6	128.8
78	2L		1208.5	1320.5	8	M22	36/35	76x60/16	8.6	68.7
79	2M		1210.5	1322.5	3	M22	36/35	76x60/16	8.6	25.8
80	2N		1212.0	1324.0	2	M22	36/35	76x60/16	8.6	17.2
81	2P		1212.5	1324.5	4	M24	41/40	76x60/16	8.6	34.4
82	2Q		1214.5	1326.5	11	M22	36/35	76x60/16	8.6	94.9
83	2R		1215.1	1327.1	1	M24	41/40	76x60/16	8.6	8.6
84	2S		1216.0	1328.0	1	M22	36/35	76x60/16	8.6	8.6
85	2T		1218.5	1330.5	5	M22	36/35	76x60/16	8.7	43.3
86	2U		1218.6	1330.6	5	M24	41/40	76x60/16	8.7	43.3
87	2V		1220.0	1332.0	2	M22	36/35	76x60/16	8.7	17.3
88	2W		1222.5	1334.5	7	M22	36/35	76x60/16	8.7	60.8
89	2X		1222.6	1334.6	5	M24	41/40	76x60/16	8.7	43.4
90	2Y		1225.0	1337.0	1	M22	36/35	76x60/16	8.7	8.7
91	2AA		1229.6	1341.6	1	M22	36/35	76x60/16	8.7	8.7
92	2AB		1233.6	1345.6	2	M24	41/40	76x60/16	8.8	17.5
93	2AC		1239.6	1351.6	2	M22	36/35	76x60/16	8.8	17.6
94	2AD		1239.6	1351.6	3	M24	41/40	76x60/16	8.8	26.4
95	2AE		1241.1	1353.1	1	M24	41/40	76x60/16	8.8	8.8

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96	2AF		1241.6	1353.6	3	M22	36/35	76x60/16	8.8	26.5
97	2AG		1243.6	1355.6	2	M22	36/35	76x60/16	8.8	17.7
98	2AH		1243.6	1355.6	6	M24	41/40	76x60/16	8.8	53.0
99	2AJ		1245.1	1357.1	1	M24	41/40	76x60/16	8.8	8.8
100	2AK		1247.6	1359.6	4	M24	41/40	76x60/16	8.9	35.4
101	2AL		1249.6	1361.6	1	M22	36/35	76x60/16	8.9	8.9
102	2AM		1252.6	1364.6	1	M22	36/35	76x60/16	8.9	8.9
103	2AN		1257.6	1369.6	3	M22	36/35	76x60/16	8.9	26.8
104	2AP		1259.5	1259.5	1				8.9	8.9
105	2AQ		1262.6	1374.6	1	M22	36/35	76x60/16	9.0	9.0
106	2AR		1264.5	1264.5	4				9.0	35.9
107	2AS		1269.5	1269.5	2				9.0	18.0
108	2AT		1274.5	1274.5	7				9.1	63.4
109	2AU		1275.5	1275.5	1				9.1	9.1
110	2AV		1285.5	1285.5	1				9.1	9.1
111	3	Φ89*4.0	1143.5	1275.5	2	M27	46/40	89x70/20	9.6	19.2
112	3A		1153.5	1285.5	4	M27	46/40	89x70/20	9.7	38.7
113	3B		1162.6	1294.6	6	M27	46/40	89x70/20	9.7	58.5
114	3C		1164.5	1296.5	9	M27	46/40	89x70/20	9.8	87.9
115	3D		1174.5	1306.5	32	M27	46/40	89x70/20	9.8	315.1
116	3E		1177.6	1309.6	1	M27	46/40	89x70/20	9.9	9.9
117	3F		1180.5	1312.5	1	M27	46/40	89x70/20	9.9	9.9
118	3G		1184.5	1316.5	8	M27	46/40	89x70/20	9.9	79.5
119	3H		1188.6	1320.6	7	M27	46/40	89x70/20	10.0	69.8
120	3J		1194.6	1326.6	1	M27	46/40	89x70/20	10.0	10.0
121	3K		1198.6	1330.6	2	M27	46/40	89x70/20	10.1	20.1
122	3L		1199.6	1331.6	3	M27	46/40	89x70/20	10.1	30.2
123	3M		1209.6	1341.6	5	M27	46/40	89x70/20	10.1	50.7
124	3N		1215.6	1347.6	1	M27	46/40	89x70/20	10.2	10.2
125	3P		1219.6	1351.6	8	M27	46/40	89x70/20	10.2	81.8
126	4	Φ114*4.0	1146.5	1276.5	8	M30	50/45	114x70/20	12.4	99.5
127	4A		1157.5	1287.5	16	M30	50/45	114x70/20	12.6	201.0
128	4B		1161.5	1291.5	3	M27	46/40	114x70/20	12.6	37.8
129	4C		1166.5	1296.5	5	M27	46/40	114x70/20	12.7	63.3
130	4D		1168.5	1298.5	4	M30	50/45	114x70/20	12.7	50.7
131	4E		1172.5	1302.5	5	M27	46/40	114x70/20	12.7	63.6
132	4F		1176.5	1306.5	3	M27	46/40	114x70/20	12.8	38.3
133	4G		1181.6	1311.6	4	M30	50/45	114x70/20	12.8	51.3
134	4H		1192.6	1322.6	6	M30	50/45	114x70/20	12.9	77.6
135	4J		1196.6	1326.6	3	M27	46/40	114x70/20	13.0	39.0
136	4K		1197.6	1327.6	2	M30	50/45	114x70/20	13.0	26.0
137	4L		1201.6	1331.6	6	M27	46/40	114x70/20	13.0	78.2
138	4M		1203.6	1333.6	3	M30	50/45	114x70/20	13.1	39.2
139	4N		1206.6	1336.6	1	M27	46/40	114x70/20	13.1	13.1
140	4P		1211.6	1341.6	3	M27	46/40	114x70/20	13.1	39.4
141	4Q		1221.6	1351.6	1	M27	46/40	114x70/20	13.3	13.3
Total					3491					21019.3

