Savar Tragedy of 2013: What and How We Can Learn from it and Minimize Loss of Lives and Sufferings

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"*If a builder constructed a house for a seignior, but did not make his work strong, with the result that the house which he built collapsed and so has caused the death of the owner of the house, that builder shall be put to death"* **Hammurabi, Babylon, 1792 to 1750 B.C.**

This was the exact law that was proclaimed by one of the great kings of the world that ruled in old Babylonian period. In the epilogue to his law he, the King Hammurabi recorded the benefits of his role and acclaimed himself to be the perfect king that provided best life to the Sumerian and Akkadians by initiating the Hydraulic Civilization and had desire to achieve apotheosis. He, by proclaiming the rules of Hammurabi, in fact set out the very first concept of socialism which many scholars refer to as "Theocratic Socialism". Hammurabi mentioned that the law will not be equally applied and he reserved greater penalty for the rich; often the *lex talionis* was applied to a member of the upper class while the member of the *muskenu* or lower class could get away with merely by paying a fine. Hammarubi's epilogue and the law itself coupled with initiation of Hydraulic Civilization stupefied Sumerians and Akkadians while these messages appeared to be epiphany to the Muskenus. (While I am quoting this, I personally believe that once a perpetrator is put under judicial system, the law of the land that existed at the time of the crime should determine the fate of the case.)

We know a building has collapsed in Savar, near Dhaka in Bangladesh and caused death of more than 1,000 people while seriously wounded few more hundred. I like the others of Bangladesh an around the world gawped like yokels as dead bodies were recovered and wounded were rescued. Like others, my cathartic paroxysm was raised seeing these ineffable sufferings of human being and the very idea that thousands of surviving members of the killed persons will never see happiness. My feelings are scowled by the penchant of foppery of few unscrupulous and who lead coruscating and modish life by spoofing the works of laborer and also I am angry against the banal yet ruder system that is prevalent in Bangladesh which fails to acknowledge the contributions of workers to the economy. This collapse, as we learned from the news media and public is a manmade disaster which should not have occurred under any condition. It appeared that the owner of the building in conjunction with the factory owners and the local public administration forced five to six thousands workers into the cracked and seriously distressed building like culling of animals into an abattoir.

The loss of lives traumatized thousands more directly and entire world reacted to this event.

In addition to these losses, this event had placed Bangladesh at verge of getting sanctions from large corporations on importing all kinds of designer apparel and also normal clothing. Walt Disney Corporation had already made it clear that they will not place any new orders from Bangladesh. European Union is considering seriously tro put halt in importing Bangladeshi garments if the conditions are not make safe for workers and the environment quickly. Human rights and labor advocacy groups are acting ceaselessly to sanction Bangladesh. Even Pope had issued statement denouncing the workers condition and compared the condition and pay of these workers to slave labor. God forbids, if this trend continues, the country will be under fatal economic crisis as 4000 garment factories employ more than 4 million workers. Each worker support more than three person in their families and as such about 12 million people will be directly impacted, not to mention other industries such as transportation, ports and dying industries will lose significant incomes. It may take few decades to find other avenues of development.

Given the possibility of sea level rise due to global warming, drying of the major rivers due to unfair water withdrawal by the upstream water user, the situation may turn into greatest disaster of the century. We know, in 1769, 1791, 1945 and 1974 Bangladesh had suffered historically most devastating famines where in each famine; hundreds of thousands of people lost their lives. In fact, about 25 percent of the total population was erased during 1769 famine. All these famines were manmade but as resilience nation, Bangladesh overcame those difficulties.

Based on the trend of the country; the overall situations of our planets climate; attitudes of our neighbors on disregarding Bangladesh's right to receive legitimate share of waters from natural rivers; crony and inept bureaucratic clicks; marauding degradation of physical environments; ever increasing rampant corruption by the educated and political workers; and the immutable and ubiquitous truth regarding the spoofing yet loquacious and sardonic nature of our leaders, it can be easily extrapolated that economic and political future of Bangladesh is gloomy at best. However, should we abjure the old concept of apocryphal regarding facts and try to grapple directly with dour mentality, the issues the nation is facing as described above, we definitely will be able to turn the table in a good time. Solving these issues need political will, patriotism and determination like that of the Greeks in fourth or fifth century B.C.

