

# VITRUVIUS POLLIO

AN ABRIDGMENT OF  
THE ARCHITECTURE OF  
VITRUVIUS

Vitruvius Pollio

**An Abridgment of the  
Architecture of Vitruvius**

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# Vitruvius Pollio

## An Abridgment of the Architecture of Vitruvius / Containing a System of the Whole Works of that Author

### INTRODUCTION

#### ARTICLE I

##### *Of the great Merits of Vitruvius, and the Excellencies of his Works*

There are so many things in the Works of *Vitruvius* that do not directly appertain to Architecture, that one would think they were less fitted to Instruct those that have a design to learn the Precepts of this Art, than to persuade the World that the Author was the most knowing Architect that ever was, and a Person of the greatest Merit: He had the Honour to serve *Julius Caesar* and *Augustus*, the two Greatest and most Magnificent Princes of the World, in an Age when all things were come to the highest degree of Perfection.

For one may see in reading his Works, which are full of a wonderful variety of Matters, which he treats of with a singular Erudition, that this great Man had acquired that Profound Knowledge which is necessary for his Profession by more excellent Methods, and more capable of producing something excellent, than the bare exercise and ordinary practice *Lib. 6.*

*Preface.* of a Mechanical Art could possibly do; being compleat in all the Liberal Arts and Sciences, and his great Wit being accustomed, even from his Cradle, to understand the most difficult Matters: He had acquired a certain Facility which meer Artizans have not, of penetrating the deepest Secrets, and all the difficulties of so vast an Art, as that of Architecture.

Now as it's true that in the Practice and Exercise of Arts, one does not *Lib. 2.*

*Pref.* always easily distinguish the Abilities of those that work in them. The great Capacity of *Vitruvius* before the publishing of his Book, which he Composed when he was in Years, had not all the Esteem it deserved; which *Lib. 6.*

*Preface.* he complains of in his Preface, and in the Age he lived; though it was full of the most refined Wits, yet he had the fortune of others, to find few to defend him from the Surprizes and Attacks of false Reasoning, and from the injustice that prejudice creates, to those who apply themselves more to cultivate the Talents they possess, than to make parade of them.

*Lib. 2.*

*Pref.*

*Lib. 6.*

*Pref.*

*Lib. 3.*

*Pref.*

*Lib. 3.*

*Pref.*

*Lib. 6.*



*Pref.* *Vitruvius* was a Man, who, as to the exterior, made a small Figure, and who had not heaped up great Riches by the practice of his Profession; and having, as it were, buried himself in study, and wholly given himself over to the Contemplation of Sciences, understood little of the Arts of the Court, or the Crafty Sights of pushing on his Fortune and making himself considerable; for though he was bestowed upon, and recommended to *Augustus*, by the Princess *Octavia* his Sister, we cannot find that he was employed in any Works of great Importance. The Noblest Edifice that we can learn that *Augustus* caused to be built, was, the Theatre of *Marcellus*; and this was done by another Architect: And the only Fabrick we can find he was employed in was not at *Rome*, but at *Fano*, a very little City; insomuch, that the greatest part of the Architects of that Age, who had gained the general Vogue, being so ignorant, that they did not know even (as himself is forced to declare) the first Principles of their Art: The Quality of a mere Architect was become so Contemptible, that if his Books had not carried all the Marks of an extraordinary Knowledge, and rare abilities, and undeceived the World by taking away the prejudice that his small employ created him, the Precepts he has left us would have wanted that Authority that was necessary to support them.

For Architecture being an Art that has scarce any other Rule to walk by, in performing all those Excellencies her Works are capable of, than what we call a Good Fancy, which truly distinguishes that which is Beautiful and Good from that which is not so; it's absolutely necessary that one be perswaded that the Fancy he follows is better than any other; to the end, that this Perswasion insinuating it self into them that study this Art, it may form in them a Correct and Regular Idea, which without this Perswasion, would be always floating and uncertain; so that to establish this Good Fancy, it's necessary to have one to whom we give great deference, and who has merited great Credit by the Learning that is found in his Writings; and is believed to have had sufficient abilities of chusing well among all Antiquity, that which is most solid and capable of founding the Precepts of Architecture.

