

## BUILDING, CONSTRUCTION TECHNOLOGY AND ENGINEERING IN THE PENTATEUCH

AFOLARIN OLUTUNDE OJEWOLE<sup>1</sup>, ORI SAMUEL OGBONNAYA<sup>2</sup> & MOSSO OBED DJALINÉ<sup>3</sup>

<sup>1</sup>Research Scholar, Department of Religious Studies, Babcock University, Ilishan-Remo, Ogun State, Nigeria

<sup>2,3</sup>Graduate Student, Adventist University of Africa, Kenya

### ABSTRACT

The Bible is not an archaic and irrelevant book, useful only for religious discourse. Scientific feats are recorded in it. It contains the beginning of significant bedrock of human development and scientific discoveries. No less are the foundational elements of the building technology and engineering found in the first five books of the Bible, the Pentateuch. To what extent does the information gleaned from these provide building construction principles that can impact modern building industry? The article probes into these.

**KEYWORDS:** Building Technology, Building Industry, Building Materials, Engineering, Metallurgy, Town Planning, Beauty & Aesthetics.

### INTRODUCTION

Scientists have found some books of the Pentateuch not only fascinating but equally informing, on the beginning of several modern scientific practices and principle (Hill & Walton, 2009). For instance, modern-day Fur Industries that make wears from animal skin and fur are reminiscent of the first garment of animal skin made for Adam and Eve after their sin (Gen 3:21). Similarly, birth control measures as embryonic pigmentation with selective breeding was seen in Genesis 30:32-42, where Jacob conducted a biological or genetic process of selective breeding to get the strongest ones in Laban's flock. Moreover, pregnancy prevention was seen in Genesis 38:9-10. Mortuary services were done in Genesis 50:2, 25-26, where embalment was used as one of the earliest ways of preserving corpse. Medical checkup and diagnosis mandated in Leviticus 13-14 (Olanisebe, 2014). Metallurgical science is evident in Genesis 4:22; Exodus 32:24; and Deuteronomy 4:20 and mining in Deuteronomy 8:4 (Meschel, 2014).

This literary research work probes the building technology and engineering in the Pentateuch with the aim of elucidating principles that can positively impact modern building industry. The biblical text is taken in its final form and the historical-grammatical method of biblical analysis is employed. Ancient building materials and methods for building technology and engineering are considered.

### BUILDING TECHNOLOGY AND ENGINEERING EXPLAINED

Building or construction technology encompasses various techniques use to create buildings, dwellings or places. Building engineering concerns, the whole process involved in the designing of the building project. Technology involves the systematic treatment of an art and the combination of logic, art, and skill (Whiting, 2011). Building technology is sometimes referred to as architectural technology. When done right and user-friendly, practitioners must efficiently and effectively analyze, synthesize, and evaluate various factors that impact the technical design, environment, available space,

builders, end-users, the style and purpose of the building, and materials and construction methods to be used. (Emmitt, 2013).

Building is integral to the human nature from creation. The Creator God is the Master Builder. The Hebrew word *banah* means “to build or construct.” It refers to, both human and inanimate process of building. Human beings are the works of God’s hands; the Lord’s “building.” God *banah*, built, mother Eve from a part extracted from Adam, the first man He created (Gen 2:22). The Exodus from Egypt was part of God’s process for building His chosen people out of Egypt by multiplying and nurturing them. The Temple that God commanded His people to build in Jerusalem was to enhance His process of building the people after His likeness (Exod 25:8; Carpenter & Comfort, 2000).

Cain, the firstborn child of the first human pair, sustained building as a human concern by building a city and naming it after his son, Enoch (Gen 4:17; Wenham, 2002). This was the first recorded building achievement of the human race. This sets the tone for the overarching need for conducive settlement for human beings, within their living environment. Buildings were constructed for protection from or adaptation to natural phenomena such as weather, topography and other bare necessities of life.

