

**Name of case study:** Scoring the Sustainability of Construction Projects

**Objectives of the case study:** The objectives are to examine sustainability assessment for different construction stages, and to evaluate the sustainability of the collected responses on construction process of projects in Erbil province.

**Rules of the case study:**

1. Group has to be three to four students
2. The questionnaires are inserted in to excel and the scores are checked base on the benchmark score.
3. The contact information of the responsible engineers should be written.
4. All questions are inserted in to excel sheet beside three columns are created for the benchmark score, given score and note if it is needed. At the end summation are taken
5. A brief paragraph should be written at the end of each categories.
6. The whole report should be submitted due to May 24, 2018.

Questionnaire has included more than 95 questions related to most sustainability measures criteria. The questions were given different weight of importance. For questions thought to cover the three pillars of sustainability namely, the economic, the social and the environment dimensions, they were given the higher weight (Class A of 3 points, Class B of 2 points, Class C of 1 points). For questions thought to cover the two pillars of sustainability namely, the economic, and the social dimensions

### **1-Site and materials of Construction.**

A1 - Avoid construction on main agricultural land

A2-Avoid building on undeveloped land that is environmentally sensitive.

A3-Avoid building on public gardens or adjacent lands to water bodies.

A4 - Choose a building that is well connected to existing public transport networks

A5 - Minimize the impact of the building and protect and promote natural vegetation.

A6 - Proper landscaping, use of contaminated rainwater, and recycled wastewater.

A7 - Minimize the surface of an impervious surface (eg parking) and provide surface drainage system that conducts water to areas on site.

A8-Grading the site to appropriate slopes and planting vegetation that holds the soil in place to prevent erosion.

A9 - Distinct location characteristics such as rock formations, forests, pastures, streams, swamps, trails and recreational facilities never be replaced .

A10 - Shadow provision, surface or reflective surface surfaces, reflective paving materials. Identifying a building for the best exposure to sunlight and wind increases solar heat gain in winter and reduces it in summer to provide heating fuel and air conditioning.

A11- Protection of trees and areas sensitive to the site from damage during construction.

Soil A12 - Soil should be carefully stored during construction and reused on site.

A13 - Construction waste is recycled.

A14 - When the steel frame is demolished, its materials are recycled.

B1 - Guard against soil erosion by water and wind during construction.

B2 - Construction machinery should be selected and maintained so that air pollution is minimized.

B3-Clay and shale, raw materials for bricks, plentiful.

B4 These wastes usually go to landfills or buried at the site.

B5 -When a brick building is demolished, the proper brick can be cleaned from the mortar and reused.

B6- Waste bricks can be crushed and used in landscaping. Brick and mortar debris can also be used as fill in situ.

B7-Steel is galvanized, or given long-lasting polymer coating, or made of more expensive stainless steel.

C1-Surplus extracted soil should be reused either on site or in another nearby location.

C2 - Clay brick can include recycled brick dust, Post-industrial waste such as fly ash.

C3- Sellers apply to brick construction

C4 - Are some spraying materials used on fire-resistant materials?

C5-Steel exposed to weather needs to be repainted periodically

C6- Steel framing members should be built in walls and the walls are thermally broken or insulated in such a way that they do not run heat between the inside and outside.

C7-Surface oil and protective coating, sometimes outgas and cause inhabitant discomfort, are not used.

## **2-Waste, recycling and green uses.**

A1-Use of waste materials from other industries such as fly ash from power plants and slag from iron kilns, copper slag, masonry sand, mill scale, sand gravel and other components of cement and concrete.

A2- Reduce energy consumption, waste, pollutants emissions from each step of the concrete construction process, from the quarries of raw materials through the eventual demolition of concrete construction.

A3- Templates can be reused many times.

A4 - When a concrete building is demolished, the reinforcing steel is recycled.

B1 - Use of concrete made from locally extracted materials and local processing plants to reduce the transport of building materials over long distances.

B2- Minimize the use of materials for molds and fixation.

B3 concrete forms are reused.

B4 - Fragments of crushed concrete can be crushed, sorted and used as new concrete complexes.

B5-parking garages replacement shop surface parking.

B6-Concrete thermal blocks are used to reduce heating and cooling costs.

B7-photo-catalysts are added to the concrete used for road construction and construction.

C1 - Waste materials such as powdered glass, recycled, used foundry sand, recycled concrete replace part of conventional aggregates in concrete.

C2 - Concrete that uses less water using super plastic materials, air entrainment, fly ash.

C3 - Excess concrete is often thrown on the site, where it is cut and removed later and transferred to the landfill for disposal.

C4 - The empty jumper mixing truck must be washed after each batch transfer, these wastes can be recovered and recycled as aggregates and mixing water

C5- Release compounds and processing compounds are used.

C6 - Destroyed concrete is buried on site, used to fill other sites, or dumped in a landfill.

C7-Previous concrete, made of coarse aggregate only, is used

C8- In the field of brown field development, concrete packing materials can be used to stabilize the soil.

