2019

Sustainable solutions for exposed concrete surfaces to climatic influences - Within various regions: An industrial-geographic letter to civil-constructors

Mahmood Alshammari
University of Wollongong

Ali K. Al-Nasrawi
University of Wollongong

Ali Abdullah
University of Babylon

Publication Details

Alshammari, M. M.H., Al-Nasrawi, A. K.M. & Abdullah, A. Jabbar. (2019). Sustainable solutions for exposed concrete surfaces to climatic influences - Within various regions: An industrial-geographic letter to civil-constructors. International Journal of Civil Engineering and Technology, 10 (1), 242-254.

Sustainable solutions for exposed concrete surfaces to climatic influences - Within various regions: An industrial-geographic letter to civil-constructors

Abstract

Environmental factors significantly influence concrete surfaces. Infrastructures are affected by variety climatic conditions including: extreme temperatures, droughts, moist and humid conditions or even inundation, and they are more likely to experience negative influences on their concrete surfaces. Thus, this research aims to identify sustainable solutions to decrease the vulnerability of concrete exposed to climatic and environmental influences by assessing the response of concrete surfaces to high solar radiation, high temperatures, and wet weather conditions. Our results within warm and tropical regions show that temperature fluctuations lead to expansion and shrinkage of concrete, particularly in buildings with poor thermal insulation. Including iron components are prone to these shrink-swell processes, causing crack development and expansion over time. Then, this study is suggested some responding solutions including; plant covering over concrete surfaces of the structures as well as use of some light-coloured silicates to reduce solar radiation absorption. Another focus of this study is to analyse the roles of some environmental factors including salinity, humidity, rain, and snow that may influence the concrete surfaces, particularly within wet and coastal regions. Previous studies show that the permeability of concrete surfaces increase the Infiltration of water which can lead to corrosion of iron components, and salt accumulation within cavities, particularly affecting coastal-zone infrastructures. Thus, a suggestion of high-density, low-porous concrete to be used to prevent the diffusion of water into concrete surfaces. The concrete surface problems that are occurring due to various environmental factors can cause severe damage. The corrosions including peeling process is an example of such damage that often is not-repairable. Notably, if peeling occurs within the primary reinforcing structure, the metal bodies are likely exposed to corrosion, which then requires a greater response to be fixed. Thus, the information provided in this study yield base suggestions which can support informed decision-making during planning and construction stages to sustain longer-lasting concrete surfaces under different environmental conditions. Additionally, the concrete material industry can benefit from this research, as the findings provide guidance to the use of more suitable materials for improved structural integrity under various climatic conditions.

Publication Details

Alshammari, M. M.H., Al-Nasrawi, A. K.M. & Abdullah, A. Jabbar. (2019). Sustainable solutions for exposed concrete surfaces to climatic influences - Within various regions: An industrial-geographic letter to civil-constructors. International Journal of Civil Engineering and Technology, 10 (1), 242-254.

International Journal of Civil Engineering and Technology (IJCIET)
Volume 10, Issue 1, January 2019, pp.242–254, Article ID: IJCIET_10_01_024
Available online at http://www.iaeme.com/IJCIET/issues.asp?JType=IJCIET&VType=10&IType=1
ISSN Print: 0976-6308 and ISSN Online: 0976-6316

©IAEME Publication **Scopus** Indexed

SUSTAINABLE SOLUTIONS FOR EXPOSED CONCRETE SURFACES TO CLIMATIC INFLUENCES – WITHIN VARIOUS REGIONS: AN INDUSTRIAL-GEOGRAPHIC LETTER TO CIVIL-CONSTRUCTORS

Mahmood M. H. Alshammari
School of Earth and Environmental Sciences,
University of Wollongong, Wollongong, NSW 2522, Australia

Ali k. M. Al-Nasrawi
Department of Geography, Faculty of Education, University of Babylon,
Ministry of Higher Education and Scientific Research, Hillah51002, Iraq