Table 4.5.2 - Table of members.

4.5.5.3 - Table of the bolt-sphere

Serial no.	Size (mm)	Quantity	Number of the	M16		M20		M22		M24		M27		M30		Single weight (kg)	Total weight (kg)
				One	Total	One	Total	One	Total	One	Total	One	Total	One	Total		
A1	BS100	12	5	5	60											4.1	49.3
A2		32	5	5	160											4.1	131.5
A3		14	5	5	70											4.1	57.5
A4		14	5	5	70											4.1	57.5
A5		210	6	6	1260											4.1	863.2
A6		210	6	6	1260											4.1	863.2
A7		82	6	6	492											4.1	337.0
A8		215	6	6	1290											4.1	883.7
B1	BS105	2	4	3	6	1	2									4.8	9.5
B2		2	4	3	6	1	2									4.8	9.5
B3		8	5	4	32	1	8									4.8	38.1
B4		8	5	4	32	1	8									4.8	38.1
B5		10	6	5	50	1	10									4.8	47.6
B6		10	6	5	50	1	10									4.8	47.6
B7		4	6	5	20	1	4									4.8	19.0
B8		4	6	5	20	1	4									4.8	19.0
B9		5	6	5	25	1	5									4.8	23.8
B10		2	6	4	8	2	4									4.8	9.5
B11		3	6	5	15	1	3									4.8	14.3
C1	BS110	8	6	5	40	1	8									5.5	43.8
C2		1	6	5	5	1	1									5.5	5.5
C3		24	6	3	72	3	72									5.5	131.3
C4		4	6	4	16	2	8									5.5	21.9
C5		12	6	4	48	2	24									5.5	65.6
C6		5	6	4	20	2	10									5.5	27.4
C7		3	6	5	15	1	3									5.5	16.4
D1	BS115	12	6	3	36	3	36									6.3	75.0
D2		2	6	4	8	2	4									6.3	12.5
D3		1	6	3	3	1	1	2	2							6.3	6.3
D4		1	6	3	3	1	1	2	2							6.3	6.3
D5		1	6	4	4	2	2									6.3	6.3
E1	BS120	4	6	3	12	1	4	2	8							7.1	28.4
E2		10	6	3	30			2	20	1	10					7.1	71.0
E3		9	6	3	27					3	27					7.1	63.9
E4		1	6	3	3	1	1	2	2							7.1	7.1
E5		4	6	3	12			2	8	1	4					7.1	28.4
E6		1	6	3	3	1	1	2	2							7.1	7.1
E7		2	6	3	6			1	2	2	4					7.1	14.2
E8		2	6	3	6			2	4	1	2					7.1	14.2
E9		1	6	3	3			1	1	2	2					7.1	7.1
F1	BS125	2	4	4	8											8.0	16.1
F2		2	4	4	8											8.0	16.1
F3		3	5	4	12	1	3									8.0	24.1
F4		3	5	4	12	1	3									8.0	24.1

