



Sine Glossa: the Coded Drawing for the Recovery with the Help of the IPDB

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February 29, 2024

Sine glossa: the coded drawing for the recovery with the help of the IPDB

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ABSTRACT

The experience of descriptive geometry taken up within digital graphic - geometric processing constitutes the scientific unit inherent to the grammar for the representation of building models; while the genres of didactic productions (descriptive visualizations in the most diverse classes from manuals to treatises and professional practice) specify the organization referring to the descriptions of the support techniques necessary for the recognizability of the building. With the definition of *sine glossa* we intend to consider the codified drawing as a regulated practice without alterations and ambiguity, useful and necessary for the understanding of models designed according to rules aimed at the recovery of a building organism. In this way, the lexical debate that has involved scholars, researchers and established thinkers over the last forty years in relation to the terminological question relating to the definitions of recovery, reuse, redevelopment, restoration within a vast and wide-ranging and erudite discussion between conservation and innovation. Of particular scientific interest are the essays, publications and theses in which the experts have oriented the thought and jointly the action of how to investigate and analyze the question of the project and the intervention on the construction site on the artefacts. At the same time, a specific and qualified observation report was introduced on the architectural, building and engineering heritage, considered to be very complex and articulated in both the diachronic and synchronic phases. The research study exposed in this essay is articulated through the technical aid of the Integra Project Database, the acronym of BIM and through the lexical comparison of abduction and deduction, aspects that investigate together with the exercise of restitution redesign of the morphological models of the codified representation the theme concerning the habitation of the bolognese villa in the garden city between the years 1920 - 1950. The outcome reveals how the codified drawing first determines questions, then resolutions which tend to keep the theoretical basis of the research positively connected in terms and meanings between abduction and deduction in a specific and hinged context such as building recovery.

KEYWORDS

Building recovery and drawing, Drawing and BIM, Draw building recovery, IPDB - BIM building recovery and drawing

1. SINE GLOSSA

With the definition of *sine glossa* that is, literally, the expression of which indicates the textual meaning which leaves no room for misunderstandings or interpretations, I intended to involve the drawing in its constitutive breadth, through the development of codified graphic-geometric models. They revealed through the clarity defined by the work approach deduced from the consequentiality of the parts with respect to the whole, how the unity of the building organism in all its components was constituted and subsequently defined. The graphic - geometric processing of objects, the drawings of particulars and construction details articulated through the rules of Descriptive Geometry, in this specific case the Mongian projection, which thanks to morphological modeling highlights the duplicity of the relationships that underlie the useful and necessary systems for the representation. First, the means of matching the structure of the representation system to the objects (double Mongian projection and parallel projection) processing forms deemed appropriate for the different drawings, after the observation referring to the different morphologies defined by the graphic-geometric modeling. In this way, the biunivocity of the relationships represented the set of steps relating to the image and the differentiated graphic-geometric descriptive phases that are intended to be revealed through specific research and investigation. Furthermore, the path relating to the ranking of homes established by year of construction was clarified, noting their value and

meaning considered such for the recovery relating to the construction heritage of the historic villa in the garden city of Bologna. This aspect considered the quality linked to the valorization for protection suitable for a functional recovery observed in the engineering culture. In conclusion, no model can be represented if its intimate graphic-geometric genesis which is the basis of its spatial and constructive configuration is not first understood; as the study also highlights the consideration due to the theme of virtuality, i.e. the rigorous relationship between reality - object of study – model. In fact, with the graphic - geometric processing of digital models performed using the AutoCAD software relating to the modeling of the engineering building work, the practice of canonical representation acquired from the knowledge of Descriptive Geometry has been preserved as the norm on which to fix the geometry of the models themselves.

1.1. CODED DRAWING AND THE IPDB

The representation codes inherent to figuration for technical drawing constitute a system of rules that orders and regulates constructive graphic geometric "communication" referring to meanings and signifiers of signs and direct physical and material contents. Through the multiple and differentiated values integrated and explained with strokes, conventions, hatching, backgrounds, textures, the use of quotas, texts, and the aid of tables, the drawing takes on the relationships existing between the construction of the signs and the object (what you intend to draw), the specific place of the formal experience and the description of the objective contents relating to the models which in turn obey the morphology of the graphic-geometric images. In this specific geometric and technical modality the UNI regulation has been integrated in such a way as to provide an understanding aimed at the graphic-geometric reading referring both to the same positions of the images as for the different and necessary numerical ratio scales, and to articulate and control the execution relating to the modeling relating to the same technical drawings. The use and functionality of the AutoCad software for representation, used for both basic and more complex functions, has made it possible to develop models necessary for a series of representations within the CAD environment, thus taking advantage of the possibility of arrange the tools to guarantee the understanding and recognition within the work of those facts that contribute to the understanding of the material, physical and construction values aimed at the building recovery of the housing organism examined. In fact, the use and development of the IPDB Integratad Project Database system for construction as a "parametric building study model" was able to "automatically" propagate the effects of a modification throughout the model and provide a valuable effect resulting from the action due to a "feedback" relating to the implications of the possible variations on the space, on the construction systems, on the selected products and on any cost of the constructions not reported here. These technical operational aspects which belong to the operational method (remembering that BIM is not a software, but rather a systematic organization of processes in a meta-design key) are decisive especially for the new building, encountering some or particular inconveniences in the specific area of recovery and of the restoration of artefacts. The recovery of buildings (usually these are non-restricted historical constructions) requires extensive thematic and disciplinary planning, which considers diagnostics through the different sectors of knowledge and structure, construction, for example (eco-compatible materials), of the systems, i.e. the control of the microclimate and the thermal nature. In summary, it is the study of the state of the art in accordance with the legislation to provide a cultural and technical response also from a perspective not covered in the essay due to an economic evaluation relating to costs and benefits.