Ali Jabbar Abdullah
Department of Geography, Faculty of Basic Education, University of Babylon,
Ministry of Higher Education and Scientific Research, Hillah51002, Iraq

ABSTRACT

Environmental factors significantly influence concrete surfaces. Infrastructures are affected by variety climatic conditions including: extreme temperatures, droughts, moist and humid conditions or even inundation, and they are more likely to experience negative influences on their concrete surfaces. Thus, this research aims to identify sustainable solutions to decrease the vulnerability of concrete exposed to climatic and environmental influences by assessing the response of concrete surfaces to high solar radiation, high temperatures, and wet weather conditions.

Our results within warm and tropical regions show that temperature fluctuations lead to expansion and shrinkage of concrete, particularly in buildings with poor thermal insulation. Including iron components are prone to these shrink-swell processes, causing crack development and expansion over time. Then, this study is suggested some responding solutions including; plant covering over concrete surfaces of the structures as well as use of some light-coloured silicates to reduce solar radiation absorption.

Another focus of this study is to analyse the roles of some environmental factors including salinity, humidity, rain, and snow that may influence the concrete surfaces, particularly within wet and coastal regions. Previous studies show that the permeability of concrete surfaces increase the Infiltration of water which can lead to *corrosion of iron components, and salt accumulation within cavities, particularly affecting coastal-zone infrastructures. Thus, a suggestion of high-density, low-porous concrete to be used to prevent the diffusion of water into concrete surfaces.*

The concrete surface problems that are occurring due to various environmental factors can cause severe damage. The corrosions including peeling process is an example of such damage that often is not-repairable. Notably, if peeling occurs within the primary reinforcing structure, the metal bodies are likely exposed to corrosion, which then requires a greater response to be fixed. Thus, the information provided in this study yield base suggestions which can support informed decision-making during planning and construction stages to sustain longer-lasting concrete surfaces under different environmental conditions. Additionally, the concrete material industry can benefit from this research, as the findings provide guidance to the use of more suitable materials for improved structural integrity under various climatic conditions.

Keywords: Environmental Reforms, Concrete Surfaces, Weather Conditions, Heat Treatments, Coatings, Concrete with A High Density.

Cite this Article: Mahmood M. H. Alshammari, Ali k. M. Al-Nasrawi and Ali Jabbar Abdullah, Sustainable Solutions For Exposed Concrete Surfaces To Climatic Influences – within Various Regions: An Industrial-Geographic Letter To Civil-Constructors, International Journal of Civil Engineering and Technology (IJCIET), 10 (1), 2019, pp. 242–254.
http://www.iaeme.com/IJCIET/issues.asp?JType=IJCIET&VType=10&IType=1

1. INTRODUCTION

Recent development in applied studies that address concrete problems and their reforms have emphasized the importance of combining engineering and environmental methods for sustainable solutions (Michael, 1963; Mays, 2003; Hardoy *et al.*, 2013; Talbot and Talbot, 2018). Concrete problems can be caused by various transverse factors (Neville and Brooks, 1987; Mays, 2003; Shetty, 2005). Some of these problems like cracking and corrosion(Baluch *et al.*, 2002; Kamei *et al.*, 2018), for instance, are resulted from environmental influences, whereas other problems result from chemical reactions within the concrete cells(Spiratos and Jolicoeur, 2000; Mays, 2003; Kamei *et al.*, 2018). Furthermore, the materials used and the mixing technique during construction may result in additional problems(Rizzo and Sobelman, 1989; Mehta and Monteiro, 2006). On the other hand, regarding weather conditions within cities, continuing concrete surfaces throughoutcities cause the formation of Heat islands during the wave radiation that received from the sun, which extremely warming up the whole city(Michael, 1963; Hardoy *et al.*, 2013). This study focuses on assessing concrete problems that are caused by different climatic conditions, particularly on exposed concrete surfaces. It is aiming to find suitable methods and materials to be suggested that use environmentally-friendly solutions, which can respond to each of these problems with respect to its geographical distribution, the regional climate, and the local setting.