## **EXAMPLES OF BUILDING CONSTRUCTION AND TECHNOLOGY IN THE PENTATEUCH**

Some examples of building construction and technology discernible in the Pentateuch are as follows:

### **Buildings of Tent (Gen. 4:22; 9:27)**

Tents were the first type of buildings people dwelt in from the beginning of time (Gen 4:20; 9:27). Patriarchs Abraham, Isaac and Jacob dwelt in tents (Gen 12:8; 26:17; 33:18). After the Exodus from Egypt, the Israelites pitched tents and live in them in the wilderness in their early settlements in Canaan (Exod 16:16; Num 1:52; 24:2). The Ishmaelites also lived in tents (Gen 25:16). These tents were made with goat’s hair into sackcloth or with animal hides like the Tabernacle coverings (Exod 26:14). Each tent was either round, held up by a central pole, or flat or oblong, held up by several poles. The ends of the tent cloth were drawn out by cords which were tied to pegs and driven into the ground. Women helped get the goat’s hair (Packer & Tenney, 1980). Tent-making was a noble profession from time immemorial, and tentmakers were in demand (Gen 4:20; 12:8; 18:1; 24:67; 25:27; 31:33).

### **The First Metallurgists (Gen 4:22)**

Tubal-Cain, one of the descendants of Cain, became the first expert in all areas of metal craftsmanship. As an artificer, he was proficient in brass and iron works, obviously used to invent many implements for building construction, engineering, farming tools, and other industrial apparatus (Wenham, 2002). These may have been useful in building the Tower of Babel (Gen 11).

### **Construction Design and Site Plan-Outline-Preparation**

The first construction design and site plan-outline ever recorded in the Bible are found in the Pentateuch. God gave Noah the site plan and measurements of the floating Ark or ship to be constructed. God stipulated and dictated the building materials to be used (Gen 6:14-16). The use of gopher and pitch, a type of resinous wood, showed the need for quality materials (Brown, Driver & Briggs, 1996). The wood was a type that cannot get soaked by water. In addition, it was pitched in and out as double support.

In Exodus 25:10-40, God directed Moses to construct the Ark of Covenant or the Tabernacle according to the pattern which God had shown him on the mountain. The dimensions of the ark: length, breadth, and height were given. It was flat-bottomed. The surface area of the ark was thus three times as much as that of the tabernacle courtyard (Exodus 27:9-13; Wenham, 2002).

Site preparation must always precede the building. In the construction of the Tower of Babel, the found or made the construction site plain at Shinar. They also prepared or pre-fabricated the bricks and asphalt for mortar (Gen. 11:2-4). This exhibits some architectural principles followed in Pentateuch ages. A level land was expedient for uniformity of the construction.

Architectural planning was known, even in those primitive times. The ancients employed simple surveying instruments in setting the property for construction. The Egyptians were said to have developed standards of accuracy in building constructions, especially royal projects (Isserlin, 1984).

### **Building Materials**

Mortar and bricks of straw were used in the Tower of Babel (Gen 11:2-3) and the Egyptian city building constructions (Exod 1:14; 5:18). Due to shortage of stones in Mesopotamia, bricks were the most commonly used building material. The bricks were made from mud or clay combined with chopped straw and sand. The straw added to the clay was to accelerate the drying process. This mixture was usually baked in the heat of natural sunlight to produce the cheapest sun-dried bricks which abounded in the ancient world. Though hard-looking, they crumbled overtime due to humidity, rain and temperature changes. However, lime-kiln burnt bricks were used for important building constructions and decorative pottery (Wohlman-Kon, 1977; Ryken, Wilhoit & Longman, 1998; Stefanovic, 2007). The use of clay in making building materials, tools and other objects was the beginning of Ceramic technology (Witth off, 2014).

“Come, let us make bricks, and burn/bake them thoroughly” (Gen 11:3). They baked bricks in furnace to make them more durable. Their use of fire in the kiln furnace symbolizes civilization, art, and craft. Their use of burnt bricks symbolized permanence and strength. They combined creativity, inventions, collaborative professionalism with utopian planning. “This is a picture of technology... of material power, of monumental architectural ability, of culture and civilization, of forethought and planning.” (Ryken, Wilhoit & Longman, 1998; p. 66).

The slime was asphalt or bitumen since Mesopotamia abounds in oil and asphalt existed in Babylon. Slime and pitch were used to prevent the penetration of water (Exod 2:3). The durable quality of the asphalt helped to permanently bind the bricks used in building constructions together, almost non-detachably. Their durability can be attested to in the ancient ruins of the well-constructed buildings with construction asphalt (Nichol, 1976-1980).

