

## OVERVIEW OF STRUCTURAL ENGINEERING EDUCATION REQUIRED FOR THE UNDERSTANDING OF VITRUVIUS'S TEN BOOKS ON ARCHITECTURE

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### Abstract

The contents of many books, *prima facie*, can be known by their title. But within the context of the present day grammatical construction and images formed in the mind through some words, Vitruvius's "Ten Books on Architecture", written in 1<sup>st</sup> century, does not fall into this category. Apparently, the over 2000 year's gap in knowledge and usage of precepts as well as educational attainment that formed the basis for the writing constituted unfamiliar background and terrain for the 21<sup>st</sup> century researchers and academia. Consequently many civil engineering developmental resources for research activities contained in the book, especially on concrete and structural materials, remain hidden from many researchers. The purpose of this work is to identify the depths of instructional and educational attainment, both in learning and practice that formed the background for writing and thus, for the understanding of the book, especially for engineers in the developing Nations. To accomplish this work, the Roman society of the time and her educational systems were studied from materials available from the public domain. Analysis of the materials obtained showed that a wide-range and multi-faceted education through learning and practice, were required to operate in the construction industry at the time; and that all construction work, including military and machine construction were termed Architecture and under the control of the Head of the Government. It is also concluded that this learning, now parceled into different disciplines, is available in the public domain for the understanding and application of precepts in the Ten Books on Architecture for a robust structural and civil engineering practice

*Keywords:* Architecture, civil engineering, construction, education, structural materials .

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## 1.0 INTRODUCTION

The translation of the "Ten Books on Architecture" written by a Roman military engineer Vitruvius (1914), is not a familiar book to be encountered amongst civil and structural engineers both in the academia and in the industry. The title of the book, within the context of present day grammatical construction, obviously connotes something else in content and practice. But buried inside this book are treasures of resources for civil and structural engineering profession both in the academia and in the industry as it is practiced in the present day. Of particular importance are resources contained in the book that are very useful for researchers in the areas of civil and structural engineering materials. Yet these resources remain hidden, especially to the developing nations who are without contact with classical studies that exist in Greco-Roman society. Even among the profession that bears the name Architecture in the modern day practice, the topics covered by Vitruvius in this book such as Law, Philosophy, Astronomy, exploration for water, construction of machines, etc. are completely foreign (Erismis and Gezerman, 2013; Fehskens, 2015 and Bosman, 2015). Very little literature, if any at all, can be found in the

field of structural and civil engineering with reference to the "Ten Books on Architecture". Apart from the title which, "*prima facie*", was earlier pointed out as suggesting something else, the whole gamut of instructional background and wide-ranging practice the needed and required for understanding of the book may be lacking. Moreover, some professional practice and areas of learning like Astronomy, Quantity Surveying, Mechanical engineering, amongst others, which formed an integral part of the book have now been re-classified into separate and independent professions in the 21<sup>st</sup> century. It is against this background that some authors concluded that the book and the author never existed (Erismis and Gezerman, 2013). It can be said that the Ten Books on Architecture, in relation to the 21<sup>st</sup> century, is neither a book of architecture nor a book of civil engineering; but without any iota of doubt, it is much wider in depth and scope than both of them. For example, making of machines and construction equipment are not the subject of the present day Civil engineering curriculum. This is because the book was not written out of a vacuum, but from a society, and thus, one should belong to this society for the required mind-set of the author. The mind that seemed to be a reservoir of accumulated multi-faceted learning and skills,

in myriads of construction in many situations and circumstances. These branches of learning and skills are now available in the public domain, but scattered and fragmented. In the developing Nations in particular, these resources are rarely presented despite the fact that they are foundational to the civil and structural engineering feats being witnessed in the developed Nations. Thus the aim of the present work is to bring these information together as much as possible. This is with a view to direct the hearts and mind of civil and structural engineers most especially in the developing Nations to a neglected source of engineering resources, and thus acquire the required background and the knowledge for robust engineering practice. It is also expected that the mind-set necessary to understand and unlock treasures of civil and structural engineering resources embedded in the “Ten Book of Architecture” for the benefit of the present generation will be activated.