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F5		8	5	5	40											8.0	64.2
F6		8	5	5	40											8.0	64.2
F7		3	6	3	9			2	6	1	3					8.0	24.1
F8		1	6	3	3			2	2	1	1					8.0	8.0
F9		1	6	3	3			2	2	1	1					8.0	8.0
G1	BS130	1	6	3	3			2	2	1	1					9.0	9.0
G2		27	6	3	81							3	81			9.0	243.8
G3		11	6	3	33					3	33					9.0	99.3
G4		3	6	3	9			2	6	1	3					9.0	27.1
G5		1	6	3	3					1	1	2	2			9.0	9.0
G6		3	6	3	9					2	6	1	3			9.0	27.1
G7		5	6	3	15			2	10	1	5					9.0	45.2
G8		1	6	3	3			1	1	2	2					9.0	9.0
G9		1	6	3	3					1	1	2	2			9.0	9.0
H1	BS140	1	5	4	4	1	1									11.3	11.3
H2		1	5	4	4	1	1									11.3	11.3
H3		1	6	3	3	1	1	1	1			1	1			11.3	11.3
H4		2	6	3	6	1	2	1	2			1	2			11.3	22.6
H5		2	6	3	6							1	2	2	4	11.3	22.6
H6		2	6	3	6	1	2	1	2			1	2			11.3	22.6
H7		2	6	3	6	1	2	1	2			1	2			11.3	22.6
H8		4	6	3	12			2	8			1	4			11.3	45.1
H9		3	6	3	9	2	6					1	3			11.3	33.8
H10		2	6	3	6			2	4			1	2			11.3	22.6
H11		1	6	3	3					2	2	1	1			11.3	11.3
H12		1	6	3	3	1	1	1	1			1	1			11.3	11.3
H13		1	6	3	3					1	1	2	2			11.3	11.3
H14		1	6	3	3			2	2			1	1			11.3	11.3
H15		10	6	3	30									3	30	11.3	112.8
H16		2	6	3	6							1	2	2	4	11.3	22.6
J1	BS150	1	5	3	3							2	2			13.9	13.9
J2		1	5	3	3					1	1	1	1			13.9	13.9
J3		1	6	3	3					1	1	2	2			13.9	13.9
J4		2	6	3	6	1	2	1	2			1	2			13.9	27.7
J5		1	6	3	3					1	1	2	2			13.9	13.9
J6		2	6	3	6							2	4	1	2	13.9	27.7
J7		2	6	3	6	1	2					2	4			13.9	27.7
J8		2	6	3	6	1	2					2	4			13.9	27.7
J9		1	6	3	3			2	2			1	1			13.9	13.9
J10		1	6	3	3					1	1	2	2			13.9	13.9
J11		4	6	3	12			2	8			1	4			13.9	55.5
J12		3	6	3	9	1	3	1	3			1	3			13.9	41.6
J13		5	6	3	15	2	10					1	5			13.9	69.4
J14		2	6	3	6	1	2	1	2			1	2			13.9	27.7
J15		2	6	3	6	1	2	1	2			1	2			13.9	27.7
J16		2	6	3	6	1	2	1	2			1	2			13.9	27.7
J17		1	6	3	3	1	1	1	1			1	1			13.9	13.9
J18		33	6	3	99							3	99			13.9	457.8
K1	BS160	2	6	3	6							1	2	2	4	16.8	33.7
K2		2	6	3	6							1	2	2	4	16.8	33.7