Pitch was used to make the ark of Noah waterproof (Gen 6:14). It protected the inhabitants of the ark from the waters of judgment. Pitch is a by-product of tar, a “dark, oily, viscous material, consisting mainly of hydrocarbons, produced by the destructive distillation of organic substances such as wood, coal, or peat” (Daintith, 2017).

In Exodus 25-40, wood was one of the major building materials (Exod 25:15-17, 23, 28; 27:1; 37:1). The common sycamore trees, with their powerful trunks, were not only used for most utensils, but most importantly, for building roofs. These wooden building roofs were packed with tree branches, clay, ashes, and mortar, all smoothed together to prevent the roof from leaking during rainfall (Wohlman-Kon, 1977). However, cedar trees were stronger for building purposes than

sycamore, but cedars were foreign and located in Lebanon. Cedars were used for large building constructions and palaces in Asia Minor and Egypt (Wohlman-Kon, 1977). Olive trees were used for doors, cypress trees for floor covering and acacia for the Ark of the Covenant (Exod 25:23, 28; 26:15-17; 27:1; 37:1). Gopher wood was used for Noah's ark (Gen 6:14).

Exodus 28:9 also spoke of engraving material (maybe pencil), and Exodus 20:25 mentioned chisel. Axes were employed in Deuteronomy 19:5; 20:19. Other building materials include fine twisted linen, goats' hair, rams' skins, porpoise skins, blue and purple and scarlet material (Exod 35:6-7).

### **Ornamentals and Furnishings of Buildings**

In Exodus 25:2-3, 10, 31; 27:1-4,17-19; Deuteronomy 27:2,4; we see many metal works and even plastering by the ancients to beautify their constructions. Most of these ornaments were metal works. They also plastered the walls to make them smooth and beautiful. Apart from the sake of beauty, these materials (especially the metals and woods) also contribute to the strength of the building. These are examples of some contemporary building materials already in use in ancient times (Shore, 2007). Other building materials include fine twisted linen, goats' hair, rams' skins, porpoise skins, blue and purple and scarlet material (Exod 35:6-7). Glass-making is hinted at in Deuteronomy 33:19, as "hidden treasures of the sand" (Patch, 1913).

### **Great Walled Cities (Num. 13:28; Deut. 3:5)**

As time went on, there were cities with almost impregnable walls. These fences are constructed sometimes with thick or double walls made of stones. It offers protection to the entire and as such was a national project. Their fences were a matter of great security importance. The ten spies noted that the land of Canaan had cities that were "fortified and very large" (Num 13:28).

### **Town Planning**

Individuals built their houses. God also gave directives in reference to its distance from the public place like the tabernacle and the settlements of neighbors. It should not be too close to the tent of meeting and it should also be in the tribal land, in his father's inheritance. This will allow space for national gathering as well as help maintain inherited properties. The specified spatial arrangement of all the tribes around the tabernacle of the tents is worthy of note. This was the way the Israelite camp migrated during the wilderness journey (Numbers 2).

### **Parapet Protection for Roofs (Deut 22:8)**

When they built their houses, they made parapets or battlements for the roofs for protection from accidents (Day, 2009; Deut 22:8). Since their houses were mostly small in sizes and their settlements crowded closely to each other, roofs were a preferred place to spend free time leisure, recreation, sleeping, meditations, family activities, drying items and other purposes. Access to the roof was usually through outside stairways. (Gilbertson, 1959; Gower, 2005).

### **Doorpost, Lintel and Windows**

These ancient buildings had doorposts made of two wooden or stone posts standing on either side of a door (Exod 21:6; Deut 11:20). The upper door post (Exod 12:7) is called the lintel. The windows were usually small and few. Each window was a rectangular aperture, in the upper part of the wall of a building and were useful in maintaining privacy and

protecting against the winter cold (Gen 26). It was securely barred and often closed with a movable shutter or lattice (Gen 8:6). Pillars were upright architectural support, used in a building to uphold the roof (Exod 36:35-36).

### **Other Buildings**

Stone reminders were built, by setting up piles of stones as pillars to commemorate special events at certain locations (Gen 28:18-19). Often, inscriptions were made on the stones to identify them (Witthoff, 2014). Altars were usually built with earth brick, rock, unhewn stones, or wood overlaid with precious metal and raised from the ground like a platform. Altars are specifically designed, set up, arranged, or established, indicating intentional building plan (Gen 4:3-4; 8:20; 12:8; 24:4-6; 26:25; Exod 27:1-8). It was very central to biblical worship, religious allegiance, and covenant relationship with God (Ryken, Wilhoit & Longman, 1998). Furthermore, sewage to be channeled outside the settlement, as insinuated in the command in Deuteronomy 23:9-14.