1.2. RESEARCH METHODS AND OBJECTIVES

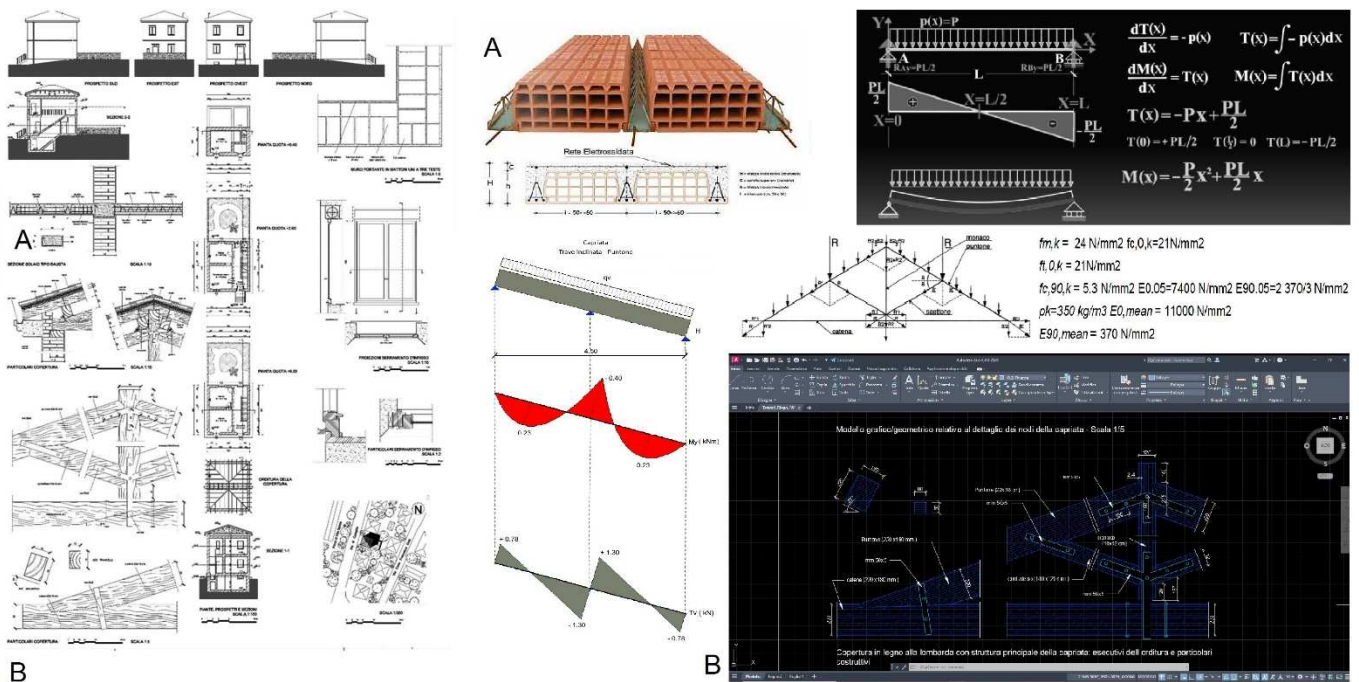
The method relating to the study conducted on the historic town (not restricted) investigated through the development of graphic-geometric models the correlation of the facts that characterized the *modus operandi* of the construction equipment with the building characteristics of the houses relating to the case studies analyzed. The morphological modeling obtained through parametric models relating to the buildings observed and re-drawn and reproduced at different ratio scales through the AutoCAD software system, intended to consider multiple information due to the useful and necessary representations both for the communication of the drawing and its contents, both for the study aimed at the realization and demonstration of a building work. This result it allowed us to understand the construction system of the artefacts, the character of the building, as well as the settlement system, considered as a whole and in unity, understanding how they were created and ordered within a consolidated context recognized in the culture of city. The study and research work also integrated and developed the use of the IPDB (Integratad Project Databas) method commercially known as BIM (Building Information Modelling). In this way it was possible to associate the phases of the work process with the elements, including

temporal ones, to visualize and verify the control of the research - project according to the different phases or steps determined. This defined the evaluation objectives as the set of technologies that allowed information to be processed and communicated through digital means within the study process for building recovery; specifically, the contribution of Building Information Modeling (BIM) applications for the technical control and understanding of building construction characteristics was investigated. The IPDB (Integrated Project Database) represents a method of interest in the process and development of research and computer-aided design. In conclusion, the method and objectives were based on the technique referring to the parametric morphological modeling of the building which used a database of relationships «combining graphic-geometric models to process and represent the characteristics of the construction and structural elements» [1], the size of the components relating to the building characteristics of the artefacts observed. The historical analysis with references to the literature, the building and detailed survey, the mapping of materials and processes, the geometry of the construction details are the general items that have outlined the study and the deductive and inductive objectives of the knowledge of a building system characterizing.