CONCRETE STRUCTURE DESIGN PHILOSOPHY

I do not have any data nor I have been at this site. But I was watching pictures of the rescue mission and demolition after main rescue was completed. The pictures of the collapsed building delineated that the building was designed and built as concrete framed structure. The collapse had daylighted steel reinforcements in columns, beams, and floor slabs. The design philosophy of a framed reinforced concrete structure utilizes two properties of the two completely different types of materials. Concrete is relatively strong in compression while steel is very strong in compression and in tension. Steel is

also ductile while concrete is brittle. The structural design optimizes the ductile behavior of steel and compression in concrete to avoid catastrophic collapse so that there is enough warning for users to escape.

All and every buildings are designed to withstand the stresses created by the weight of the structure itself (dead load); loads due to wind and earthquake (transient load), due to occupancy by human, furniture, storage shelves, machines and others (live loads). Each of these types of loads are determined by the type of structures, nature of use, type of occupancy, how to escape during emergencies and other factors that the architects, owners and the engineers determine. The regulators also has input in this. There are manuals and codes that are internationally agreed to utilize the amount of loads for design. International Building Codes, Bangladesh Code and other codes are available to the designers. These codes provided guidelines to ensure a safe design and use of the structures.

Prior to designing the structures, a geotechnical exploration is completed to evaluate the type of soils/rocks that exist beneath site. Based on testing of soils both in the field and the laboratory, type of foundations and concrete floor slabs on grades are chosen and designed. The settlement potential of the foundations is also calculated based on soil properties. In fact, engineers are able to predict amount of settlement and total time settlement will take to complete based on results of laboratory testing. Some soils settle quikly such as sand and some soils take really very long time to complete the anticipated settlements such as clay soils. Dhaka city and Savar area have clay type soils which are predominantly reddish color due to oxidation of metals such as iron and magnesium and clay soils generally stick to hand/leg when exposed if the soil is wet. Sand and silts in and around Dhaka are gray in color and they do not stick to hand or leg even if they are wet. Cox Bazar Beach has sand as well and they are clean sand. Some sands are not clean as they contain clay and silt or dust particles that are very small to see by unaided eyes. Sand, dirty sand, and silt soil are not good to resist seismic loadings.

A structure will settle more if loads on its foundations are larger and the sizes of the foundations are also larger as stress from the foundations reach deeper an laterally wider portions of soils. Generally buildings are designed for settlements induced by loads from its live, transient, and dead loads. But, if there is a large building or large foundations with heavy loads is very close, loads from the other buildings also induce settlement to new building and vice versa. In and around Rana Plaza, there are numerous high rise buildings adjacent to the collapsed building. In Dhaka city, this is a pandemic issue. As the buildings are adjacent to each others, the limited and no space from those directions impedes rescue operations as well.

The collapsed Rana plaza had shown distress in walls with gaping holes as shown in news media which had been treated as warning sign by the regulators and engineers. In case of this building, the regulators actually condemned the building and termed as non-occupiable status due to possible imminent failure. However, these warnings were not listened by the building owner and reportedly by some engineers. It is true that sometime due to shrinkage of cement and mortar, in most framed buildings, cracks do appear in

non-load bearing walls. But they are limited in dimensions and most likely associated with separation cracks at the junction below the beams. It appears that that was not the case here and the regulatory authority rightfully identified the distress to be structural. While these distress in Rana Plaza appeared to be in non-load bearing walls as shown by news media pictures, these were most likely created either from the settlements of foundations or induced by deflection or sway of the frame due to overloading or other factors.

QUALITY OF CONCRETE AT RANA PLAZA

Some of the columns had buckled and concrete had crumbled from the main section and the steel reinforcements appeared to be clean depicting no bonding was created between the concrete and steel. The columns appeared to have four main reinforcements at the crumbled places disclosing the fact that for an eight story factory building, this may be under reinforcements. The building floor slabs seems to be four inches thick and reinforcements contained one layer placed in grid line. No estimation could be made regarding the size of the reinforcing steels but if the thickness is considered four inches, reinforcing steel may be at eight inches apart. This also appeared to be insufficient for a factory or manufacturing building floors. One other thing I observed that during demolition with a Jack hammer fitted to an excavator, the hammer would penetrate the concrete like a knife is penetrating a cube of butter. The concrete also crumbled under the action of the hammer creating small gravel size pieces.

Normally a good concrete with a compressive strength of 3000 pounds per square foot would require heavy force and vibration from a Jack hammer to break the concrete. The concrete pieces will also be larger as the failure surfaces will follow the week zone avoiding the reinforcing steel. Good concrete will crack diagonally along the center of grid mesh created by the reinforcements. This obviously was not the case. This lead me to initially conclude that the concrete utilized in the building construction was of very low strength and there was not enough cement to create good bond between the steel and concrete for efficient transferring of stress created by moments and shear. This, however, must be confirmed by testing and further inspection of concrete and review of the logs of the Jack hammer utilized during demolition.