### **Construction Safety**

God gave specific instructions and guidelines that would have positively impacted construction safety to be observed by clients, contractors, and laborers alike. Exodus 21:18-19 insists: "If men have a quarrel and one strikes the other with a stone or with {his} fist, and he does not die but remains in bed; If he gets up and walks around outside on his staff, then he who struck him shall go unpunished; he shall only pay for his loss of time, and shall take care of him until he is completely healed" (NASB). Furthermore, Exodus 21:12 maintains: "He who strikes a man so that he dies shall surely be put to death." Finally, Exodus 22:21-24 teaches: "You shall not wrong a stranger or oppress him, for you were strangers in the land of Egypt. You shall not afflict any widow or orphan. If you afflict him at all, {and} if he does cry out to Me, I will surely hear his cry; and My anger will be kindled, and I will kill you with the sword, and your wives shall become widows and your children fatherless."

### **Skilled Labor**

It was understood by ancient Israelites that all skills in building technology and engineering as well as artistic and creative gifts for interior and external decorations and ornamental works were all inspired by and received from God. All building skills come from God and must be used for God's purposes and glory (Exodus 31:1-6; Shore, 2007). "He has filled them with skill to perform every work of an engraver and of a designer and of an embroiderer, in blue and in purple {and} in scarlet {material,} and in fine linen, and of a weaver, as performers of every work and makers of designs (Exod 35:35). Carpentry or wood-working was indispensable in the Tabernacle construction (Exodus 25).

All construction workers must receive prompt payment, otherwise the hirer or client is thereby adjudged sinful and unrighteous. "You shall give him his wages on his day before the sun sets, for he is poor and sets his heart on it; so that he will not cry against you to the LORD and it becomes sin to you" (Deut 24:15). "You shall not oppress your neighbor, nor rob {him.} The wages of a hired man are not to remain with you all night until morning" (Lev 19:13).

## **COUNSELS FROM THE PENTATEUCH FOR MODERN-DAY BUILDING TECHNOLOGY AND ENGINEERING**

Several important principles can be gleaned from the Pentateuch to enhance the practice of modern-day building construction and engineering.

### **Simplicity in Building Constructions**

Normally, the homes that the ancients lived were extremely simple (Gilbertson, 1959). We are also pilgrims on this earth, like them, and our dwellings should also be simple and not ostentatious like those whose interests end in this world. Our final home is heaven.

### **Quality Assurance**

Simplicity should not mean low quality; that would result in losses in the long run. Low quality cuts short the longevity of structures and this means double-spending. We should never use poor materials. For instance, they often used burnt bricks which were more durable. Today, there is a menace of dilapidating and collapsing buildings resulting from greedy building professionals who use poor materials for building constructions.

### **Safety is Number One**

Jewish law required each house top to have barricades to keep anyone from falling off (Deut. 22:8). God is against the buildings that endangers the life of people. The building should be structurally strong without exception.

### **Appreciation of Giftedness**

Exodus 31:1-6; 35:35 insists that God is the Source of all gifts of building technology, engineering, and architecture just as He gives spiritual gifts. These should be celebrated as well.

### **Spacious Environs**

In Numbers 2:2, God asked the Israelites to build not so close to the public place of meeting. Today, people build houses without statutory set-backs for roads, hindering easy passage. The Bible is against indiscriminate erection of structure without regards to public good and safety.

### **Serenity of Our Homes**

In Exodus 33:7, the tent of meeting was built far off from the peoples' settlement. We should build places of worship in places that would minimize noise pollution and disturbances for families.

### **The Dignity of Labor**

Masonry as a profession is never to be looked down upon as menial and disgraceful. God, Himself, is a Builder (John 14:1-2; Heb 11:10; Rev 21:10-23). No job in the building construction should be degraded.

### **The Importance of Planning in Life**

The importance of planning in life cannot be overestimated. God is the Master-Planner. He always gave clear measurements and site plans for all projects seen in the Bible. God never embarks on any building project without the blue print laid down. We should learn this from God. Our lives should be well-planned.