## 2 0 METHODOLOGY

The approach adopted for this work consisted of two stages. The first stage involved the collection of materials in form of translated Books that originated from three strategic personalities identified in the book. These materials are “The Gallic Wars” by Caesar (2016), “The Deeds of Divine Augustus” by Augustus (2021) and “The Ten Books on Architecture” by Vitruvius (1914). The second stage involved collection of materials in the form of translation of books written by some notable people (Livy, 1905; Tacitus, 2021, Seutonious, 2021 and Josephus, 2021) in that period of time. Also, at the second stage, the research works of present day scholars and organizations documentation on the “Ten Books on Architecture” (Erismis and Gezerman, 2013; Fehskens, 2015, Bosman, 2015, and Houston, 2016) were studied. All these materials were studied as a whole in an attempt to have an

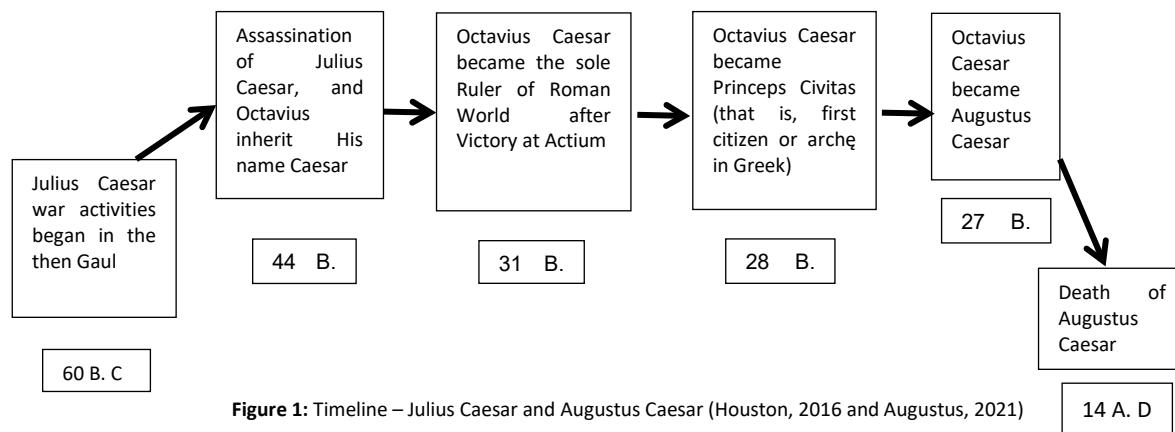


Figure 1: Timeline – Julius Caesar and Augustus Caesar (Houston, 2016 and Augustus, 2021)

But Vitruvius wrote specifically for Augustus Caesar, who was still very active in the construction of many public projects as at 2 BC when he was given the title of the “Father of His Country” (Houston, 2016 and Augustus, 2021). To Augustus Caesar, Vitruvius [1] wrote in the introduction of the Book.

*“ . . . I began to write this work for you, because I saw that you have built and are now building extensively, and that in*

insight into some concepts used in the Book as well as understanding the image formed in the minds when some words are used. In order to established the background required to appreciate the book, the materials were analyzed and divided around themes such as: the time frame for the writing of the book, the audience of the author, the educational requirement at the time, the person of Vitruvius the author, the meaning and scope of the architecture profession at the time, and the author’s treatment of concrete and structural materials. At the time under consideration, architecture and civil engineering meant the same thing and thus were used interchangeably (Milliken, 1958). The emphasis in this discussion is within the context of civil and structural engineering.