VIBRATION INDUCED BY EQUIPMENT

In addition, as the buildings lose power occasionally, the factory owners utilize independent isolated electrical generators placed at the roof of the factory buildings due to lack of space. When there is loss of public electricity due to load shedding, these generators are started to produce high frequency and high amplitude vibrations. If the vibration is strong enough to create particle velocity of more than 20 millimeter per second, old and substandard concrete structure will starts showing cracks/distresses. It is reported that there were multiple generators in the roof of the Rana Plaza. Multiple generators have possibility of creating out of synchronizing vibrations which create very high particle velocities that are really bad. If, for some reason, the vibrations are in synchronization, they create high amplitude vibrations that may create resonance, most

catastrophic situation in which building collapse is imminent. It would be easy to determine these factors for this structure but it appears that the building collapsed like falling of a deck of cards on a table. Resonance induced failures generally are associated with uncontrolled back and forth sway of the building. The high particle velocity induced vibration (particle velocity more than 30 millimeter per second is very disturbing and a person will not be able to stand for extended time) and most of the people will not be able to stay standing. But out synchronization vibration may have caused internal damages which could be determined as we know the type, capacity, manufacturer and model numbers of the generators. As the structure had thin sections with low reinforcements and low quality concrete, the vibrations created by electrical generators might have not been attenuated or absorbed. In fact, should equipment that produce vibrations and water reservoir that had a possibility of creating sloshing during initial filling or sloshing created by water hammer, these equipment and water reservoirs area should utilize vibration isolators by placing extra reinforcing steel and thickening of concrete so that vibration is significantly reduced and extra load is transferred to the frame without any significant deflections.

The above assertions are my opinion I formed based on pictures shown in media and gathered by reading some articles in newspaper. To determine actual conclusions and causes, the following tasks should be completed, at a minimum: design review; review of soil data; inspection and testing of steel and concrete; interview with stack holders and people who survived. The information gathered in such manner will also provide strategy to develop codes for these types of similar structures and minimize helter-skelter type development.

WHAT SHOULD WE DO

Time has come for us to unite ourselves and tackle the issues. The engineering and architectural issues associated with factory buildings are easy to solve but will definitely take time. Best option in this regard would be to adopt International Building Code 2011 by references except few provisions such as ground acceleration provided in earthquake engineering design of buildings. The non-applicable portions such as snow loads, permafrost conditions and also some modifications could b done in wind loads provisions. It is my understanding that Bangladesh has its own code which could be supplemented to IBC. The reason for advocating IBC code is that it has the acceptance to the world wide communities as European Union and other western countries had raise the issue of insufficiencies of facilities design and working conditions, it will give an added benefit to follow IBC. No design is good if they are not built right. To ensure quality of proper contrition, inspection and testing of each features during construction is a must. In western countries, inspection becomes the backbone of the construction industry which ensures safe and in-compliance facilities and structures.

There are other issues associated with the garment industry: working conditions; salary, health and educational benefits, retirement benefits; environmental issues including discharge of dyes, waste products associated with particulate matters (PM_{10}) that are being generated during manufacturing; discharge of waste materials.

The perpetrators should be brought to justice and existing legal system should be applied to continue the judgment. In the mean time all the debris from the rescue operations should be stored for expert review and if no samples of concrete or steel had been collected it should be done immediately. This will provide data which can be used by the experts to recreate what happened and develop future revisions in codes for industrial/factory buildings. The data and results will be useful in training inspectors and the first responders.

HOW SHOULD WE DO

While Bangladesh developed its own building codes in 1995 via a code committee consisting of government officials, consulting engineers and university professors, the codes, in reality this code had never been implemented. Besides, as the technology had been changing and factories or industries are utilizing modern equipments and methods, the owners focus to maximum the use of space to maximize production, there are inherent lag in adopting codes that were developed. In this regard, few members of **the American Association of Bangladeshi Engineers and Architects (AABEA)** who are associated with building and construction industry in the USA had met and developed the following outline of the immediate steps to be taken to initiate compliance of the industry to minimize loss of life and property. The outline, especially the design and construction requirements are heavily drawn from **International Building Code (IBC)**.