2. PROBLEM

Impacts of the various environmental conditions on concrete integrity are significant, in different levels and aspect, according to various factors including the geographical regions. What are the issues that result from climatic conditions, and have influenced the exposed concrete surfaces? Are there any sustainable environmental solutions suitable to address such problems? Are these solutions economically feasible?

3. HYPOTHESIS

Different environmental conditions, including main climatic factors such as temperature, clearly influence concrete surfaces and their resistivity, durability and strength(Michael, 1963). Effectsof these climatic stresses are peeling, cracking and localized corrosion(Baluch *et al.*, 2002; Kamei *et al.*, 2018).

Many simple-to-apply environmental treatments can be suggested which are suitable to solve a range of climate-related problems and are furthermore low-cost. Therefore, most of the concrete problems would benefit from environmental solutions in addition to repairing the damaged surfaces (Rizzo and Sobelman, 1989; Hardoy *et al.*, 2013; Kamei *et al.*, 2018). These solutions are environmentally friendly and improve the longevity of concrete surfaces using some recommended materials(Spiratos and Jolicoeur, 2000; Hardoy *et al.*, 2013), such as the concrete silicate colorant (Min'ko *et al.*, 2018), see Figure 1.

4. OBJECTIVES

This study aims to evaluate the problems of concrete surfaces that occur as a result of different environmental stresses byinvestigating the climatic factors and their effects on exposed surfaces,and to propose environmental solutions to improve residential areas while at the same timereducing construction and repairing costs.

Figure 1. Concrete silicate colorant(Supplee Sr, 2003; Min'ko *et al.*, 2018).

5. REASONS FOR CONCRETE DETERIORATION

5.1. Physical causes for concrete deterioration

Mehta and Gerwick (1982) grouped the physical causes for concrete deterioration into two categories: (a) surface macerate or loss of mass due to abrasion, erosion, and cavitation. (b) cracking due to the high-temperature gap(Michael, 1963), high humidity and moisture levels, salt crystallization in the pores of concrete pores, structural loading, and exposure to extreme temperatures (e.g., freezing or fire)(Michael, 1963; Hardoy *et al.*, 2013).

5.2. Chemical causes for concrete deterioration

Chemical causes for concrete deterioration have been classified into; (a) hydrolysis of the cement paste components by soft water; (b) cation exchange reactions between aggressive fluids and the cement paste, and (c) cement reactions that are leading to the formation of expansive materials, such as in the case of sulphate attack, alkali-aggregate reaction, which causes corrosion of reinforcing steel in concrete(Neville and Brooks, 1987; Spiratos and Jolicoeur, 2000; Shetty, 2005).

It is essential to emphasize that the distinction between physical and chemical causes of concrete deterioration has been poorly addressed(Spiratos and Jolicoeur, 2000). In practice, both frequently superimpose each other. For example, loss of mass and cracking increase the permeability of concrete, which then becomes the primary cause of many other problems including chemical deterioration. Similarly, the detrimental effects of the chemical phenomena will lead to physical deterioration(Spiratos and Jolicoeur, 2000; Baluch *et al.*, 2002). For instance, leaching of the components of hardened cement paste by soft water or acidic fluids increases the porosity and permeability of concrete, making the material more vulnerable to abrasion and corrosion(Malhotra, 1976; Kamei *et al.*, 2018).

5.3. Permeability and porosity

In concrete material, the role of water has to be seen as a necessary ingredient for cement hydration reactions and as a variable that facilitates the mixing of the components of concrete during the construction stage from the beginning(Shetty, 2005). Gradually, (however, depending on weather conditions and thickness of a concrete layers or columns) all of the water will be evaporated from the concrete (through many ways including the capillary attributes) and will be lost(Gallé, 2001). This will leave the pores empty or unsaturated as tiny holes connect through microscopic channels (permeability) in different types (see figure 2).