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K3		10	6	3	30								3	30	16.8	168.4
K4		4	6	3	12						1	4	2	8	16.8	67.3
L1	BS170	2	4	3	6						1	2			20.2	40.4
L2		3	5	3	9					1	3	1	3		20.2	60.6
L3		1	5	3	3					2	2				20.2	20.2
L4		4	5	3	12					1	4	1	4		20.2	80.8
L5		2	5	3	6					2	4				20.2	40.4
L6		1	5	3	3						2	2			20.2	20.2
L7		3	5	3	9					1	3	1	3		20.2	60.6
L8		3	5	3	9					1	3	1	3		20.2	60.6
M1	BS180	1	5	3	3					2	2				24.0	24.0
M2		1	5	3	3					1	1	1	1		24.0	24.0
M3		1	5	3	3					1	1	1	1		24.0	24.0
N1	BS190	2	4	3	6							1	2		28.2	56.4
N2		1	5	3	3							2	2		28.2	28.2
N3		1	5	3	3							2	2		28.2	28.2
Total		1185			6032		284		124		136		288		86	7099.0

Table 4.5.3 - Table of the bolt-sphere.

No.	Standard	Quantity	Single weight(kg)	Total weight(kg)
A	BS100	789	4.1	3242.99
B	BS105	58	4.8	275.97
C	BS110	57	5.5	311.83
D	BS115	17	6.3	106.27
E	BS120	34	7.1	241.49
F	BS125	31	8.0	248.86
G	BS130	53	9.0	478.60
H	BS140	36	11.3	406.03
J	BS150	66	13.9	915.56
K	BS160	18	16.8	303.04
L	BS170	19	20.2	383.68
M	BS180	3	24.0	71.91
N	BS190	4	28.2	112.77
Total		1185		7099.0

Table 4.5.4 - Table of the statistical bolt-sphere.

No.	Screw bolt	Quantity	Single weight(kg)	Total weight(kg)
1	M16	6032	0.14	844.48
2	M20	284	0.25	71.00
3	M22	124	0.32	39.68
4	M24	136	0.41	55.76
5	M27	320	0.58	185.60
6	M30	86	0.80	68.80
Total		6982		1265.32

Table 4.5.5 - Table of screw bolts.

4.5.5.4 - Other tables

No.	Size	Length(m)	Quantity	Total weight(t)
1	Φ60*3.5	3676.2	3182	17.93
2	Φ76*4.0	178.6	146	1.27
3	Φ89*4.0	106.3	90	0.89
4	Φ114*4.0	85.8	73	0.93
Total			3491	21.02

Table 4.5.6 - Table of statistical members.

No.	Diameter	Thickness	Thickness of shroding	Diameter of the bolt hole	Quantity	Single weight(kg)	Total weight(kg)
1	60	3.5	14	17	6032	0.36	2171.5
2	60	3.5	16	21	284	0.36	102.2
3	60	3.5	20	28	48	0.49	23.5
Total					6364		2297.3

Table 4.5.7 - Table of shrouding.

No.	Sleeve	Diameter(mm)	Quantity	Single weight(kg)	Total weight(kg)
1	27/30	17	6032	0.10	603.20
2	34/35	21	284	0.28	79.52
3	36/35	23	124	0.31	38.44
4	41/40	25	136	0.46	62.56
5	36/35	23	320	0.31	99.20
6	50/45	31	86	0.77	66.22
Total			6982		949.14

Table 4.5.8 - Table of sleeve.