2. CULTURAL MODELS FOR BUILDING RECOVERY

The apodictic formal and constitutive confirmation of the building heritage of the Emilian "garden city" defines the very character of the building. This aspect is of particular interest and is worthy of observation even if through a brief discussion. At the same time, knowledge of the historical heritage, both restricted and non-restricted, is another topic to which attention should be paid at different levels. Currently, the concentration on the recognizability of the characteristics of buildings is an old and scarce topic interest. In the same way, the historical-cultural recognition of the vast urban-building heritage is postponed to a building and architectural debate without conviction, in other ways set aside for questions historical – educational. The character of a building is first and foremost a practical technical question. Essentially when observing a building such as in the case study shown here, one finds in the building construction tradition the orderly sequence of solid brick walls, wooden floors and concrete brick floors, roofs with wooden trusses. The unity of the construction tradition constitutes a design outlined by a simple static scheme. Further considerations investigate and analyze additional construction issues of greater complexity. For example, the connection of flat elements connected by successive one-dimensional elements such as floors or arches or spatial elements such as vaults, define a box-type construction and structural system characterized by significant rigidity. Two terms agree and open the discussion. The first concerns the adequacy, i.e. conformity, the second structural and consequently constructive regularity. The character of the building must also be considered and based on the dual relationship that is established between technique and practice. On these terms it is possible to establish a sequence of investigations based on the recognisability of the construction system of an artefact. On the basis of this, three aspects can be indicated which are considered levels of assessment and evaluation: the first is given by the consideration of adequacy - conformity which presupposes a direct relationship, specifically following the sense and meaning referred to the construction system; the second considers the structural regularity, which establishes a relationship defined by continuity, in the first instance it is considered through the analytical calculation of the structures, in the second aspect the direct steps for the transmission of actions are made explicit (vertical loads or horizontal actions), from the point where they are applied to the foundation, through the different resistant elements that make up the building; the third case concerns the synthesis it establishes the grade of structural simplicity, which allows for ease of sizing, modeling of the structure, definition of loads and explicit consideration of all construction details. In this path, drawing is essential and the survey determine the knowledge of the problems and the state of the art, anticipating the general questions relating to the possibilities of recovering the structures in light of the dependence on the character of the building. The graphic-geometric models return the dimensions, the "hierarchies" providing a first classification on the conditions of the artefact obtained from cross-readings relating to its constitution. A further clarification aimed at acknowledging the legislation on the "recovery of brick-cementic floors is set by the D.M. of 17 January 2018 in § 7.2.6. indicates that: «... the flat horizontal structures can be considered infinitely rigid in their average plane provided that they are made of reinforced concrete, or in brick-cement with a reinforced concrete slab of at least 40 mm thick, or in a mixed structure with a reinforced concrete slab reinforced concrete of at least 50 mm thickness connected to the steel or wooden structural elements by appropriately sized shear connectors..." depending on the overall geometries of the building, it is immediate to note that, at least theoretically, completely leveled floors or in any case with a slab less than 5 cm and not reinforced cannot be considered infinitely rigid with significant consequences in the distribution, for example for horizontal seismic actions on the vertical seismic-resistant elements of the calculation model. Consequently, the investigation solutions for the consolidation of a floor (Fig. 1)

must consider whether and how the hypothesis of infinite stiffness in the plane or, on the contrary, of absence of stiffness is varied in order to take it into account in the overall calculation of the building. The observation is clear in relation to the fact that in historic buildings there are many brick-concrete floors built in the period between the 1930s and up to the 1960s-70s of the last century without an upper slab or with a slab of a few centimeters " [2].



structural question of the artefact for engineering is part of a philological and comparative path, in which weights, measures, shapes and structures belong to the grammar and syntax of the building, whose form resides in its history, in its constant definition, also in 'adequacy, to the point of being necessary and indispensable as an integral part of form of the city (*forma urbis*). In summary, «the character of a building consists exclusively in its reality and that its spectacle is only a consequence of it, that is, a derivative or its by-product» [4].