The permeability, porosity, and mineral components of the aggregate seem to have an essential influence on the concrete behavior including peeling and surface corrosion levels. For example, within the scenarios of the temperature range(Michael, 1963), porosity, permeability, and moisture levels of highly porous aggregate will be susceptible to disruptive expansion, leading to external/internal cracks and corrosion in the case of frost conditions hit(Baluch *et al.*, 2002; Kamei *et al.*, 2018). Low-porosity aggregates, however, will be significantly less affectedby such internal moisture movement(Shetty, 2005; Kamei *et al.*, 2018).

The concrete materials, including the siliceous aggregates that contain quartz (e.g., granite and sandstone), can cause problems in concrete at high temperatures (≥ 573°C)(Michael, 1963). At this temperature, the transformation of a-quartz to b-quartz escalates with a sudden expansion of the order of 0.85% (Michael, 1963; Kamei *et al.*, 2018). In the case of carbonate rocks, similar distress can begin above 700°C as a result of the carbonation reaction. In addition to possible phase transformations and thermal decomposition of the aggregate, a mineral of the aggregate also determines the response of concrete to fire in some other ways(Neville and Brooks, 1987). Therefore, the aggregate minerals determine the differential thermal expansions between the aggregate and the cement paste and the ultimate strength of the interphase transition zone.

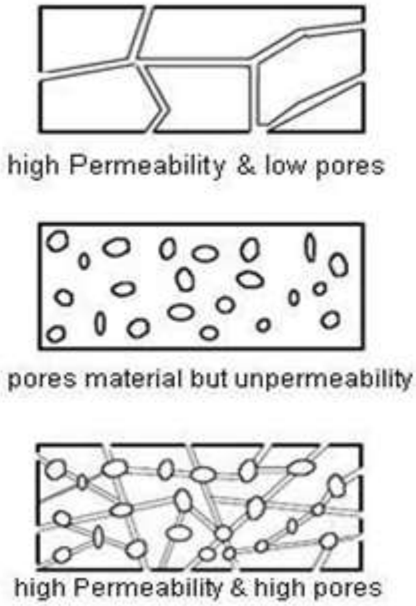


Figure 2. Permeability and pore types, different types are related to the effects of different temperature impacts on the concrete aggregate(Gallé, 2001).

5.4. Temperature and concrete interactions

Temperature is the most influential factor on concrete surfaces, causing expansion, stretch, and shrinkage cracking within tropical and hot regions(Michael, 1963; Baluch *et al.*, 2002), and severely impeding the concrete's strength flexibility under extremely cold conditions (Michael, 1963; Hardoy *et al.*, 2013). The other important factor that needs to be considered is the premature removal of concrete formwork (structure covers) before the concrete acquires sufficient maturity or strength, which will lead to stress vulnerability consequences later on. This problem may arise when the construction assessment decisions are based on curing durations of concrete cylinders under laboratory conditions (Ismail H and Al-Zubaidi S.A., 1999), while actual curing durations of infield concrete may vary significantly. Construction engineers need to consider the possible effects of lower or higher temperatures during concrete curing on its properties at early construction stages, as well as the methods of evaluating and controlling curing levels (Mehta and Gerwick, 1982; Ismail H and Al-Zubaidi S.A., 1999; Mehta and Monteiro, 2006).

Hot-weather concreting

In terms of construction problems with structural concrete, the American Concrete Institution-ACI committee since 1991 defines hot weather as any combination of high air temperature, low relative humidity, and wind velocity tending to impair the quality of fresh softness, hardened concrete or otherwise resulting in abnormal properties(Committee, 2005). In addition to increasing slump loss, stretching and contraction-shrinkage cracking(Baluch *et al.*, 2002), and the decrease of settling time in fresh concrete, hot weather increases the mixing water requirement for a given consistency (figure 3) and creates difficulty in holding the air in an air-entrained concrete mixture(Michael, 1963). Retempering of mushy/soft concrete is frequently necessary for hot weather(Michael, 1963). At times, this causes adverse effects on strength, durability, stability, and appearance of the hardened concrete surface(Malhotra, 1976; Mays, 2003).For example, the concrete that dried within a higher moderate temperature than the ambient normally develops an early higher strength after 28 days only. The strength is usually lower than the same concrete placed and cured at a relatively low temperature.