In existing buildings to be used for large numbers of workers, **the Occupational Safety and Health Administration (OSHA)** provides guidelines for safety and health of individual workers. In fact **OSHA** admits and empower each employees to have right for a safe work place and their right to demand to address any and all issues that requires attention. OSHA maintains a web site from which all the posters could be downloaded. The web address is

www.osha.gov

IBC web address is

www.icbo.org

It is explicitly understood that to implement the code outline provided below will be time consuming and expensive. Besides there might be shortage of trained manpower to implement these codes/ recommendations. As such, first step might be to concentrate on developing the administrative and training of man power portion as outlined in IBC, OSHA and other codes. In this regard, AABEA will be best suited to act as bridge between the regulators over in Bangladesh and the code requirements. As accepted by OSHA, it will be imperatives that during development of the remedial retrofits, representatives from the workers be included.

Inspection of all existing garment manufacturing plants:

1. All existing garment industries must be inspected by certified code specialists, Engineers, Architects, and Mechanical, Electrical and Plumbing Engineers;
2. No factory can be operated in any building which was built without any building permit;
3. For buildings built with appropriate permits, and if engineers finds that the building is capable of operating the existing garment factory to continue the plant it will be necessary to secure an undertaking from the building owner that the building was built as per specifications as shown in permit drawings;
4. If the building is found built without any building permit, or additional stories were built, which were not shown on the permit drawings and/or if the inspecting authority finds that the facility was not built meeting all specifications; and or facility is risky to carry on the existing operation, the inspecting authority will issue a "Condemnation Letter" for specified use and issue it to the owner with copies to Fire Department, Police Department, BGMA, Ministry of Industry, and utility companies;
5. Upon receipt of such "Condemnation Letter" all utility companies will disconnect all their utility connections and building must be vacated by the garment plant;
6. These types of buildings can be used for other purposes if specified by the inspecting authority.

Retrofit of all Existing Certified Buildings for Garments factory & compliance:

1. All buildings fit for occupying by the garment plant, the regulatory authority will issue a Certificate of Occupancy (CoO). A copy of the CoO issued by the regulatory agency should be posted in the main lobby and on each floor prominently; One copy should be with the Building Manager's file;
2. The CoO will contain at a minimum, name of the owner, address, type of structure and intended use, occupancy capacity at a minimum. Utility companies will verify such certificates for continuation of their service to the building;
3. A file containing CoO, design details (load bearing capacities on various part of the building), an as-built drawings, updated use plan, if any; an emergency evacuation plan of the facility should be given to the Fire Department, which will be kept in digital format with this emergency responding agency so that they can use it during evacuation/rescue operation;
4. All flammable materials including cloths and readymade garments before shipments must be secured in fire contained rooms, built with fire retardant materials with metallic doors, so that if fire happens in these areas can be contained for several hours and workers can be escaped safely. These storage areas cannot be build near the fire escape routes;
5. All escape routes should be stripped with self illuminating materials during the dark and smoke, so that workers can escape safely in any adverse situation;
6. Emergency evacuation plan must be installed in all corridors with a distance not to exceed 50 feet;

7. All corridors, work areas and stairs case must be equipped with adequate numbers of emergency lighting; firefighting equipment and fire suppression cylinders;
8. Every floor must have additional metallic escape stairs for emergency evacuation. The access and landing areas of such escape stairs must be kept free from any type of obstructions for all times;
9. Window screens installed by garment owners to protect pilferage some of those should be build with wire mesh (mosquito screen type) and easy to break during the emergency;
10. Building must have deep tube well fire pumps or gravity flow reservoir system with a minimum capacity of 15000 gallon capacity. Where the gravity flow reservoir is not possible in that case the reservoir should be equipped with motorized pumps and fed by emergency generator;
11. Building must be equipped with fire hydrant and fire hose system installed on every floor, connected with the deep tube well or reservoir so that the fire fighting unit of the building can handle the emergency before the Fire Service unit arrives at the scene;
12. No occupied garment factory can be kept under lock and key collapsible gates, they must me manned all the time;
13. Each plant must have trained persons to handle the emergency evacuation system. They will be trained and certified by Fire Department, so that they can handle the emergency before Fire Service unit arrives at the scene;
14. The owner of the plant must conduct fire drills randomly to educate occupants about evacuation during any emergency;