2.2 THE TECHNICAL AND LEXICAL ISSUES ON THE RECOVERY OF BUILDINGS

A constant and broad matrix discussion literary and cultural still involves the comparison regarding the technical and administrative aspects relating to the articulation of the interventions and the orientation of these in the context of debate and application relating to the space of operations relating to building recovery: specifically on the large and vast historical heritage (not restricted) of places and cities. The same regulatory sources characterized by the urban planning law L.1150/42 (mother of all the regulations on houses and buildings) establish the less legal and more literary methods of intervention and interpretation, which have the task of regulating the formation of urban planning tools executive, through the drafting of maps that describe the city through graphic codes of the technical drawing urban planning, as well as in considering also parts of territory already built. Thereby through the action of the Institutions, Regions and local authorities, the power to implement the disciplinary tasks of the interventions has been established by applying the regulations contained therein. The forms relating to the categories of interventions concern a series of intentions and procedures which attest to their titling, specifically the direct recognizability regarding the recovery of existing buildings. «The legislation referring to Law 457/78 and precisely the articles. 27; 28; 31, considers the general intervention procedures also involving the restoration of the works of the artefacts» [5]. To understand the sense of the debate relating to intervention practices linked to the recovery of buildings, the description relating to the operational intervention items is reported in a succinct and very brief manner. Ordinary maintenance concerns the action aimed at preventing and overcoming degradation (Fig.2).

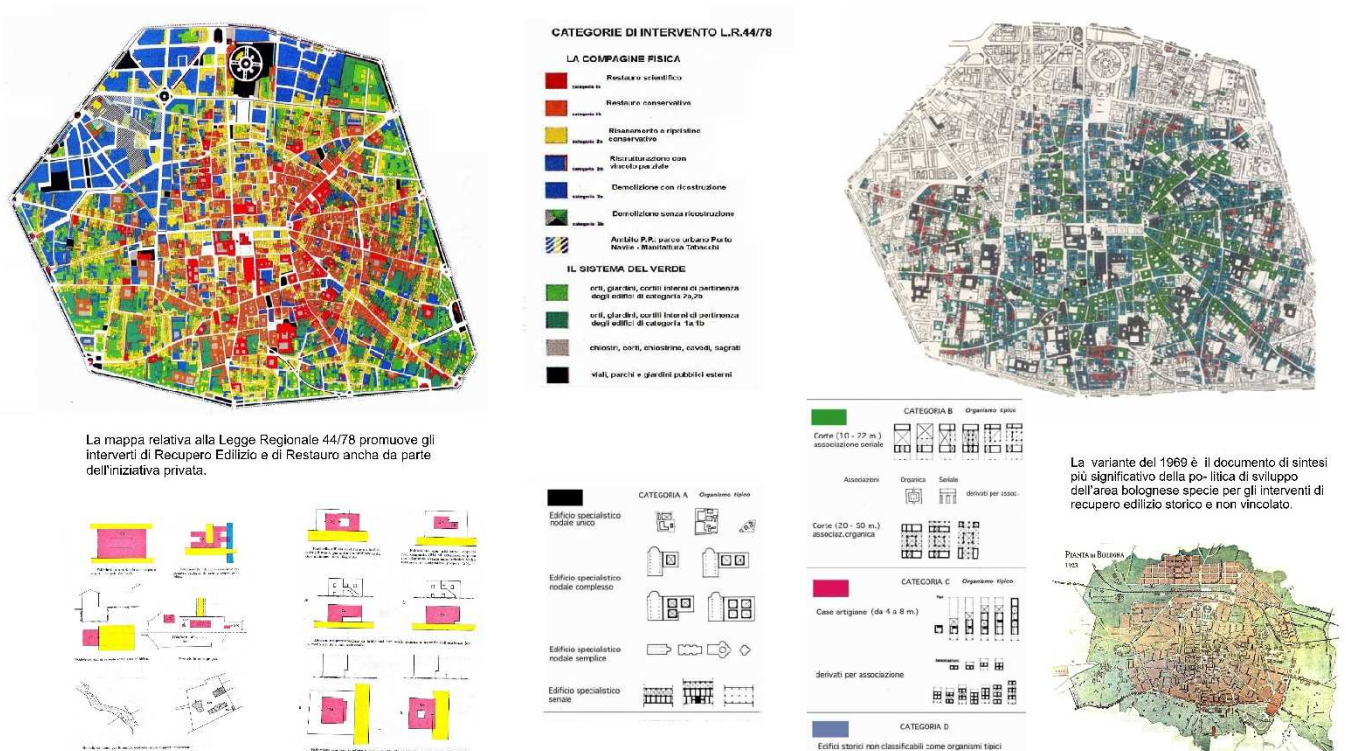
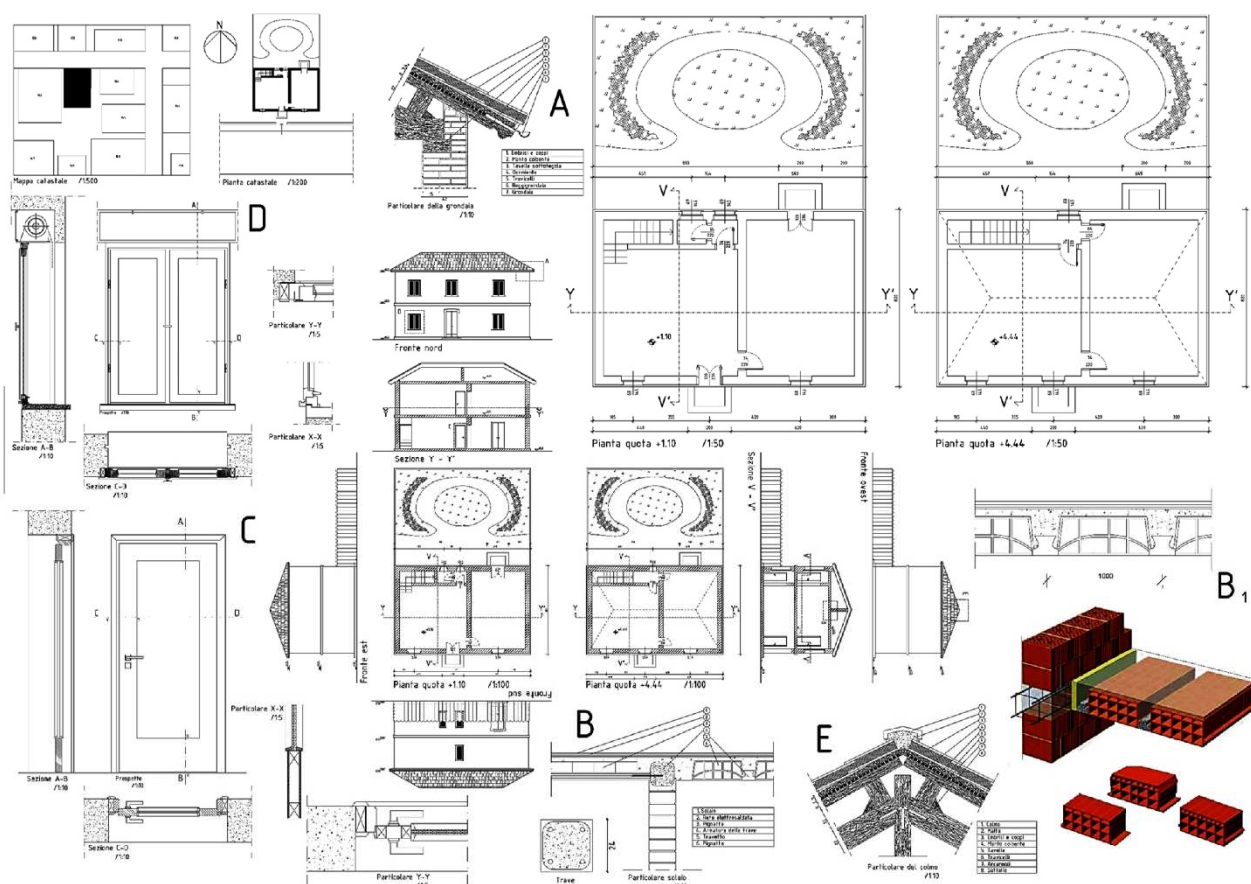