C9-Concrete paving is used in black instead of asphalt pavers.

C10 - Internal concrete slabs made of white concrete are used.

### **3-Roofs**

A1-A Roof Rainwater can be made into a tank, or pond for use as domestic water, industrial water, or irrigation.

A2-A surface can support solar heat collectors to save electricity

B1-A roof is used properly to shade the windows from the high summer sun but recognizing the light warming from the sun in the winter is low.

B2- The light-colored ceiling cover is used.

B3-Reflective surfaces are used.

B4-bitumen is used to rely heavily on asphalt compounds derived from coal and petroleum

B5 - Materials resulting from the demolition of built roof membranes are usually burned or transported to waste dumps.

C1. In hot climates, the shading layer is used above the ceiling, with a free ventilation space in between.

C2-cellulose insulation material is used in surfaces.

C3 - Glass wool and mineral wool thermal insulation materials are used in surfaces.

C4-Polystyrene foam thermal insulation material is used in surfaces.

C5- Roofing panels made of cellulose or glass fiber surfaces.

C6-adhesive bonding, solvent welding, and thermal welding of the layers may give off volatile organic compounds (FOC), are not used.

C7-thermal membranes are used as single chips.

### **4-Exterior wall system**

A1 - The outer wall system is used in the entire glass.

B1- glass is used where it can provide daylight lighting and provide views

The south facing surfaces are used from the outer wall to generate electricity.

C1-Windows is opened and closed by occupants.

C2-Thermal bridges are removed from the outer wall.

C3-Fresh air must be provided by the ventilation system in the building, not by air leaking through the outer wall.

C4 glass is used to provide the solar heat of the building in the winter, but be careful to avoid glare, high local temperature, ultra violet degradation of internal surfaces and furnishings exposed to sunlight.

### **5-Interior wall system**

A1-Gypsum Waste generated during construction is minimized by scaling walls and ceilings to make effective use of entire boards or by ordering custom size plates for non-standard sized surfaces.

B1-gypsum board scrap can be permanently stored in hollow cavities of finished walls, eliminate disposal of transportation costs and reduce the amount of material destined for landfill waste.

C1 - additives used in the manufacture of gypsum boards that are moisture resistant and fire resistant are not potential sources of volatile organic emissions (FOCs)?

C2-paints, adhesives that cover the wall used to finish gypsum surfaces can be significant emitters of VOCs, are not used.

## **6-Finishing materials**

A1- The finished material has high recycled content.

A2-Floor plans that are flexible and easily adaptable are used with new uses and partitioning systems that are easy to modify and encourage building reconstruction.

B1-Finished materials eventually finish in landfills.

B2- Finished materials are processed, and manufactured locally.

B3-Indoor Finishing materials and coatings including emitters do not use? For example glue and folders used in wood panels and other manufactured wood products, the leveling compounds applied to supporting, fabrics, carpets, dressings, carpet cushions, carpet adhesives, antimicrobial treatments, carpet mothproofing, wall adhesives covering flexible flooring adhesives and vinyl in all its forms, gypsum board Common vehicles, curtains and upholstery fabrics, paints, varnishes, stains, and more.

B4-formaldehyde gas is not used? It is irritating to build passengers, causing nausea and headaches, and can aggravate asthma.

B5-Organic compounds folate are not used? They're air pollutants.

B6-Use of high ceilings, low partitions, transparency, reflective surfaces, and light colors can maximize day lighting potential and views to the exterior.

B7- Areas designed with exposed structure and without suspended ceilings.

B8- concrete, stone, construction, ceramic tile, cement mortar and plaster used. It is chemically inert and emission-free.

C1 - Internal finishes derived from rapidly renewable sources, such as bamboo flooring or certified timber, reduce the depletion of limited raw materials and the protection of forest ecosystems.

C2-chemical 4-phenyl cyclohexane is not used. Emitted rubber folders are used in some carpets and pads. A carcinogen.

C3-acoustic ceiling tile are not used? It can be a source of volatile organic emissions (FOC) as well as a repository of emissions from other sources.

C4-light-emitting acoustic tiles used.

C5 - Organic adhesives used in tiles and resins are not used? Could it be sources of emissions.

C6 - Sealants applied to hardwood flooring materials to provide water repellent and protection against staining potential sources of emissions, are not used?

C7-self-leveling used in the preparation of Subfloors for flexible floor coatings are potential sources of emissions, are not used?

C8-vinyl (polyvinyl chloride) is a component of many flexible floor coverings and other interior finishing products, is used.

C9- Carpets and pillows are made with at least some recycled material.

C10- The applied adhesives in the factory are used. They tend to have lower VOC emissions than adhesives applied to the construction site.

C11- Carpet tiles not full carpets are used. Tile allows easy spot replacement, reduces the need to replace the full carpet when the area becomes small worn or damaged, thus prolonging the life of carpet installation and reduce waste.