## 3 0 RESULTS AND DISCUSSION

### 3.1 The Historical Time Frame for the Writing of the Book

The historical time frame and understanding the Roman political attainment within the context of whole known civilized world, which formed the background for the writing of the Book, are an important aid to the understanding of Vitruvius’s mind. By studying the time frame of the activities of two key figures mentioned in the book will help in this direction. These figures were Julius Caesar and his son, Augustus Caesar, who both were Emperors of the city of Rome; nay the head of the human civilization at the time. Figure 1 is a brief attempt to re-construct the time frame of the activities of these two men using the materials in Houston (2016) and Augustus (2021). From Figure 1, from elementary arithmetic, the time frame of the materials accumulation obtained through learning and practice; that was used in the composition of the book spanned 74 years.

*future also you will take care that our public and private buildings shall be worthy to go down to posterity by the side of your other splendid achievements”*

The translation of the “Deeds of Divine Augustus” written by Augustus (2021) around 2 BC was a compendium of extensive public building and utilitarian works that Vitruvius was probably referring to in the quoted passage above. It can thus be

reasonably said that Vitruvius wrote this book after 2 B.C. That is, the issue under the present discussion is about a book written over 2000 years ago. Consequently, the 2000 years gap in knowledge and precepts ought to be bridged in order to acquire the right mind-set for its understanding and application of the precepts contained in the book. The tools for bridging this gap are now available in the public domain, especially internet archival sources. Notable among them the works of Oleson, 2004; Thiemann et al., 2010; Strickland, 2010; Newman and Vassigh (2014); Grůňová and Holešová, 2018; Schulzová, and Bošová (2019) and Ghazvini, 2020.

### 3.2 The Person and Status for whom the Book was meant

A study of the introduction of the book showed that the book was not meant for general public at the time it was written. Neither was the book meant for ordinary person, but for a particular person with a unique status. This person was Augustus Caesar, who was not only the Emperor of Rome at the time, but also the Head of Universal government at the time. Available records showed that he was the ruler over the civilized world at the time (Struckland, 2010; Houston, 2016 and Augustus, 2021). He succeeded his father as the Head of the Government, Julius Caesar (as shown in Figure 1) The reasons he wrote the book to him were stated in the introductory section of the Book. In a passage, Vitruvius (1914) said:

*“Owing to this favour I need have no fear of want to the end of my life, and being thus laid under obligation I began to write this work for you, because I saw that you have built and are now building extensively, and that in future also you will take care that our public and private buildings shall be worthy to go down to posterity by the side of your other splendid achievements. I have drawn up definite rules to enable you, by observing them, to have personal knowledge of the quality both of existing buildings and of those which are yet to be constructed”.*

From this passage, it can be observed that he wrote the book to the Head of the Government, so that he can have a definite rule of ascertaining knowledge of the quality of existing public and utility buildings and also knowledge of the expected quality of public and utility buildings that are to be constructed. At the time, the Head of the Government, a Republican one, was called “arche” in the classical Greek of the time. This word means the Prince or the Government Personified. This is the first of the two words, according to [Chambers, 1983 and Janetius, 2020), that were combined to form the word “architecture” as in equation 1

$$\text{arche} + \text{tekton} = \text{architecture} \quad (1)$$

The second word, “tekton” simply means to build, or to construct and will be described shortly. It will be seen shortly,

that in the period under consideration, over 90% of the volumes of construction were undertaken by the Head of the Government on behalf of the people. This can be seen in Table 3. It must be noted at this point that Government at the time was run by victorious military commanders, an experience that he was to put in practice while running the Government. From Table 3, it is obvious that the architecture or civil engineering being described by Vitruvius had military undertone. That however does not mean that one has to be a military general to understand the book. Rather it is to be viewed as being a military general in a philosophical contest this time around. This is because philosophers sometimes described their conflict with wicked ideas as wrestling as in an athletic contest or a war (Keener, 1993). For this contest, they also used lists of virtues, not fists or missiles or any violent means (Keener, 1993). It can be seen Table 3 in section 3.3 that philosophy was part of the curriculum for the studies of architecture at the time. Thus, an academic in our time, who have earned a Doctor of Philosophy (PhD) or working towards it is expected to, during his course in life, confront and overcome wicked ideas that opposed to the principle of common good. Common good, it has been established to be the end of philosophical discourse (Simm, 2011 and Hussain, 2018). Such a moral contest was played out lately in the circumstances surrounding the collapse of 21 storeys building in Nigeria, in which over 50 people, including the owner died (Adelagun, 2021). The engineer withdrew his services through a written document several months before the building collapsed, when he observed non-compliance with safety rules (Adewole, 2021 and Olawale, 2021). The withdrawal ought to be seen as the results of internal moral conflict or struggle involving the sacrifice of his personal relationship and possible loss of income as well as risk of forfeiting future patronages for the larger interest of the society as it concerns common good, which this time, is the public safety (Simm, 2011 and Hussain, 2018). Thus the attitude of not compromising the common societal good for personal rewards either in cash or kind is what is required in our time, to understand and apply the precepts set forth by Vitruvius’s in his Ten Books on Architecture.