Fig. 2 (codified technical-urban planning drawing referring to the overall and study maps of the city of Bologna: on the left intervention categories for building recovery and restoration, year 1978. On the right, typology categories for the recovery of buildings in the ancient centre, 1969-70. Down on the left extracts and cadastral drawings of the buildings. Down on the right historical map of the city of Bologna from 1923. © 2023, Author/open source property: xxxxxxxxxxxxxxxxxxxx).

Administratively it concerns the repair, renovation or partial replacement of finishing works, provided that the original (formal) characteristics of the building are preserved. Extraordinary maintenance, on the other hand, considers a further intervention to ordinary practice in which the original characteristics of the buildings are partially and not strictly modified. In this case it is necessary to verify compliance with building regulations. This also considers the renewal and/or replacement of parts, be they of a structural nature (art. 3 of the Consolidated Building Act, D.P.R. 380/2001). It is also specified that the interventions cannot alter the volume of the building, in reference to Legislative Decree 133/2014, known as the "*Sblocca Italia*" decree. The term "building recovery" refers to an attitude that involves a series of interventions aimed at ordinary and extraordinary maintenance, which in turn lead to considering the aspects of building renovation and restoration and rehabilitation interventions. conservative. In this case a dichotomy is established. The question concerns whether building recovery, in addition to incorporating renovation, is also a field on which to act for restoration interventions. Certainly, building recovery includes among its intervention skills the cultural attitude of "conservative" rehabilitation, as a maintenance type action. With the term conservation it should be clarified what is the act of intervention confirming a state of fact, with the consequent arrest of the different transformation processes, in which culturally it is not permitted the morphological modification of the building organism. Furthermore, the recovery of the existing building heritage also refers to the functional reuse of the existing buildings as a whole on the territory, through diversified interventions depending on the state of conservation of the buildings. This is certainly a very general definition, which does not recognize a univocal classification of intervention. According to Edoardo Benvenuto's thoughts, the word "recovery" «reconnects with memory, with remembrance, with acceptance; it extends by analogy to the diverse and extensive fields of science. ... recovering is in fact nothing other than saying what has already been said and since saying means inserting a word in a context, decide which meanings to attribute to it, eliminating many other possible ones" [6]. The theme of building recovery is therefore open to revelation and in this observation lies the dimension that refers to a particular interest in which it investigates the competence and cultural attitude of building recovery itself. It is mentioned, reporting the recent legislation relating to Law n. 34 of (27.04.2022), paragraph d) which specifies the "building renovation interventions", which are aimed at transforming the building organisms through a systematic set of works that can lead to a completely or partially different building organism from the previous one. These interventions include the restoration or replacement of some constituent elements of the building, the elimination, modification and insertion of new elements and systems. The scope of building recovery or renovation interventions also includes demolition and reconstruction operations of existing buildings with different shapes [7], elevations, grounds and planivolumetric and typological characteristics, with the innovations necessary for adaptation to anti-seismic regulations, for the application of accessibility regulations, for the installation of technological systems and for energy improvement. The intervention may also include, only in the cases expressly provided for by current legislation or municipal planning instruments, increases of volumetry also to promote urban regeneration interventions. They constitute, interventions aimed at restoring buildings, or parts of them, which may have collapsed or demolished, through their reconstruction, constitute recovery or renovation, provided that it is possible to ascertain their pre-existing consistency. It remains understood that, with reference to properties subject to protection pursuant to the Cultural Heritage and Landscape Code referred to in Legislative Decree 22 January 2004, n. 42, with the exception of buildings located in protected areas pursuant to art. 142 of the same legislative decree, as well as, without prejudice to the legislative provisions and urban planning instruments, to those located in the homogeneous zones A referred to in the decree of the Minister for Public Works of 2 April 1968, n. 1444, or in areas similar to these on the basis of regional legislation and municipal urban planning plans, in consolidated historical centers and nuclei and in further areas of particular historical and architectural value, demolition and reconstruction interventions and restoration interventions of collapsed buildings or demolished constitute building renovation interventions only where the shape, elevations, grounds and plan, volumetric and typological characteristics of the pre-existing building are maintained and no increases in volume are envisaged; the concept of "prevalence" of the definitions given by the State regarding the definition of building interventions.

3. GEOMETRIC MORPHOLOGICAL MODELS FOR BUILDING RECOVERY

The representation of the survey (acquisition operations), as well as the redrawing (restitution operations), constitute a fundamental document for transmitting and communicating in an effective and adequate way the physical, mechanical and objective reality of the building organism. The graphic-geometric description of the models developed in the case study whose object concerned a survey carried out through investigations and analyses, with a sequence of steps and operational processes involved and determined the considerations of solutions through which targeted and referring to building recovery; basing the digital operations of the drawing with the AutoCAD software as a systematic foundation for the BIM method, correctly known by the acronym of IPDB or the Integral Project Database. The methods and procedures of graphic-geometric elaboration and transcription are not to be considered phases detached from the process which concerns in the first aspect the drawing operations for the survey just as in the second aspect the restitution operation was obviously necessary for the possibility to carry out the control of knowledge through representation methods, entrusting graphic techniques with the descriptive rendering specific to the relationship scales. For example, the knowledge relating to descriptive geometry has allowed the intrinsic rules that underlie it to develop and represent models relating to the building object both in the two-dimensional drafting through the rules that regulate projective and descriptive operations, and by using specific reference codes and codified geometric rules attributable to numerical ratio scales. A further contribution was provided by modeling due to three-dimensional processing in which the representation of the oblique drawing is specific to understand the volume of the object or its part in the general or particular characteristics. The transmission of the data acquired from the survey operations was in turn elaborated in order to describe and obtain models in which the morphological representation is perceived as well as measured; this guaranteed, through the drawing elaborated with horizontal sections, vertical sections, and elevations (fronts), drawn up at the appropriate scales, with the graphic drafting of particulars - construction details, to complete the cognitive process of the building organisms studied (Fig.3).

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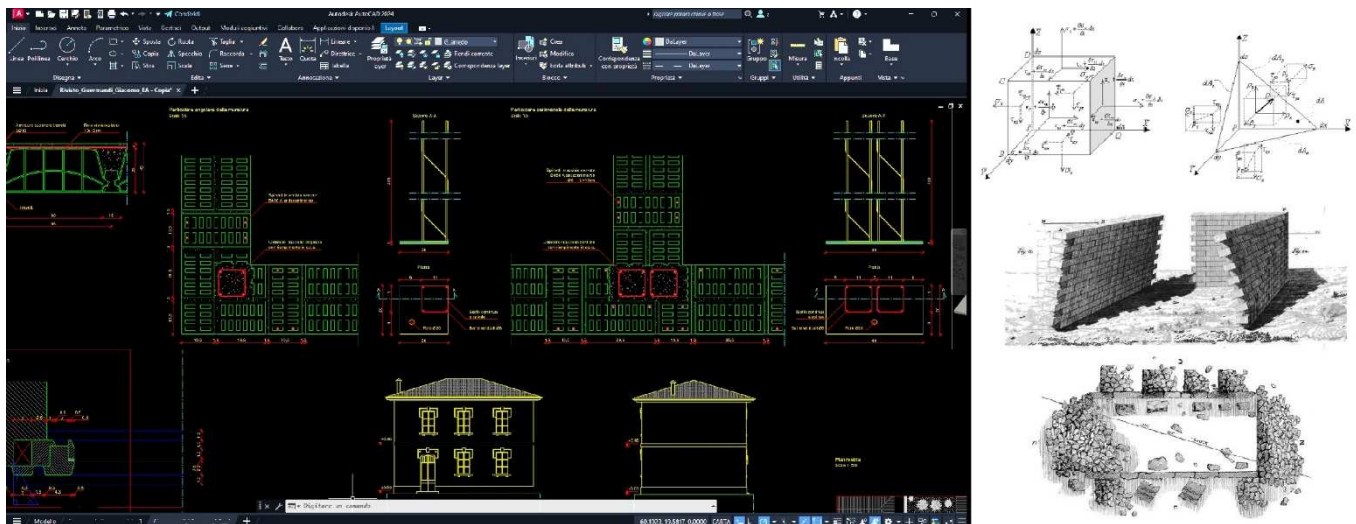