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No.	Bolt	Quantity
1	M5x13	6032
2	M6x13	284
3	M6x15	580
4	M8x15	86
Total		6982

No.	Diameter	Thickness	Thickness of top	Diameter of hole	Quantity	Single weight (kg)	Total weight (kg)
1	76	4.0	16	23	124	1.20	148.8
2	76	4.0	16	25	136	1.20	163.2
3	89	4.0	20	28	180	1.90	342.0
4	114	4.0	20	28	60	2.50	150.0
5	114	4.0	20	31	86	2.50	215.0
Total					586		1019.0

Table 4.5.9 - Table of bolts.

Table 4.5.10 - Table of conic end with plate.

Serial number	Sphere connected	Quantity	Bottom thickness	Single weight(kg)	Total weight(kg)
J-1	F1	1	12	24.3	24.3
J-2	H2	1	12	24.2	24.2
J-3	B2	2	12	24.5	49.1
J-4	F5	8	12	24.3	194.7
J-5	F6	8	12	24.3	194.7
J-6	F1	1	12	24.3	24.3
J-7	B1	2	12	24.5	49.1
J-8	B3	8	12	24.5	196.3
J-9	A1	11	12	24.6	270.4
J-10	H1	1	12	24.2	24.2
J-11	A1	1	12	24.6	24.6
J-12	F3	3	12	24.3	73.0
J-13	A6	2	12	24.6	49.2
J-14	F2	2	12	24.3	48.7
J-15	B4	7	12	24.5	171.7
J-16	A5	2	12	24.6	49.2
J-17	B4	1	12	24.5	24.5
J-18	F4	3	12	24.3	73.0
Total		64			1565.2

Table 4.5.11 - Table of supports.

5. CONCLUSION

This project started with an emphasis on the Stefanini room and its survey and intervention. Then the project got bigger scale through an emphasis to the whole courthouse, even though the focus was mainly on the courtyard.

Whether the conservation or new additions for the project, for both of them, the six principles of conservation are followed.

1. Reversibility
2. Recognition
3. Compatibility
4. The least intervention
5. Energy efficiency
6. Accessibility

First of all, this project provided solutions for the potential problems in Stefanini room, following the survey on mapping, thermography and psychrometry. Two big focus were the damage on the painting in the room and the heating and ventilation issues with the whole room, and these issues are covered with possible solutions.

After that, this project changed the scale and focused on more to the Courthouse itself. To summarize this whole approach to the rest of the project, it was basically about attracting more people to the courthouse, because the courthouse is also partially an art gallery, and improve the time that people will spend here through focusing on the courtyard.

To attract people, information boards about the Courthouse and the art gallery inside were placed into crowded places and key points in all Milan. These boards making people know that there is another place to visit in Milan.

Following the increase of attraction, this project focused on making some quality of life improvements to the Courthouse. Early construction images of the Courthouse has been found through investigation and that was part of the inspiration, because the Courtyard had a clear look and without any cars, it was a big open space.

Therefore, the next step of the project was to get rid of all these cars and make this open space for people to use.

Courtyard project was a bigger project with details overall, it is separated into 3 main parts, the landscape, the facade and the roof.