### 3.3 The Required Education Of The Time

Another important useful tool necessary to understand Vitruvius’s book on Architecture is the knowledge of educational training at the time. The expected curriculum content up to High School level as described by (Milliken, 1958) is as shown in Table 1. From Table 1, it can be observed that what was then known as Architecture or Civil engineering was studied in High School. However, the detailed curriculum for this type of Civil Engineering of the time, according to Vitruvius (1914) is presented in Table 2 (Fapohunda, 2021). Careful observation of Table 2 clearly shows a build-up on Table 1. For example, music, geometry, astronomy, medicine, and architecture are in both Tables.

**Table 1:** Expected Syllabus content up to High School (Milliken, 1958)

S/no	Stages	Some of the content of the Syllabus
1	Early years Home training (less than 7 years old)	<ul style="list-style-type: none"> <li>• Teachings in               <ul style="list-style-type: none"> <li>- Discreet behaviour</li> <li>- Modesty in speech</li> <li>- To show respect in behaviour</li> <li>- To show respect for Roman Law, summarized as “ to live honestly, to injure no one and to give everyone his due”</li> </ul> </li> </ul>
2	Elementary school (7 – 12 years old)	<ul style="list-style-type: none"> <li>• Great attention paid to reading and writing in Latin and Greek</li> <li>• Arithmetic</li> <li>• Training of memory through learning by heart Greek and Latin prose and poetry</li> </ul>
3	High school (12 – 19 years old)	<ul style="list-style-type: none"> <li>• Grammar (in Greek and Latin)</li> <li>• Dialectic (the art critical enquiry by discussion)</li> <li>• Geometry</li> <li>• Astronomy</li> <li>• Music</li> <li>• Medicine</li> <li>• Civil Engineering</li> <li>• Public speaking</li> </ul>

**Table 2:** Breakdown of the curriculum of Vitruvius’s Architect (Fapohunda, 2021)

S/no	Knowledge Required	Relevance to the Profession
1	Skillfulness with pencil	a) Necessary to be able to sketch the appearances of work being proposed
2	Knowledge of Geometry	a) Teaches the use of ruler and compass required for making plans of buildings on the ground. b) Enable the right application of square, the level instrument and the plummet c) The Optics in Geometry enable light to the building to be drawn from fixed quarters of the Heaven d) Arithmetical part of geometry enables the cost of the building to be calculated and measurement to be computed e) Geometrical theories and methods allow symmetrical problems to be solved
3	Knowledge of Political History	a) Necessary to be able to preserve or repair the society and her infrastructures
4	Knowledge of Philosophy	a) To make the Civil Engineer not to be self-assuming, but make him courteous, just, honest and without avariciousness. b) Civil Engineer have to be honest and incorruptible. c) To learn Physics and its fundamentals, which is taught under Philosophy so as to be able handle numerous construction works
5	Knowledge of Music	a) To give knowledge of canonical and mathematical theory b) To be able to tune ballistae, catapult and scorpions to proper key c) To be able to make water organs and objects which resemble them
6	Knowledge of Medicine	a) To settle the issues of climate, air, healthiness or otherwise of sites and the use of different waters to ensure healthiness of dwellings
7	Know opinion of Jurists	a) So that in drawing up contracts, interests of both the employer and contractor are safely guarded. b) For the understanding of laws governing some elements of building, for example, drains, windows, water supplies, etc.
8	Knowledge of Astronomy	a) To locate East, West, South and North b) Knowledge of Constellations and Stars
9	Theory of Heavens	a) To locate equinox, solstice, course of stars and revolution of the firmament b) To be able to comprehend the Theory of Heavens c) To be able to construct machines and engines