Minimum Fire Emergency Standards for new Garment Plants

1. All commercial and multi storied buildings cannot be build without proper building permits (including foundation, structural, mechanical/electrical/plumbing and fire alarm). The regulatory authority will save guard all applications, drawings and permit digitally, so that those can be reproduced any time in the future. It will also be the responsibility of the owner to secure both building and all trade permits before they start construction;
2. No utility connection will be provided by utility companies for any such facilities unless they have copy of Certificate of Occupancy (CoO) issued by the regulatory agencies. The CoO will contain at a minimum, name of the owner, address, type of structure and intended use, occupancy capacity at a minimum. Utility companies will verify such certificates from the regulatory agencies before approval for such connections;
3. A copy of the CoO should be posted in the main lobby and on each floor prominently;
4. All building permits and CoO must be saved in the digital form to save guard such vital documents by the issuing authorities;
5. For any building where more than 50 people will live, assembles, and or work at a single time must have access through a wide road and water hydrants so that Fire Engine can reach and maneuver when it will be required;

6. A file containing CoO, design details (load bearing capacities on various part of the building), an as-built drawings, updated use plan, if any; an emergencyevacuation plan of the facility should be given to the Fire Department, which will be kept in digital format with this emergency responding agency so that they can use it during evacuation/rescue operation;
7. If the building is designed and or used to secure high hazard materials, a copy of the manifest must be with the local Fire Department and nearest Post Offices or any local government agency;
8. All flammable materials including cloths and readymade garments before shipments must be secured in a fire contained rooms, built with fire retardant materials with metallic doors, so that if fire happens in these areas can be contained for several hours and workers can be escaped safely. This area must be equipped with fire sprinkler system. These storage areas cannot be build near the fire escape routes;
9. All escape routes should be stripped with self illuminating materials during the dark and smoke, so that workers can escape safely in any adverse situation;
10. Emergency evacuation plan must be installed in all corridors with a distance not to exceed 50 feet;
11. All corridors; work areas must be equipped with adequate numbers of firefighting equipment and fire suppression cylinders;
12. Building must be equipped with fire sprinkler system;
13. Building must have deep tube well fire pumps or gravity flow reservoir system with a minimum capacity of 15000 gallon capacity;
14. Building must be equipped with fire hydrant and fire hose system installed on every floor, connected with the deep tube well or reservoir so that the fire fighting unit of the building can handle the emergency before the Fire Services unit arrive at the scene;
15. Based on the occupancy, the corridors and stairs must be built as per standard codified in the International Building Codes (IBC);
16. Every floor must have additional metallic escape stairs for emergency evacuation. Access to and the landing areas of the emergency escape stairs must be kept free from any type of obstructions for all times;
17. Window screens installed by garment owners to protect pilferage some of those should be build with wire mesh (mosquito screen type) and easy to break during the emergency.
18. No occupied garment factory can be keep under lock and key collapsible gates, they must me manned all the time;
19. Each plant must have trained persons to handle the emergency evacuation system. They will be trained and certified by Fire Department, so that they can handle the emergency before Fire Service unit arrives at the scene;
20. The owner of the plant must conduct fire drills randomly to educate occupants about evacuation during any emergency;
21. The renter or factory owner must have a copy of all relevant documents and verify if the facility can be used to operate their plants. They have to understand the building use, design and restricted covenant prior to set up of the factory.

Garment Factory Inspection System for Fire Emergency

1. Every 6 months or more frequently the plant must be inspected by the Fire Department personnel for their compliance;
2. Fire Department at a minimum will inspect the facility based on their protocols and issue inspection reports;
3. If any deficiencies identified will be given notices to rectify those immediately and may impose penalty for non-compliance.

Design Code For Building New Garment Plant:

1. All buildings that would be designed for Garment Factories shall be classified as Occupancy Class described in **Chapter 3 and 4** of the International Building Code. As these factories store flammable cloths and yarns, they may be classified as **High Hazard Group H** rather than Factory Group F. As such, this may put limits on number of occupants at a time with safe passageways for fires or other emergencies to exit within a certain time frame. This will minimize fatalities in case of emergencies;
2. Live load design should be categorized as Heavy Manufacturing as recommended in **Table 1607.1** of International Building Codes with a minimum live load of 250 pounds per square foot and a concentrated load of 3000 pounds. The load combinations for floors shall be analyzed by structural engineer to optimize the design;
3. Any overhead roof water reservoir or other equipment (such as Electrical Generators) storage areas shall be designed appropriately by a structural engineer with sufficient knowledge and experience and with reputation among the engineering community;
4. All construction should be certified by the designer. The concrete mix, testing, and inspection of reinforcements should meet the design requirements and the engineer of record should be the one that certify the materials;
5. An occupancy certificate should be available at all entry to the building and design report should be at the facility file and at the office of the appropriate regulatory office. The fire service office should keep a copy of as-built drawing and updated use-plan in case they can use it during evacuation/rescue.
6. The renter or factory owner must state that he/they had the understanding of the building use, design and restricted covenant prior to set up of the factory.
7. All framed structural buildings shall be designed by structural engineer who have experiences of designing and optimizing the designing of buildings including lateral analysis and stability analysis of the buildings under wind, seismic or other transient loads.
8. All buildings must have a geotechnical exploration completed with sufficient borings, field and laboratory testing, and a report with recommended foundation design criteria such as bearing pressure, settlements, pile load capacity, seismic site classifications, site specific response spectra for zero, 0.2 and 1.0 second