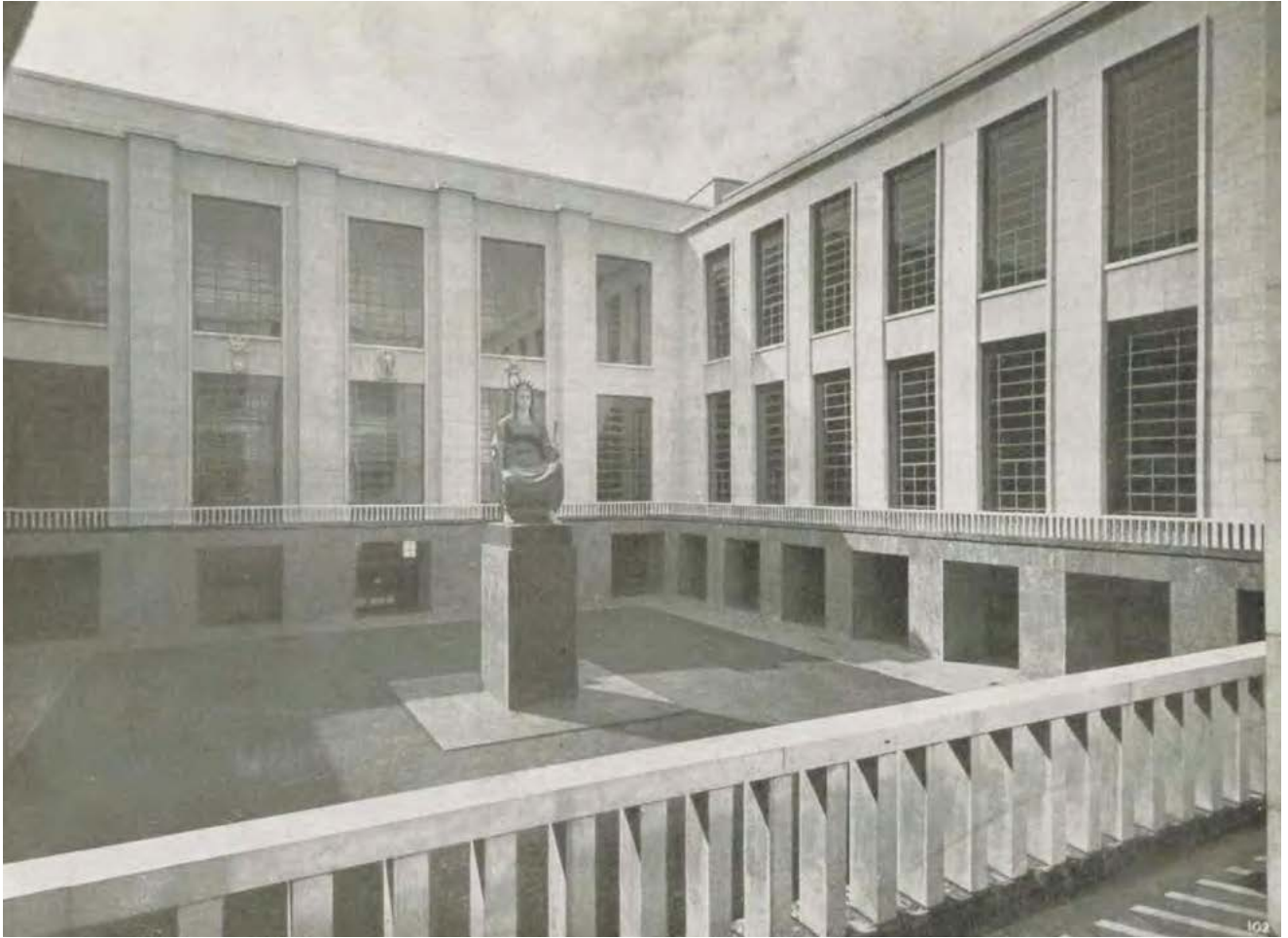


Figure 5.1 - Courtyard of the Courthouse/ early construction images.



Figure 5.2 - Courtyard of the Courthouse / today.



Figure 5.3 - Courtyard of the Courthouse / render with project details.

The modular platform provides an easy solution for landscape design, which makes it modular, changeable and easy to remove. Using different materials such as grass, wood, glass etc. are providing enough variety, also give control to people to change the design whenever desired.

The new facade system will make the new roof more compatible for the environmental control of the courtyard by providing air flow inside, while also improve the facade design differences of two different part of the Courthouse, which built in different time periods. Also the new facade provides additional shading devices for the offices on the top floor, providing more comfortable work environment.

New roof in the central courtyard is completely reversible and will be recognized easily. Also all the installments are reversible. The roof has two different materials, glass for more open and fresh look, and some panels in order to provide shading when required.

The roof not only provide energy saving plan for the building itself, especially during the summer, but also make the courtyard more comfortable area for people, which increase the accessibility in the central of the whole building.