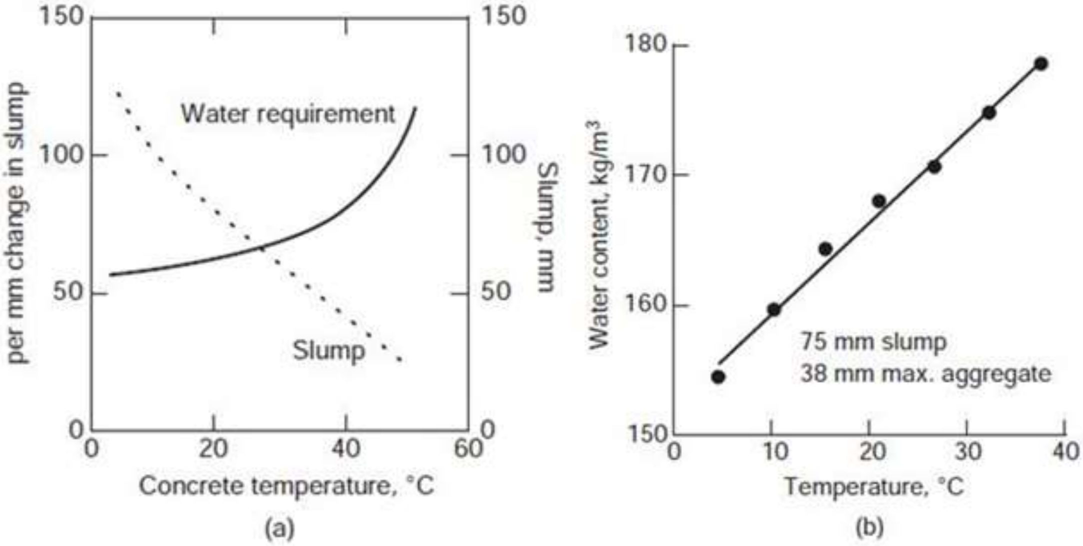
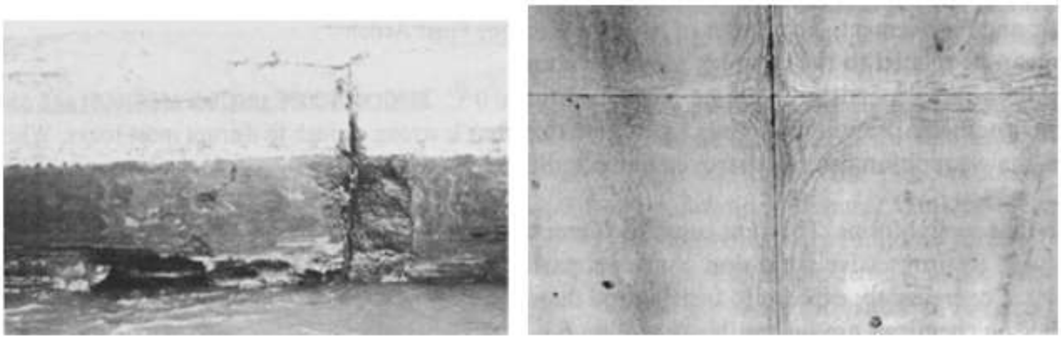


Figure 3. (a) The effects of concrete temperature on the slump and water requirement, (b) impacts of ambient temperature on the water requirement of concrete (source: report of ACI Committee 305 on hot weather concreting, ACI Mat. J., Vol. 88, No. 4, p. 422, 1991)