Fig. 4 (restitution relating to the morphological modeling referring to the consolidation masonry of the Bolognese villa in 1935. Graphic drawings of construction elements for a functional recovery of the brick-concrete masonry. © 2023, Author/Owner. AutoCAD drawings, operator: xxxxxxxxxxxxxxxxxxxxxxxxxxxx. Others: xx. On the right: three-dimensional representation of the infinitesimal continuum in equilibrium due to the action of Cauchy's normal σ and tangential τ tensions; on the side, Cauchy tetrahedron. Down: representation of the mechanical behavior of wall facings (Rondelet, 1832, Vol. 2, tav. CLXXXII. Mallet, study on the effects of an earthquake with a diagonal direction with respect to a masonry building: Mallet, 1846, p. 54).

From this derives an attestation of the morphological models in which the form and content are recognised. This way it is possible glean some analogies from the literature. This concerns the consideration and reflection on the concept of morphology. The citation, the analogy concerns the referent in which morphology deals with the mechanisms that regulate the internal structure of words, that is, the way in which the minimal elements with meaning combine with each other to form the words of a language. It examines the processes that intervene in the formation and transformation of the words themselves. The fundamental unit is therefore the morpheme: the minimal element endowed with meaning of which words are composed. This results in the "inflectional morphology" which determines the variation of a word in all its possible forms; "derivative morphology" includes the complex of rules and transformations through which we move from primitive words to derived words, through the addition of derivative morphemes. From the analogy with literature to drawing of morphological models the step is quite risky, but not therefore impossible. The passage relating to the representation of a building object undergoes "variations" in reference to the numerical representation scale in the way in which the representation codes are attested to specify the elements or the element described with the same ending (morpheme). Therefore it is made explicit and necessary to use the methods of representation in a careful manner, distinguishing the usefulness and penetrating the meaning of what is considered, in relation to expressiveness and in relevance to the communication referring to the particular context in which one is operating. The drawing is therefore objective. The method of double orthogonal projection (Mongian projection) in which the object is represented by projecting it onto two reference planes perpendicular to each other, thus defines the object projected from two points of view, placed at infinity according to the perpendicular directions to the floors themselves. This results in a complete and exhaustive representation in terms of measurement and sufficient, so that even the principles relating to perceptive organization restore recognisability to the graphic and geometric image. The structured method concerning the Integral Project Database (BIM) to guarantee complete and organic systematicity (integrated design) was considered as an experience of acquiring an appropriate, specified and detailed knowledge of the building organism, attributable to construction details with a good understanding that in building recovery - restoration some of the important aspects that emerge during the phases come from problems that require rapid solutions on site. In this case the "BIM model" allows the appropriate development and regularization of facts and events, preparing the interested actors for constant monitoring between causes and effects, avoiding interdisciplinary and professional conflicts, in such a way as to guarantee control between the virtual aspect (systematicity of the BIM program) with multi-scale models and aspects of complementary knowledge (graphic - geometric) of competence (Fig.4).