The Veneration we have for the first Inventors of Arts, is not only Natural, but it's founded upon Reason; which makes us judge, that he that had the first Thought, and first invented any Thing, must needs have had a fitter Genius, and a better Capacity for it, than all those that afterwards laboured to bring it to its utmost Perfection. The *Greeks*, who were the Inventors of Architecture, as well as of other Sciences, having left many Works behind them as well in Building as in Books, which were looked upon in the time of *Vitruvius*, as the Models of what was perfect and accomplished in this Art, *Vitruvius* chiefly followed and imitated them; and in the Composition of his Book, gathered from them all that was to be found Excellent and Rare in all their Works; which makes us believe, that he has omitted nothing that was necessary, to form the General Idea of Good and Beautiful, since there is not the least probability that any thing could escape so Rare a Wit, Illuminated with so many different Lights.

But because at present the Reputation of *Vitruvius* is so generally established, that all Ages have placed him in the first Rank of great Wits, and that there is nothing necessary to recommend the Precepts of Architecture, but to prove they were drawn out of his Works: We having here designed to make only an Abridgment of his Works, we thought it would be necessary to cut off many things that this Famous Author has drawn out of an infinity of Writers, whose Works are now lost, and only gives a short Account of the Contents of every Book, in the beginning of this Abridgment; handling only in this Book, those Things that directly belong to Architecture; disposing the Matter in a different Method from that of *Vitruvius*, who often leaves off the Matter he is treating of, and takes it up again in another place.

The Order we have proposed to our selves in this Abstract, is, That after having given an Account in few words of what is contained in the whole Book; we Explain more particularly what we judge may be serviceable to those that study Architecture. This Treatise is divided into Two Parts; The First contains the Maxims and Precepts that may be accommodated to *Modern* Architecture; the Second contains all that appertains to the *Ancient* and *Antique* Architectures; which, though often

affected, have little that's now made use of, may yet nevertheless serve to form the Judgment, and regulate the Fancy, and serve for Examples of things that may be useful.

I make a Distinction between the *Ancient* Architecture, and the *Antique* Architecture, and the *Modern*; for we call that Architecture *Ancient* of which *Vitruvius* has writ, and of which we may as yet see many Examples in the Fabricks that remain in *Greece*. The Architecture which we call *Antique*, is that which may be found in the Famous Edifices, which, since the Time of *Vitruvius*, were built at *Rome*, *Constantinople*, and many other places. The *Modern*, is that which being more accommodated to the present use, or for other Reasons, has changed some of the Dispositions and Proportions which were observed by the *Ancient* and *Antique* Architects.

## ART. II

### *The Method of the Works of Vitruvius, with short Arguments of every Book*

All his Works are divided into Three Parts: The First *Lib. 1*.

*Chap. 3*. Treats of Building; The Second is Gnomonical, and treats at large of Astronomical and Geometrical Affairs. The Third gives Rules and Examples for making Machines or Engines serviceable, either in War or Building. The First Part is treated of in the Eight first Books: The Second in the Ninth: The Third in the Last.

The First Part which relates to Building is twofold, for they are either publick or private. He speaks of private Buildings in the Sixth Book; and as to that which relates to publick Buildings, it's likewise divided into Three Parts, *viz.* That which has Relation to Security, which consists in Fortifications, described in the Third Chapter of the First Book; That which appertains to Religion, of which he treats in the Third and Fourth Books, and that which relates to publick Conveniencies, as *Town-Houses*, *Theatres*, *Baths*, *Academies*, *Market-places*, *Gates*; of which he treats in the Fifth Book.

The Gnomonical part is treated of in the Ninth Book.

The Third Part which treats of Machines, is treated of in the Tenth and Last Book.

Besides these particular Matters of Architecture, there are Three things that appertain to all sort of Edifices, which are, Solidity, Convenience, and Beauty. He speaks of Solidity in the Eleventh Chapter of the Sixth Book; of Convenience, in the Seventh Chapter of the same Book; and of Beauty through the whole Chapter of the Seventh Book; which contains all the Ornaments that Painting and Sculpture are capable of giving to all sorts of Fabricks; and as to Proportion, which ought to be esteemed one of the principal Foundations of Beauty, it's treated of throughout all his Works.

But to make it better understood, in what Method every Book explains those things, we must tell you, That in the First Book, after having treated of those things that belong to Architecture in General, by the Enumeration of the Parts that compose it, and of those that are required in an Architect, the Author explains in particular what choice ought to be made of the Seat where we ought to Build, as to Health and Convenience; after he speaks of the Foundations and of the Building of Fortifications, and the Form of Towers and Walls of Cities, he dilates himself upon the Air and Healthiness of the Situation.