The study of Roman law which started at the early years as can be observed in Table 1, has now grown up to be the study of Roman Jurisprudence in Table 2. The medium of instruction was in Latin and Greek language. Thus, the working knowledge of Latin and Greek language are imperative if one is to make something out of the reading of Vitruvius, and indeed for a robust practice of structural engineering as previously observed Statesmen, Astronomy, Music etc. are necessary for appreciation of the Ten Books on Architecture. According to Fapohunda et al. (2017), all these developmental resources are preserved in either Latin or Greek, thus underscoring the

by Fapohunda et al. (2017). It is also obvious that instructional course of study, involving the elements in Table 1 and 2 are necessary for the understanding and application of the contents of the Ten Books on Architecture. A very broad and deep instructional background obtained through leaning and practice in many branches of studies like Law, Medicine, Geography, Philosophy, Governmental history, Theology of importance of the working knowledge of Latin and Greek in the construction profession. Degrees in Civil/Structural engineering, without the working knowledge of Latin and Greek languages is just like scratching the surface and will not be

sufficient to read the Ten Books on Architecture. A lifelong education in order disciplines, outside the contents of the conventional Civil engineering is required. The current information technology will make it possible. In the quest for professional development through continue professional education, as recommended by Engineering regulation bodies in many countries and the Book will be a good companion, a guide and a good reference material.

### 3.4 The Person of Vitruvius

That Vitruvius was a soldier, serving Julius Caesar and later his Son, Augustus Caesar is obvious from the preface to the book where he said:

*“... For in the first place it was this subject which made me known to your father, to whom I was devoted on account of his great qualities. After the council of heaven gave him a place in the dwellings of immortal life and transferred your father's power to your hands, my devotion continuing unchanged as I remembered him inclined me to support you”.*

This is to be expected. This is because all Romans sons at the time, on reaching the age of 19 years began military service (Milliken, 1958). And it is in the military service that practical construction skills are learnt for Roman soldier. He must be able to build trenches, roads and ramparts; lay out a camp or fortification, and learns how to lay out a plot and map out system of drains (Barrow, 1955). It is no wonder that civil engineering was part of the curriculum at the High School level

as can be observed in Table 1. Apart from being a soldier of an Emperor, Vitruvius was an erudite scholar and a man of universal learning, who is also closed to the royalty of many Kingdoms. He was also versed in the theological issues of the time. The scope of his educational background can be observed in Table 2. All these are reflected in the book. About seven Kings and their practices as well as their achievement were mentioned in the book. He also traversed the field of Philosophy discussing the findings of notable philosophers, from Socrates to Archimedes, totaling over seven. He was also generous to his fellow architects (that fits his description) by mentioning the works of very many of them. By virtue of familiarities with Gods and their things, Vitruvius can be rightly called a Priest in the modern day terminology, but more importantly a very saintly person, who believes that without honesty and incorruptibility, no work can be rightly done. If the “Ten Books on Architecture” is strange to us in the 21<sup>st</sup> century, it is because of the depth and width of the background required to make meaning out of the book, which are lacking in us. However, acquisition of this background is possible through the mass of information that is available in the public domain.

### 3.5 The Meaning and Scope of the Profession of Civil Engineering in the time of Vitruvius

Vitruvius (1914) gave a graphic description of what constituted Civil engineering in his time. According to him, Civil engineering consisted of three parts namely: (i) the art of Building (ii) making of time-pieces and (iii) construction of machinery. The constituents of each division are presented in Table 3 (NA in the Table means not available).