4. SUMMARY AND CONCLUSIVE CONSIDERATIONS

The graphic and geometric restitution relating to the codified processing of the models designed both at different scales of numerical ratios and in space, developed in the disciplinary and study field aimed at building recovery constitutes, for civil engineering, a further reflection useful for control of the cognitive process in the context of technical representation. The theme relating to the essay presented also intended to discuss, above all to combine, the study relating to a topic relating to the hinge concerning the method relating to the Integral Project Database system commercially known as BIM. The theme relating to the essay presented also intended to discuss, above all to combine, the study relating to a topic relating to the fundamentals regarding the method relating to the Integratgrad Project Database system commercially known as BIM. The BIM system is not software and consequently cannot ignore the use of specific applications, especially in the use of AutoCAD software capable of originating and controlling peculiar and appropriate virtual models and clearly attributable to the construction sector and at the same time communicating documents able to dialogue with all the figures and operators participating in the construction process of a work, especially in the particularities of the interventions connected to building recovery. The research was divided into checking the knowledge relating to the design of the built-recovered work for engineering, recognizing through drawing and surveying the material and construction facts that characterize and interest the organism examined. In fact, through investigation and analysis, the characteristics of the building, the specific materials were analysed, compared directly (surveys - assessments), and indirectly through literature, treatises, manuals with handbook publications and even historical recipe books (Fig.5). With this we intend to promote and reconsider those aspects also referring to analysis techniques as well as to the use of tools since too often the latter have occupied the attention of workers and researchers with greater obstinacy, emphasizing in them a form of particular attachment and of expedient resolution on construction issues and beyond; forgetting that the "practical" operations belong to those phases that allow constant acknowledgment and control of the finalized actions, especially in the construction site documents and practices for building recovery. The codified drawing made it possible to understand the coincidence of units between work - survey - drawing. This report reproduces its strengthening in considering the sense and the final meaning whose objective was to represent the building recovery of housing organisms that made up an important part "of the culture and history of the site" [8] investigated. It is understood that drawing remains the most effective working principle in which the operations of measuring, describing, of composing and repeating. The intelligibility of building recovery lies in the intrinsic ability to understand by providing an answer, that is to explain the rule, which deductively and inductively resides within the building, a fact of acquiring the construction compatibilities of the past to "restore" and "preserve" the present, and especially in drawing there is a system capable of distinguishing and adequately delineating the variety of signs of which the factory itself is composed and organized in its characters and structure. And it is through simplicity that we clearly understand that the essence of the building's constituent elements is arranged literally, *sine glossa*, that is, in a conception of knowledge, constructive wisdom, regularity and order of the unity of the founding relationships.

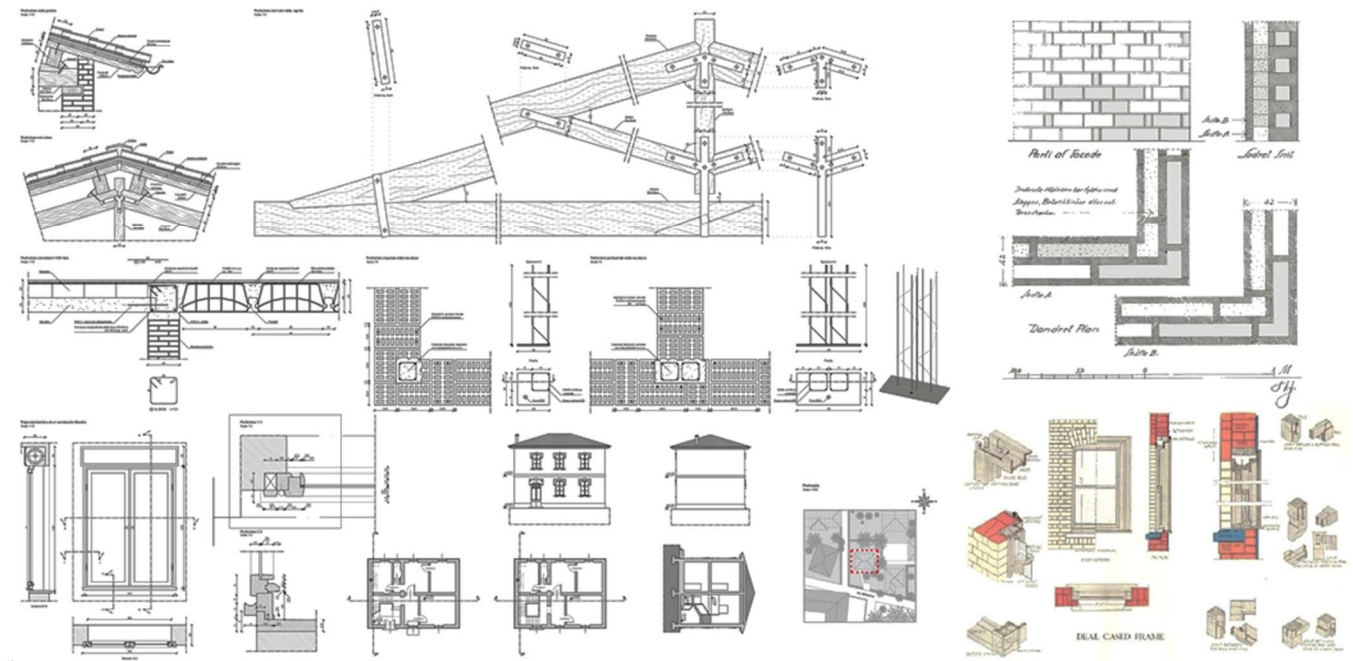


Fig. 5 (return relating to the morphological modeling referring to the Bolognese villa in 1950. Graphic drawings of construction elements and diagnostics for functional recovery. © 2023, Author/Owner. AutoCAD drawings, operator: xxxxxxxxxxxxxxxxx. Others: xxxxxxxxxxxxxxxxxxxxxxxxx. On the right, construction manual, masonry equipment; down: constructional details of double – hung sashes and frame).

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