In the Second Book, he speaks of the Original of Architecture, and what were the first Habitations of Mankind; after he treats of the Materials, *viz.* of Brick, Sand, Lime, Stones, and Timber: After which he treats of the different Methods of laying, binding, and Masonry of Stones. He Philosophizes upon their Principles, and upon the Nature of Lime, upon the choice of Sand, and the time of cutting of Wood.

The Third Book treats of the Proportion of the Temples, and of seven sorts of them which are those called *Antes*, *Prostyle*, *Amphiprostyle*, *Periptere*, *Pseudiptere*, *Diptere* and *Hypæthre*. After he speaks of the Different spaces that ought to be betwixt every Pillar, to which he gives the Five Names

following, (which in the latter Part of this Book shall be more fully explained, as well as divers Terms of Art) viz. *Pycnostyle*, *Systyle*, *Diastyle*, *Aræostyle* and *Eustyle*. After that, he gives in particular the Proportions of the *Ionick* Order, and demonstrates that it has a Proportion with Humane Bodies.

The Fourth gives the Proportion of the *Corinthian* and *Dorick* Orders for Temples, with the Proportions of all the Parts that compose them.

The Fifth treats of Publick Fabricks, viz. of *Market-places*, *Theatres*, *Palaces*, *Baths*, *Schools* for Sciences, and *Academies* for Exercises, and in Conclusion, of *Sea-Ports*; and after occasionally discourses at large upon Musick, because, speaking of Theatres, he gives an account how the Ancient Architects, were in some places of the Theatre wont to place Vessels of Brass to serve for several sorts of tunable Echo's, and augmenting the Voice of the Comedians.

In the Sixth he teaches what were the Proportions and Forms of private Houses among the Greeks and Romans, as well in the City as Country; and describes all the parts of the House, viz. the Courts, Porches, Halls, Dining Rooms, Chambers, Cabinets and Libraries.

In the Seventh he treats of the manner of making use of Mortar for Plaster and Floors; how Lime and the Powder of Marble ought to be prepared to make Stuck. He speaks likewise of the Ornaments that are common to all sorts of Buildings, as Painting; and all sorts of Colours, as well Natural as Artificial, that the Ancients made use of.

In the Eighth he speaks of Waters, and Rivers, and Fountains; viz. of their Springs, of their Nature, and Properties; how they are to be sought; and of the Conduits that are to bring them to Cities and Villages.

The Ninth is wholly Gnomonical, and teaches the manner of making Sun-Dials, and gives an account of the Rules of Geometry, how to measure solid Bodies. He discourses at large of the Course of the Stars, and the particular Description of those that are called Fixed Stars.

The Last is taken up wholly in the Description of making Machines to lift up great Weights, and others for several uses; viz. for the Elevation of Water for Corn-Mills, Water-Organs and Measuring the Way as well by Sea as by Land; but it chiefly treats of Machines fit for the use of Building and War.



# PART I

## *Of Architecture that is common to us with the Ancients*

### CHAP. 1

#### *Of Architecture in General*

#### ARTICLE I

#### Of the Original of Architecture

*Lib. 2.*

*Chap. 1.* IT's related by Historians, That Men, who in former times inhabited Woods and Caverns like wild Beasts, first assembled themselves to make Houses and Cities, which was occasioned by a Forest that was set on fire, which drew all the Inhabitants together by its novelty and surprizing effects; so that many Men meeting together in the same place, they found out means, by helping one another, to harbour themselves more conveniently, than in Caves and under Trees; so that it is pretended, that Architecture was the Beginning and Original of all other Arts. For Men seeing that they had success in Building, which necessity made them invent, they had the Thoughts and Courage of seeking out other Arts, and applying themselves to them.

Now even as they took Trees, Rocks and other Things that Nature her self furnished Beasts to harbour themselves under, which were made use of as Models for the first Houses, which at first were only made of green Turf and broken Branches of Trees, they made use of them afterwards, in the same manner, to arrive at something more perfect. For passing from the Imitation of the Natural to *Lib. 4.*

*Chap. 2.* that of Artificial, they invented all the Ornaments of Edifices that were most curiously wrought, in giving them the Form and Shape of those things that are simply necessary to the most natural Buildings: And the Pieces of Timber of which the Roofs and Floors of Houses are made, were the Original of *Pillars, Architraves, Frises, Triglyphs, Mutils, Brackets, Corniches, Frontons* or *Piediments*, which are made of Stone or Marble.