### **Divine Value for Beauty and Aesthetics**

In Exodus 25, the Tabernacle and its components reflect the beauty. The creation story in Genesis 1 repeated reiterates that everything God built or constructed was "good, very good." Everything was beautiful. God placed the human pair inside a beautiful garden as their abode. God's first directive to Adam was to dress and keep Eden. God is a God of

beauty and aesthetics.

All of the design elements for the sanctuary and its contents (Exodus 25) suggest God's great love of beauty, of design, of loveliness. We have sometimes imagined that God enjoys plainness. This is hardly the case. God's love for beautiful things, for craftsmanship, for design and art, is displayed throughout His creation, and it is mirrored in the wonderfully designed elements of furnishings He commanded Israel to fashion for His holy worship. The church has often struggled with the issue of beauty in places of worship. Some have argued that, since Christians are God's temple today, places of worship should be austere, stark, and plain. Others have argued that large expenditures on our places of worship are self-serving in view of the great and continuing needs of so many of the peoples of the world. But in the biblical descriptions of both the Tabernacle and the later temple, other Christians have found models of beauty, craftsmanship, and artistry that bring joy both to man and God (Radmacher, Allen & House, 1999).

But this is not the case today. People are so heavenly minded that they lose sight of the fact that we are still on earth. Those who desire to make the house of God appealing to sight are often criticized as extravagant and wasteful. Just like Judah in his spirit of Satan chided Mary's true service to God. We should never feel that we have spent too much or overspent on God.

Many people's maiden divine encounter is through an experience of beauty, which involves God's full disclosure (Oakes & Moss, 2004). Beauty reflects God's presence anywhere it is seen in all of creation, animate or inanimate (Gottfried, 2014). God has designed and placed beauty even in unexpected places and things, hence, our need to consciously prepare to encounter beauty. Beauty has the power to transform society and enhance shalom (peace). God's workers should intentionally produce products that reflect God's beauty. Builders and planners should create living environments that help people to encounter nature in ways that divulge God's beautiful presence (Garcia-Rivera, 1999; Lane, 2001; Gottfried, 2014).

### **Ecological Design**

Just as every creature of God intentionally alters their environment, God expects humans to intentionally shape and design material things, energy, and processes around them to bring about desired need and beauty (Ryn & Cowan, 1996). Building designs should not be environmentally destructive. Ecological design is "any form of design that minimizes environmentally destructive impacts by integrating itself with living processes" (Ryn and Stuart Cowan, 1996, p. 18).

The principles and approaches gleaned from the creation story and other portions of the Pentateuch could be surmised as followed: The interdependence of humans and nature should be recognized and respected. Building designs should integrate nature with the built environment. All creation should prosper and be replenished, restored and nourished in the course of every building project. It is not enough to minimize environmental impact of constructions; one should endeavor to enhance the environment and other living processes. The spiritual, social, biological, economic, social, and ecological interplay of every project must feature in the costs and benefits analysis as we seek equity for all the stakeholders in a participatory process (Edwards, 2005; Gottfried, 2014).

The modern-day building industry is embracing the concept of integrated method of green building design. Furthermore, the deepening environment and energy crisis is yielding the positive result of enhancing the relationship between human, architecture and the environment (Zhang et al., 2014; Chen, 2015; Shuang & Yibin, 2016).

## CONCLUSIONS

Indeed, the Bible contains some insights on building construction and engineering. People had built dwelling places and metallurgy was known and integrated into engineering works even in the antediluvian World. Building construction must begin with architectural and engineering plan or outline. The site must be prepared and the ground is leveled before construction commences. Building materials in the Pentateuch include mortar, slime, bricks, pitch, wood, stones, axe, chisel, engraving pencil, and gold, silver, bronze, iron, and other metals. Buildings were plastered for beauty and cities are walled for security. Under God's directives, building structures were spaced to make room for easy movements and better living conditions.

The principles gleaned from building constructions and engineering in the Pentateuch include the need for simplicity, maintaining quality in constructions, and ensuring the safety. As God plans His projects before execution, we should develop and follow adequate plans for our lives. We should be intentional in ensuring beauty and aesthetics in our living environments. The talents employed in architectural, engineering, building construction and aesthetics were endowed by the Almighty God.

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