**Table 3:** What Architecture consisted of in the time of Vitruvius (1914)

S/No	Architecture	Types	Divisions	Descriptions
1	The art of Building	Construction of Fortified Towns Construction of Public buildings	NA Defensive Religious Utilitarian	NA Planning of Walls Towers Gates Devices for resisting hostile attacks Erection Fanes Erection of Temples to Immortal Gods Erection of meeting places for public use <ul style="list-style-type: none"> <li>• Harbour</li> <li>• Markets</li> <li>• Colonnades</li> <li>• Baths</li> <li>• Theatres</li> <li>• Promenade</li> </ul>
		Structures for private individual	In the city In the country side	NA NA NA
2	Making of time-pieces	NA	NA	NA
3	Construction of machinery	For military purpose For non-military purposes	NA NA	Catapults, ballistae, siege machines, tortoise, towers, amongst others Hoisting machines, engines for raising water, water wheels, water mills, water screws, pump, odometer, amongst others.

From the above Table 3, it seemed that civil engineering was the profession of practical construction and this construction revolved around military and defensive; religious and public utility buildings. Augustus Caesar Augustus (2021) listed the construction work he undertook to include amongst others: 82 temples of the Gods, Senate house, State box, Capitol, Theatres, Aqueducts, Forum, Bridges, and Towns in colonies. Going through these one by one will not only require a working knowledge of Latin and Greek languages, but also a lesson in the Roman political systems, which is not the aim of this work. However, looking at the political institutions of the United States of America, especially in Washington D.C. the capital, some words like Capitol, Senate, State box and Theatres, etc., can be understood, and the purpose for their construction becomes clearly evident. The emphasis on practical construction rather theories or designs as the defining parameter for an architect can be seen from the second word from which architecture was formed as shown in equation 1. The first word was earlier explained in section 3.2. However, the second one “tekon” simply means to build and he who builds as the builder. That is, actualization or construction of public and private structures, in visible and tangible terms. What can be built or constructed is very wide and open, from military to non-military utilities and equipment; from all manner of housings to towns; from bridges to waterways, and the list goes on. The list of what were constructed can be observed in Table 3. A much more detailed and comprehensive list of construction and building works could be seen in the works of Augustus (2021). From the root of the word “architecture”, as explain here, it is clear that Vitruvius was writing the book for August Caesar in his capacity as the “Prince-Builder” or “Government-Builder” or as the person in whom the Government at the time was personified (Houston, 2016). In the period under consideration, architect and engineer are used interchangeably (Milliken, 1958) because they mean the same thing in professional practice. Even in the present day, the American ACI (1994) used Architect and Engineer alternatively. Civil and Structural engineering activities through the construction of public works are to be encouraged in our days by all the levels of Government because public construction work is a major source of massive direct and indirect employment.

### 3.6 Vitruvius and Concrete and Structural Materials

Although most of the activities described in Table 3, called by Vitruvius (1914) as Architecture in the period under consideration, *prima facie*, fall within the domain of modern day civil and structural engineering practice, the areas of concern in this work is the concrete and structural materials aspect of the book. Although Vitruvius did not specifically use the word “structural materials”, nonetheless, the materials for construction at the time like wood, concrete, pozzolans, etc. are all considered to be structural materials in today’s theory and practice. This aspect though not covered in Table 3, just like many others that bother on theory and preparation to the practice of the art, are nonetheless embedded in the book, and should be of concern to researchers in concrete and structural materials. Vitruvius devoted the whole book two (containing 10 chapters) on what in today’s practice are essentially structural materials. Why is this to be considered significant? The answer is not far-fetched when viewed against the brevity

with which he discussed some issues, especially the functional requirements of a building. These are three Latin words namely *firmitas*, *utilitas*, *venustas*. Now when the present day Architects in the academia or the industry reviews or writes on the Ten Books on Architecture, it is usually within the context of these three (Oleson, 2004; Newman and Verssigh, 2014 and Taylor and Levine, 2021). The expressions that Vitruvius used to describe these three are presented in Table 4