The *Pillars* which are to be smaller at top than at bottom, were made in Imitation of the Boles or Trunks of Trees, and their use was taken from the Carpenters' Posts that are made to support the Building. The *Architraves* which are laid across many *Pillars*, represent *Summers* that join many *Posts* together. The *Frises* imitate the *Muring* that is raised upon the *Summers* betwixt the ends of the Beams that are laid directly upon the *Pillars*. The *Triglyphs* represent the Ceiling or Joyner's work which was made upon the ends of the Beams to conserve them. The *Corniches* are as it were the extream parts of the *Joists*. The *Modillions* represent the ends of the *Sheers*, and the *Dentels* represent the ends of the principal *Rafter*. The *Frontons* are made in imitation of the *Firms* or *Girders*, upon which is laid the Roof of the House.

There is likewise another Original of Architecture, which is taken from the Inventers of the several Orders, and those that added the Ornaments to embellish them. For it's the common *Lib. 4.*

*Chap. 2.* Opinion, that the first Fabrick that was made, according to any of the Orders, was the Temple that King *Dorus* built in Honour of *Juno* in the City *Argos*. And it obtained the name of

the *Dorick* Order, when *Ion* the Conductor of a Colony, which he established in *Asia*, made many Temples be built according to the Model of the Temple built by *Dorus* in *Greece*.

But the *Ionians* having changed some of the Proportions and Ornaments of the *Dorick* Order, were the Authors of another Order, which was called the *Ionick*, according to which, they built a Temple in Honour of *Diana*. The reason of this change was, that this Temple being dedicated to a Divinity, which they represented under the Shape of a Young Lady, they thought it was proper to make their Pillars more tapering, the better to represent the airy Stature of this Goddess, and for this reason they adorned it more delicately, adding Bases which represent the Buskin'd Ornaments of the Legs and Feet, according to the Mode of that time; and Made the *Channellings* deeper to represent the Foldings and Plaits of a fine light Garment. They put likewise *Volutes* or *Scrowls* upon the *Capital*, pretending that they imitated the Head-Dress of a Young Lady, whose Hair Beautifully descending from the top of her Head, was folded up under each Ear.

Afterwards *Calimachus* an *Athenian*, embellished the Capitals of the Pillars, adding to them more Beautiful *Volutes* or *Scrowls*, and more in number, enriching them with the Leaves of *Brank Ursine* and *Roses*. It's said, That this Capital, which, according to *Vitruvius*, makes all the Distinction betwixt the *Corinthian* and *Ionick* Order, was invented by this ingenious Artisan upon this occasion. Having seen the Leaves of the above-mentioned Plant grow round about a Basket which was set upon the Tomb of a Young *Corinthian* Lady, and which, as it happened, was set upon the middle of the Plant. He represented the Basket by the *Tambour* or *Vase* of the Capital, to which he made an *Abacus* to imitate the Tile with which the Basket was covered, and that he represented the Stalks of the Herb by the *Volutes* or *Scrowls*, which were ever after placed upon the *Corinthian* Capital. See Table the IXth.

This great Artist likewise invented other Ornaments, as those we call *Eggs*, because of the *Ovals* in the *Relief* which are in the Mouldings of the *Corniches* and are like *Eggs*. The Ancients called this Ornament *Echinus*, which signifies the sharp prickly shell of Chestnuts, because they found these Ovals represented a Chestnut half open, as it is when it's ripe.

*Lib. 3.*

*Chap. 2.* He likewise makes mention of another Famous Author, who found out the proportion of all the Parts of a Fabrick, which was *Hermogenes*; to whom he attributes the Invention of the *Eustyle*, *Pseudodiptere*, and of all that is beautiful and excellent in Architecture.

## ART. II

### What Architecture is

ARchitecture is a Science which ought to be accompanied with the Knowledge of a great many other Arts and Sciences, by which means *Lib. 1.*

*Chap. 1.* it forms a correct Judgment of all the Works of other Arts that appertain to it. This Science is acquired by *Theory* and *Practice*. The *Theory* of *Architecture* is that Knowledge of this Art which is acquired by study, travelling and discourse. The *Practick* is that knowledge that is acquired by the Actual Building of great Fabricks. These Two Parts are so necessary, that never any came to any great Perfection without them both. The one being lame and imperfect without the other, so they must walk hand in hand.

Besides, the Knowledge of things that particularly belong to Architecture, there are infinite other things that are necessary to be known by an Architect.

For, First, it's necessary that he be able to couch in writing his intended Building, and to design the Plan, and make an excellent Model of it.

Geometry likewise is very necessary for him in many occasions.

He must also know Arithmetick to make a true Calculation.