These additions are independent from each other. They are not connected to each other in any way. But all of them combined has the same goal, which is to provide a big open area for people.

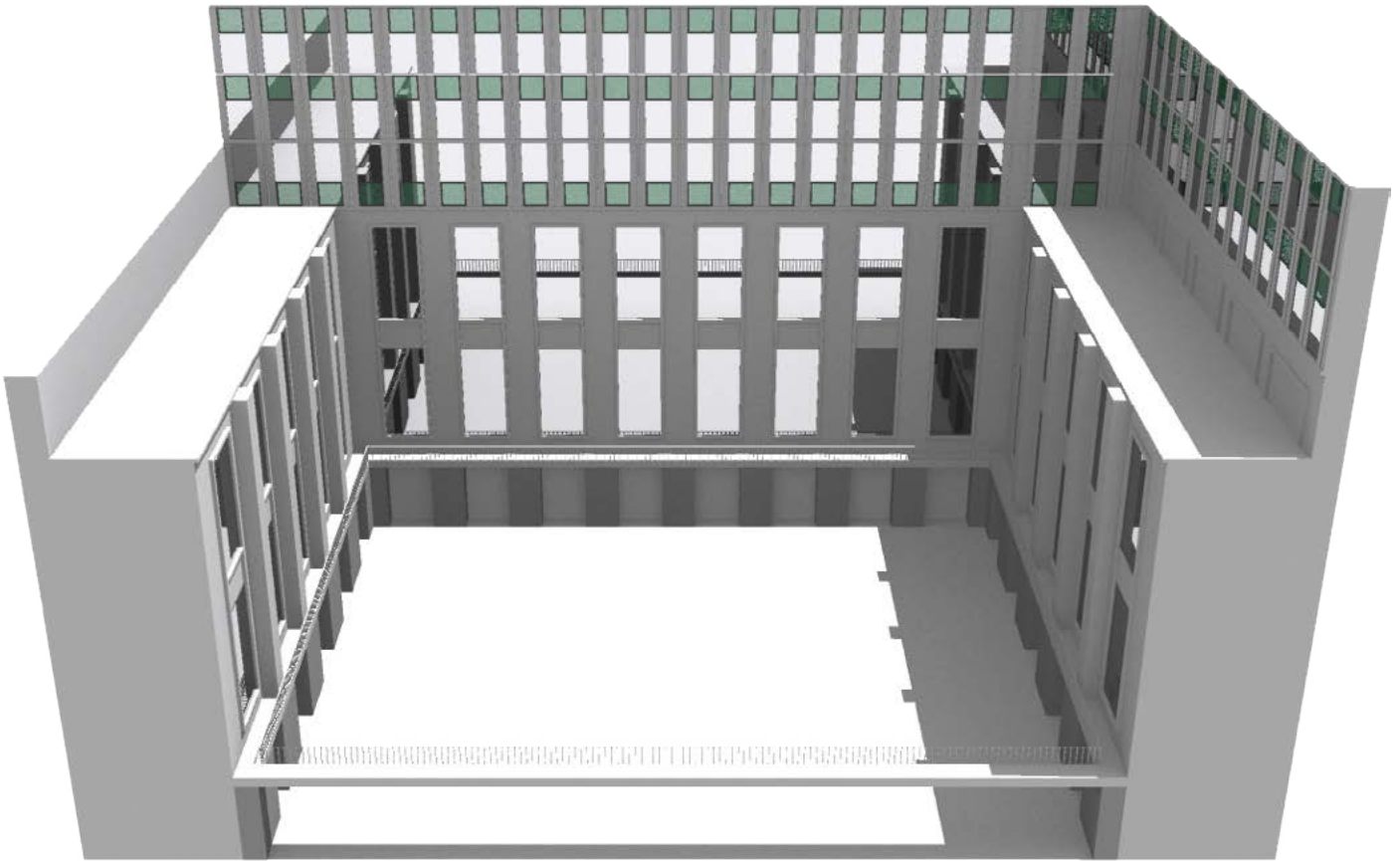


Figure 5.4 - Before the project / section perspective.