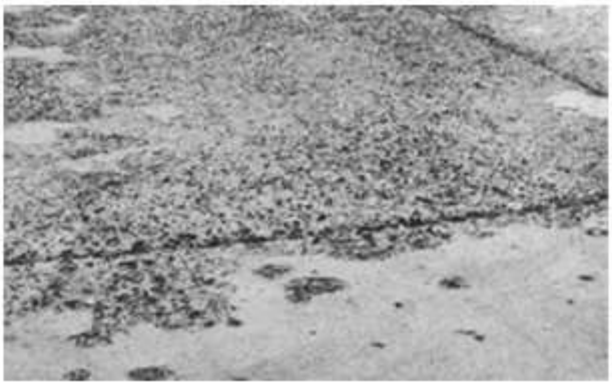
Control of concrete temperature is essential because the water mixing has an excellent effect per unit weight of any of the materials on the concrete temperature. The use of cold water mixing is the most efficient way to reduce the concrete temperature (Hardoy *et al.*, 2013). This as an expression can be employed for determining the suitable temperature of concrete and the water temperature required to calculate the gap that will be needed to be considered to lower the temperature of concrete by a given amount(Neville and Brooks, 1987; Kamei *et al.*, 2018).

Frost-weather concreting

In cold climates, the causes of deterioration of concrete surface have been linked to frost impacts. In such environments, damage to concrete can occur on pavements, retaining columns/walls, bridge decks, or railings (Figure 4) (Hardoy *et al.*, 2013). Such damages are attributed to fluctuating freezing action (variability of freezing and melting cycles), which is one of the major problems requiring substantial expenditures for the repair and even replacement of structures in some cases (Rizzo and Sobelman, 1989; Kamei *et al.*, 2018).



A B



C

Figure 4. Different effects of concrete deterioration due to frost action exemplarily shown for (a) pavements, (b) retaining walls, and (c) bridge decks(López *et al.*, 2016; Kamei *et al.*, 2018).

6. CONCRETE MICROSTRUCTURE VULNERABILITY

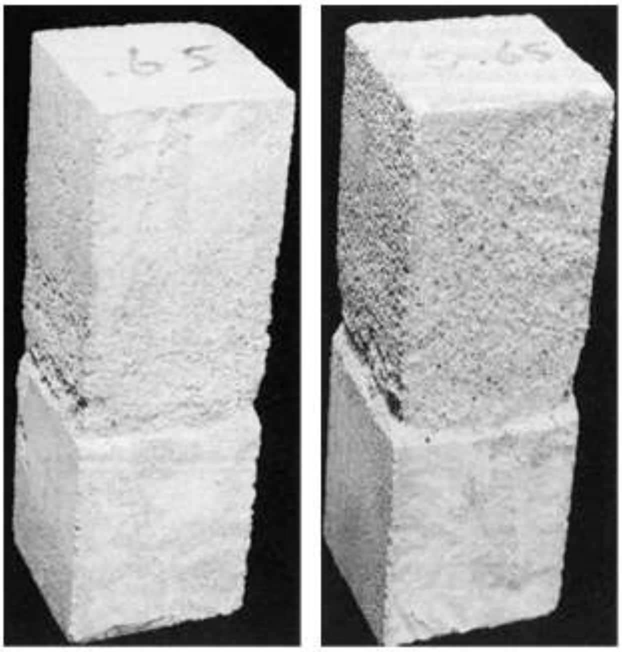
Many factors could be involved in causing the vulnerability of concrete attributes and can be related to the microstructure of the material complexity(Mehta and Gerwick, 1982; Mehta and Monteiro, 2006). However, the deleterious effect depends not only on the characteristics of the concrete, but also on the environmental conditions (Hardoy *et al.*, 2013). For instance, concrete under given freezing conditions can be damaged to different levels/conditions(Mehta and Monteiro, 2006).