He must be knowing in History, and be able to give a reason for the greatest part of the Ornaments of Architecture which are founded upon History. For Example, if instead of Pillars he support the Floors of the House with the figures of Women, which are called *Cariatides*, he ought to know that the *Greeks* invented these Figures to let Posterity know the Victories they obtained over the *Cariens*, whose Wives they made Captives, and put their Images in their Buildings.

It's necessary likewise, that he be instructed in the Precepts of Moral Philosophy; for he ought to have a great Soul, and be bold without Arrogance, just, faithful, and totally exempt from Avarice.

The Architect also ought to have *Lib. 1.*

*Chap. 11.* a great Docility which may hinder him from neglecting the advice that is given him, not only by the meanest Artist, but also by those that understand nothing of Architecture; for not only Architects, but all the World must judge of his Works.

*Lib. 1.*

*Chap. 2.* Natural Philosophy is likewise necessary for him for to discover what are the Causes of many things which he must put a remedy to.

He ought also to know something of *Physick*, to know the qualities of the Air, which makes Places Healthful and Habitable, or the quite contrary.

He should not be ignorant of the Laws and the Customs of Places for the Building of Partition Walls, for prospect and for the conveying of Waters and Sewers.

He ought to know *Astronomy*, that he may be able to make all sorts of Dials.

It was necessary among the Ancients, that an Architect should have skill in *Musick* to make and order *Catapults* and other Machines of War, which were strung with strings made of Guts, whose sound they were to observe, that they might judge of the strength and stiffness of the Beams which were bended with those Strings. *Musick* was also necessary in those days for the placing musically Vessels of Brass in the Theatres, as we have said before.

## ART. III

### What are the Parts of Architecture

There are Three Things which ought to meet in every Fabrick, *viz. Solidity, Convenience and Beauty*, which Architecture gives them; by the due ordering and disposition of all the Parts that compose the Edifice, and which she rules by a just Proportion, having regard to a true *Decorum*, and well regulated *Oeconomy*; from whence it follows, that Architecture has Eight Parts, *viz. Solidity, Convenience, Beauty, Order, Disposition, Decorum, Oeconomy.*

*Solidity* depends upon the goodness of the Foundation, choice of Materials, and the right use of them; which ought to be with a due order, disposition and convenient Proportion of all Parts together, and of one in respect of another.

*Convenience* likewise consists in the ordering and disposition, which is so good that nothing hinders the use of any part of the Edifice.

*Beauty* consists in the excellent and agreeable form, and the just proportion of all its parts.

*Order* is that which makes, that all the parts of an Edifice have a convenient bigness, whether we consider them apart or with Relation to the whole.

*Disposition* is the orderly Ranging and agreeable Union of all the parts that compose the Work; so that as Order respects the Greatness, Disposition respects Form and Situation, which are Two Things compriz'd under the word *Quality*, which *Vitruvius* attributes to Disposition, and opposes to Quantity, which appertains to Order. There are three ways by which the Architect may take a

view beforehand of the Fabrick he is to build, viz. First, *Ichnography*, which is the *Geometrical Plan*; *Orthography*, which is the *Geometrical Elevation*, and *Scenography*, which is *Perspective Elevation*.

*Proportion*, which is also call'd *Eurythmy*, is that which makes the Union of all parts of the Work, and which renders the Prospect agreeable, when the Height answers the Breadth, and the Breadth the Length; every one having its just measure. It is defin'd, the Relation that all the Work has with its Parts, and which every one of them has separately to the Idea of the whole, according to the measure of any Part. For as in Humane Bodies there is a Relation between the Foot, Hand, Finger and other Parts; so amongst Works that are Perfect, from any particular Part, we may make a certain Judgment of the Greatness of the whole Work: For Example, the Diameter of a Pillar, or the Length of a *Triglyph*, creates in us a right Judgment of the Greatness of the whole Temple.

And here we must remark, that to express the Relation that many things have one to another, as to their Greatness or different Number of Parts, *Vitruvius* indifferently makes use of three words, which are *Proportion*, *Eurythmy* and *Symmetry*. But we have thought it proper only to make use of the word *Proportion*, because *Eurythmy* is a Greek word, which signifies nothing else but *Proportion*; and *Symmetry*, although a word commonly used, does not signifie in the Vulgar Languages what *Vitruvius* understands by *Proportion*; for he understands by *Proportion*, a Relation according to Reason; and *Symmetry*, in the vulgar Languages, signifies only, a Relation of Parity and Equality. For the word *Simmetria* signifies in Latin and Greek *Relation* only. As for Example, as the Relation that Windows of Eight Foot high, have with other Windows of Six Foot, when the one are Four Foot broad, and the other Three: and *Symmetry*, in the Vulgar Languages, signifies the Relation, for Example, That Windows have one to another, when they are all of an equal height and equal breadth; and that their Number and Distances are equal to the Right and the Left; so that if the distances be unequal of one side, the like inequality is to be found in the other.