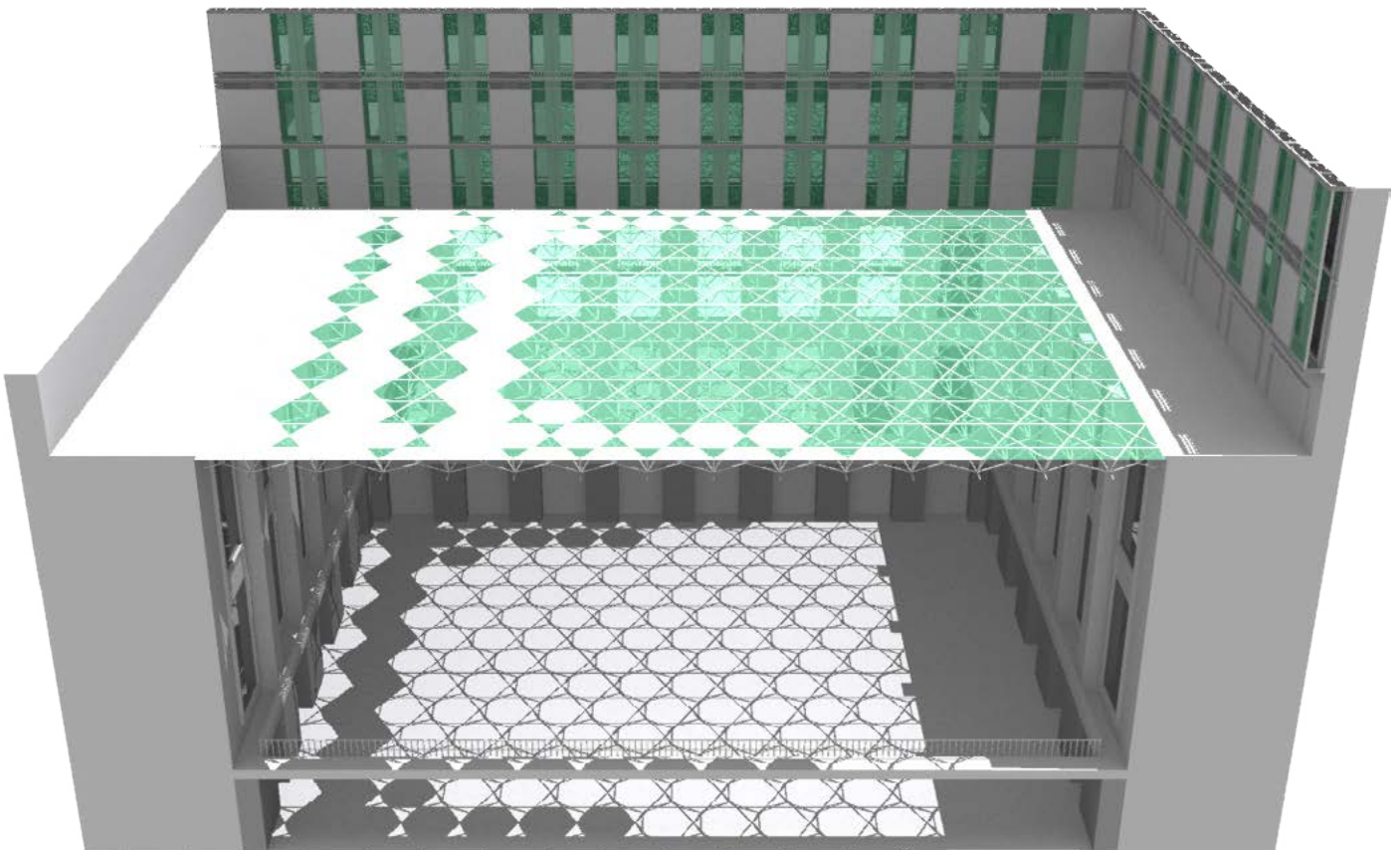


Figure 5.5 - After the project / section perspective.

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