periods. This will help the structural engineer to optimize the seismic load and load due to vibrations. Some skinny, ductile but tall structures may undergo cyclic loading during wind that create so-called vortex shedding, may govern the design instead of earthquake and these should be accurately analyzed considered in the design.

9. If the site use cone penetration test, the cone penetration should utilize pore water measurement and its dissipation criteria so that geotechnical engineer can develop proper criteria for settlement and bearing capacity analysis. Standard penetration tests should be done in appropriate manner using **American Society for Testing and Materials (ASTM) standard or equivalent British or Australian standards**. These are not expensive.
10. Concrete mix design should be developed by the structural engineer and instead of brick khoa, stone aggregate should be used for high rise framed structures. Fine aggregates in concrete should be sand with water absorption of less than two percent to make sure the sand are made of durable minerals.
11. No recommendations will work unless there is a good inspection. Buildings and factory owners including designer, inspectors shall carry liability insurance extending to the life of the building except the insurances from the designer and construction inspectors. Liability insurance from designer, contractors, and construction inspectors shall extend at least 10 years. No building should be occupied without liability insurance. The insurance company also inspect to reduce their risk associated with working environment, sufficiency of building design, fire escape and other emergency requirements.
12. AABEA will be able to put together a team of expert to develop the training curriculum for inspection and testing of concrete in the field and in laboratory and can properly certify those individuals. AABEA will be able to donate manuals and will be able to assist in setting up laboratory for testing and inspection in each municipalities and jurisdiction. They can perform the testing/inspection and fees should be collected during building permit as that is done in USA by the cities development service departments.

Construction Inspection Services:

It is true that the regulatory agencies do not have enough manpower for inspection during the construction. And without proper inspection it is difficult to maintain the quality of any structure. To maintain the quality of the construction as per designed specifications and without increasing the expenditures of the public agencies the following options are recommended:

1. The government can use 3rd party inspection systems as supplement to their services. The third party inspectors shall be certified and work under qualified and experience engineers. The regulatory agency can train local Architectural/Engineering companies for proper inspections and to issue certificates to them and authorize them as 3rd party inspectors. The regulatory agencies will assess and collect a reasonable fee for such facilities from these companies/individuals.

2. The 3rd party inspectors will inspect the constructions based on design and specifications and will safeguard all inspection reports in digital formats. The final inspection reports will be submitted to the regulatory agency for issuance of the CoO, once the construction is satisfactorily completed. These inspectors will assess and collect a reasonable fee from the building owners;
3. All construction should be certified by the designer based on inspection protocols. The concrete mix, testing, and inspection of reinforcements should meet the design requirements and the engineer of record should be the one that certify the materials;
4. Bangladesh Testing Institute or Technical Educational Institutions will randomly test all electrical cables, reinforced steels, cements, and other major building materials available in the market for quality certifications. These institutions can assess and collect a nominal fee from the manufacturers. These institutes must safeguard the test protocol and test results in digital format;
5. All 3rd party inspection companies must carry liability insurance to coverage;
6. This certifications will be renewable every year, and the regulatory agencies will keep records of these vendors with the performance reports;
7. Before the CoO is issued for the facilities the regulatory agencies will inspect the facilities;

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"Hatred does not last long, but present brilliance will become future glory when it is stored up everlastingly in the memory of mankind" **Pericles, Athens, 440 BC.**

I am quoting this from one of the most successful Greek Emperor who utilized the democratic ideas as political philosophy, civic orders, scientific thinking, and transformed the country in which Athenian citizenship became a cherished prize. We know, Athen was small country with no significant natural resources but still it was one of the best countries ever existed in human history and shaped the modern day political, philosophical and scientific thinking. How did they built this society and sustained it. In this short article I will try to analyze this in the perspective of Bangladesh. Before that,