*Decorum* or *Decency*, is that which makes the Aspect of the Fabrick so correct, that there is nothing that is not approv'd of, and founded upon some Authority. It teaches us to have regard to three things, which are, *Design*, *Custom* and *Nature*.

The Regard to *Design* makes us chuse for Example, other Dispositions and Properties for a Palace than for a Church.

The Respect we have to *Custom*, is the Reason, for Example, That the Porches and Entries of Houses are adorned, when the Inner Parts are Rich and Magnificent.

The Regard we have to the Nature of Places, makes us chuse different Prospects for different Parts of the Fabrick, to make them the wholsomer and the more convenient: For Example, the Bed-Chambers and the Libraries are exposed to the Morning Sun; the Winter Apartments, to the West; the Closets or Pictures and other Curiosities, which should always have equal Light, to the North.

*Oeconomy* teaches the Architect to have regard to the Expences that are to be made, and to the Quality of the Materials, near the Places where he Builds, and to take his Measures rightly for the Order and Disposition; viz. to give the Fabrick a convenient Form and Magnitude.

These Eight Parts, as we have said, have a Relation to the Three first, viz. *Solidity*, *Convenience*, *Beauty*, which suppose, *Order*, *Disposition*, *Proportion*, *Decorum* and *Oeconomy*. This is the reason that we divide this first Part only into Three Chapters; the first is of the *Solidity*; the second of the *Convenience*; the third of the *Beauty* of the Fabrick.

## CHAP. II

### *Of the Solidity of Buildings*

#### ARTICLE I

##### Of the Choice of Materials

THE Materials of which *Vitruvius* speaks are, Stone, Brick, Wood, Lime, and Sand.

All the Stones are not of one sort, for some are soft, some harder, and some extreemly hard.

Those that are not hard are easily cut, and are good for the Inner Parts of the Buildings, where they are cover'd from Rain and Frost which brings them to Powder, and if they be made use of in Buildings near the Sea, the Salt Particles of the Air and Heat destroys them.

Those that are indifferently hard, are fit to bear Weight; but there are some sorts of them, that easily crack with the heat of the Fire.

There is likewise another sort of Stone, which is a kind of Free-Stone; some are Red, some Black, and some White, which are as easily cut with a Saw as Wood.

The best Bricks are those which are only dry'd and not baked in the Fire; but there are many Years required to dry them well: and for this Reason, at *Utica*, a City of *Africa*, they made a Law, That none should make use of Bricks which had not been made five Years: For these sort of Bricks, so dry'd, had their Pores so close in their Superficies, that they would swim upon Water like a Pumice-Stone; and they had a particular Lightness, which made them very fit for all sorts of Buildings.

The Earth of which these Bricks were usually made was very Fat, and a sort of White Chalky Clay without Gravel or Sand, which made them Lighter and more Durable; they mixed Straw with them to make them better bound and firmer.

The Woods which were made use of in all Buildings, are Oak, Poplar, Beech, Elm, Cypress, Firr; but some of them are not so proper for Building as others.

The Firr, because it has great plenty of Air, and Fire, and but little Earth and Water, is light, and does not easily bend; but is very subject to Worms and Fire.

The Oak which is more Earthy lasts for ever under Ground; but above Ground is apt to cleave.

The Beech which has little of Earthiness, Humidity and Fire, but great plenty of Air, is not very solid and easily breaks.

The Poplar and the Linden Trees are only good for light Work, they are easily cut and so finest for Carving.

The Alder is good to make Piles of in Marshy Places.

The Elm and the Ash have this property, that they do not easily cleave, and that they are pliable.

The Yoke-Elm is likewise pliable, and yet very strong; this is the Reason that they made Yokes for their Oxen of them in Old Time.

The Pine and the Cypress have this defect, that they easily bend under any Weight, because of their great Humidity; but they have this Advantage, that their Humidity does not engender Worms, because of their Bitterness which kills them.

The Juniper and the Cedar have the same Vertue of hindering Corruption: the Juniper by its Gum, which is call'd *Sandarax*, and the Cedar by its Oil call'd *Cedrium*.