**Table 4:** The functional requirements of Building

Terms	Some Translations	Description by Vitruvius
<i>Firmitas</i>	<ul style="list-style-type: none"> <li>Strength</li> <li>Durability</li> </ul>	Strength arises from carrying down the foundation to a good solid bottom and from making proper choice of materials without parsimony
<i>Utilitas</i>	<ul style="list-style-type: none"> <li>Utility,</li> <li>Convenience</li> </ul>	Utility arises from a judicial distribution of the parts , so that their purposes be duly answered, and that each have its proper situation
<i>Venustas</i>	<ul style="list-style-type: none"> <li>Beauty</li> <li>Aisthetics</li> </ul>	Beauty is produced by pleasing appearances and good taste of the whole , and by dimensions of all types being duly proportioned to each other

By observing these descriptions in Table 4, the practicing Civil engineers of the 21<sup>st</sup> century know that what Vitruvius called *firmitas* is about the wide expanse of Soil or Foundation or Geotechnical engineering as well as rock mechanics. That is, the foundation types that can support the types of structures in Table 3. Similarly, the functional requirement of *utilitas* is in the domain of structural engineering. This is because only building or constructions that are strong and durable against all manner of foreseeable failure can be taught to have utility value. For the structures described in Table 3 to have utility value, the whole expanse of structural mechanics, strength of materials, structural analysis, and structural design and detailing, etc. will be involved in their design. The third requirement, *venustas* can also be explained in terms of Civil and structural engineering because it is the content of structural engineering that gives permanent form to a construction or building, hence beauty. Besides, in the language of the time, aesthetics was understood within the of classical philosophical training as they relate to construction with respect to some details in Table 2. Thus when Vitruvius devoted a book, out of the 10 books, on structural materials like wood, quarry stones, pozzolana, bricks, and others with the exception of steel and few other modern materials, the book should not be read just in passing. It is meant to be studied. For each of these materials, Vitruvius describes such things as: their formation, how they can be produced or searched for, storage mechanism, application methods, and so on. The precepts described here especially in materials formation and development can be used as tools to solve the sustainability and environmental issues involved in the making of structural concrete. In addition, Vitruvius describes these structural materials also from the philosophical angle, and this is a must read for practicing Civil and structural engineers. Perhaps, the most important is his description of structural materials from the perspective of their composition from primordial elements. By primordial elements, he meant

air, water, fire and the earth. He averred that by the use of these primordial elements, issues that bother on areas like: test for suitability of materials, tests for varieties, treatment before use, proportions for composition, how new materials are to be made, when they are to be made, how long the materials are to be kept before use, and so on; can be addressed. These descriptions give an insight into the possibility of generating infinite numbers of kind of these materials. Understanding and utilization of these precepts will no doubt help solve some sustainability issues created by the use of non-renewable natural materials in the production of structural concrete. Also, these issues have the potential to help researchers in the attempt to discover suitable construction materials for sustainability in concrete and structural materials.

#### 4.0 CONCLUSIONS

From the above exposition, it is evident that wide and diverse learning and skills are required for the formation of necessary background to enable the studying and application of the principles of building all manners of structure, set forth by Vitruvius. This discourse also showed that all the learning is available, either in the established Universities or the public domain. Furthermore, it is obvious the Vitruvius emphasized the practical aspect of construction works; and the construction is responsibility of the head of Government; which if adopted in our time will no doubt generate massive direct and indirect employment. Finally, in attempt to widen the resource base for structural materials, so as to address some of the environmental concerns of concrete production, study of and application of the principles of primordial elements, as discussed by Vitruvius should be given a trial by the academia. In order to make the book attractive to Civil engineering community, since architecture and civil engineering meant the same thing at that time; the book should perhaps be translated to read “the Ten Books on Civil Engineering” in line with the present realities.

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