The Larch-Tree has likewise the same Vertue, but its particular property is, that it will not burn. There is a remarkable Story of this Wood, which is, That when *Julius Cæsar* besieg'd a Castle at the Foot of the *Alpes*, there was a Tower built of this Wood, which prov'd the Principal Defence of the

Place. He thought to take it easily by making a great Fire at the Foot of the Tower, but for all this great Fire, the Tower did not suffer the least Damage.

The Olive-Tree is likewise very serviceable, if it be put in the Foundations, and Walls of Cities; for after it has been singed a little, and interlaced among the Stones, it lasts for ever, and is out of all danger of Corruption.

Lime is made of White Stones or Flinty Pebbles, the harder the Stones are which 'tis made of, the better it is for Building. That which is made of soft Spongy Stones, is proper for Plastring.

There are five sorts of Sand; *viz.* Sand that is dug out of the Ground, River Sand, Gravel, Sea-Sand, and Pozzolana, which is a Sand peculiar to some Parts of *Italy*.

The best Sand is that which being rubb'd between the Hands makes a little Noise, which that Sand does not, which is Earthy, because it is not rough. Another Mark of good Sand is, that when 'tis put upon any Thing that is White and shak'd off, it leaves no Mark behind.

The Sand which is dug out of the Earth has all these Qualities, and is esteem'd the best. *Vitruvius* makes four sorts of it; *viz.* White, Black, Red, and Bright like a Carbuncle.

If it happen that there be no good Place to dig Sand in, we may make use of Sea-Sand, or River-Sand, which is likewise better for Plastering than the Sand which is digged, which is excellent for Building, because it dries quickly. Gravel likewise is very good, provided the grosser Parts be taken away. Sea-Sand is worst of all, because 'tis long adrying; and for this Reason, where 'tis made use of in Building, they are forc'd to desist sometimes till it dry.

The Sand which is found near *Naples* call'd *Pozzolana* is so proper to make good Mortar, if it be mixed with Lime, that not only in the ordinary Fabricks, but even in the very bottom of the Sea it grows into a wonderful hard Body. In Old Times they made use of it for Moles or Ports of the Sea, for after having made with Piles and Boards a Partition, they fill'd up the whole Compass of the Partition with this Mortar, which dry'd of it self in the middle of the Water and became a solid Body.

## ART. II

### Of the Use of the Materials

THE first thing we should have a Care of before we begin to build, is, to have the Stones dug out of the Quarry before they be used, and to expose them in some open Place, to the end that those which are endamaged by the Air, during this Time, may be put in the Foundation, and those that prove Durable and Good may be kept for the Walls above Ground.

We must likewise have a great care of the Wood which we make use of; That it be cut in a seasonable Time, which is in Autumn and Winter; for then it is not full of that superfluous Humidity which weakened it in dilating its Fibers, but it is firm and well closed by the Cold. This is so true, that the Wood of Trees which grow and become very great in a little Time, by reason of their great Humidity, is tender and apt to break, and very unfit for Building Which Experience shows us particularly in those Firrs call'd *Supernates*, which grow in *Italy*, on that side the *Apennine*, towards the *Adriatick*-Sea, for they are great and beautiful, but their Wood is not good for Building; whereas those on the other side of the Mountain, which are exposed to Heat and Dryness, call'd *Infernates*, are very good for Building.

This superfluous Humidity endamages Trees so much, that we are sometimes constrain'd to make a hole at the foot of the Tree and let it run out, which is the occasion of the Practice which is observ'd in cutting of Wood for Building, to Tap that Tree at the Foot, cutting not only the Bark, but even some part of the Wood it self, and so leave it for some time before it be Fell'd.

It is likewise easie to judge of what great Importance the draining of this superfluous Humidity is for strengthening *Lib. 1.*



*Chap. 5.* the Timber, and hindring Corruption, from this, That those Piles which are interlaced among the Stones in the Walls and Fortifications of Towns endure for ever without Corrupting, when they have been burnt a little on the outside.

*Lib. 1.*

*Chap. 11.*

*Lib. 2.*

*Chap. 8.* Bricks ought not to be made use of but in very thick Walls; for this reason they did not build with Brick in *Rome*, for to save Ground; they were not permitted to make the Walls of their Houses above a Foot and a Half thick, which Makes about 16 Inches and a half of our Foot.

They likewise never made the top of their Walls with Brick; for the Brick of the Ancients not being baked, this part of the Wall would have been easily endamaged; for this reason they built it with Tiles, a foot and a half high, comprizing the Cornish or Entablature which was made likewise of Tiles to cast off the Water and defend the rest of the Wall. They likewise chose for these Cornishes the best Tiles, viz. those that had been long on the top of the Houses, and given sufficient Proof that they were well baked and made of good Matter.

The Walling with Brick was so much esteem'd among the Ancients, that all their Fabricks, as well publick as private, and their most beautiful Palaces were built with them. But that which principally made this sort of Building be esteem'd, was its great Duration; for when expert Architects were called to make an Estimate of Buildings, they always deducted an 80th. part of what they judged the Building cost for every Year that the Wall had been standing, for they supposed that the Walls could not ordinarily endure more than Fourscore Years; but when they valued Buildings of Brick, they always valued them at what they cost at first, supposing them to be of an Eternal Duration.

To make the right use of Lime and Sand, and to make good Mortar of them, it is necessary that the Lime be first well Quench'd, and that it be kept a long time, to the end that if there be any Piece of it that is not well burnt in the Kiln, it may, being extinguished at leasure, soften as well as the rest. This is of Great Importance particularly in Plastering and Works of *Stuck*, which is a Composition of Marble finely beaten with Lime. For if any little Pieces remain that are not well baked, when they come to be made use of, they crack and break the Work.

The way to know whether the Lime be well Quench'd, is thus: You *Lib. 7.*

*Chap. 3.* may thrust a Chip of Wood into it or a Knife, and if the Chip of Wood meet with any Stones, or that the Knife comes out clean without any sticking to it, it signifies the Lime was not well burnt; for when 'tis well Quench'd, it is Fat and will stick to the Knife; but the quite contrary happens to Mortar, for it is neither well prepar'd, nor well mix'd, if it stick to the Trowel.

For to make the right use of *Lib. 2.*

*Chap. 4.* Sand, you must first consider what it is to be employ'd in; for if it be Mortar for Plastering, you must not make use of Sand that was lately dug out, for it dries the Mortar too fast, which cracks the Plastering; but quite contrary if it be to be employ'd in Masonry, it must not have been a long time expos'd to the Air, for the Sun and the Moon do so alter it, that the Rain dissolves it, and turns it almost all into Earth.

*Lib. 2.*

*Chap. 5.* The Proportion that Sand and Lime ought to have to make good Mortar, should be three parts of Sand that is dug, or two parts of River-Sand or Sea-Sand against one of Lime, and 'twill be yet much better, if you add to the Sand of the Sea and the River a third part of Tiles well beaten.

*Lib. 7.*

*Chap. 3.* One of the Principal Things that is to be observ'd in making Mortar, is, to mix it well. The Grecian Workmen were so careful of this, that they Tewed it a great while, putting Ten Men to every Vessel wherein they wrought it, which gave so great a hardness to the Mortar, that when any big pieces of Plaster fell off the Old Walls, they made Tables of it.

## ART. III

### Of the Foundation

*Lib. 6.*

*Chap. 11.* THE Foundation is the most important part of the Fabrick; for the Faults committed in it cannot be so easily remedied as in other parts.

To lay the Foundation well, you *Lib. 1.*

*Chap. 5.* must dig till you come to solid Ground, and even into the solid as much as is necessary to support the Weight of the Walls; it must be larger below than above the Superficies of the Earth.

*Lib. 3.*

*Chap. 3.* When you have found firm Earth to make it more solid, you must beat it with a Rammer; but if you cannot arrive at solid Earth, but find it still soft and spongy, you must dig as far as you can, and drive in Piles of Alder, Olive, or Oak, a little singed, near together, and fill up the void Places between the Piles with Coal.

*Lib. 1.*

*Chap. 5.* In short, you must make all Masonry with the most solid Stone that can be found for this use.

To make the Binding of the Stones the stronger in the Foundation of great Fabricks, you must put Piles of Olive a little singed and placed very thick from one Parement or Course to another, which serves, as it were, for Keys and Braces; for this Wood so prepar'd, is not subject to Worms, and will endure for ever, either in the Earth or in the Water, without the least Damage.

*Lib. 6.*

*Chap. 11.* When you would make Cellars, the Foundations must be much larger; for the Wall that is to support the Earth requires a greater thickness to resist the strong Efforts that the Earth makes against it in Winter, at which time it swells and becomes more heavy by reason of the Water it has drunk up.

## ART. IV

### Of the Walls

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