Frost related damages in concrete can take several forms. The most common is cracking and peeling, mostly starting on the concrete surface and caused by progressive expansion of the cement paste/porous-cells by repeated freezing and melting cycles(Mehta and Monteiro, 2006). Coarse materials in concrete components which allow for more permeability and porosity within the concrete cells enhance the likelihood of cracking to occur (Baluch *et al.*, 2002). Notably, parallel to joints and edges, the concrete body is eventually acquiring a pattern resembling a large capital letter “D”. The term D-cracking describes this type of cracking (figure 5) (Baluch *et al.*, 2002; Mays, 2003; Kamei *et al.*, 2018).

6.1. Salt crystallisation in concrete pores

Concrete surfaces which are exposed to salinity will face similar problems to the frost related damages. Especially coastal zones are often exposed to wave-action related high-saline humidity, which causes scaling on surface cracks, flakes or peels during wetting and drying cycles(Hardoy *et al.*, 2013). At the same time, within inland regions, salt scaling can occur due to underground water levels, soil type and associated minerals particularly to affect the concrete foundation and surface. The two main salt forms that can influence concrete are sodium sulfate and sodium carbonate (Baluch *et al.*, 2002).

Under certain environmental conditions, the concrete material can deteriorate by stresses caused by crystallization of salts in the pores(Hardoy *et al.*, 2013). For example, a retaining wall or slab with a high permeability, in contact with salt sources and subject to moisture loss by high evaporation levels, will have a concentrated salt quantity. This will cause cracking and peeling damages to the concrete infrastructure. This phenomenon is attributed to the significant pressures produced by crystallization of supersaturated salts(Baluch *et al.*, 2002; Mays, 2003).



A B

Figure 5. Cracks, peeling and corrosion are curving around the four corners of the slab to D shape(Mehta and Gerwick, 1982; Talbot and Talbot, 2018).

Damage depends on the salt crystallization location, which is determining the dynamic balance between the rate of evaporation from the surface and the rate of salt supply to that site.

When the rate of evaporation is lower than the rate of saline water supply, the salt crystallization will occur on the external surface, without causing damage. However, when the rate of transmitting salinity liquid through the concrete permeability and porosity is slower than the rate of evaporation, then the crystallization zone will occur substantially inside the concrete cells. Salt crystallization under such conditions will result in a sufficient cell expansion to cause damages, including flaking or spalling over time.

The terms of salt scaling, salt weathering, and salt hydration attack have been used to describe the physical manifestation phenomenon that has been observed with masonry and porous concrete exposed to hydratable salts such as sodium sulfate and sodium carbonate(Neville and Brooks, 1987; Baluch *et al.*, 2002). Thenardite (Na_2SO_4) is converted into its hydrated form [mirabilite ($Na_2SO_4 \cdot 10H_2O$)] at 20°C when the relative humidity is more than 72%, and at 32°C when the relative humidity is $\geq$ 81%(Nord, 1973). More interestingly, the transformation of Thermonatrite ($Na_2CO_3 \cdot H_2O$) into Natron (Na_2CO_3) is occurring at a similar temperature and humidity conditions, which happen to be within the everyday environmental fluctuation range in many parts of the world(Nord, 1973; Hardoy *et al.*, 2013). Due to large differences in the density, considerable volumetric expansion is associated with the transformation of the anhydrous form of these salts into their hydrated form. That is happening as a consequence of numerous of ambient relative humidity and temperature up-and-down cycles(Hardoy *et al.*, 2013). As a result, clear damages and progressive deterioration occur on the concrete surface, which is purely attributed to physical salt attack from a penetrating salt fluid. This problem distinguishes itself from the chemical interactions problem involving cement hydration materials, which have not been recognized to cause structural damage (Spiratos and Jolicoeur, 2000; Mays, 2003; Shetty, 2005).

6.2. Concrete within coastal environments

Influences of seawater on concrete deserve particular attention for several reasons. Firstly, coastal and offshore structures are exposed to several deterioration processes of the chemical and physical components simultaneously(Spiratos and Jolicoeur, 2000). This is providing an excellent opportunity to understand the complexity of concrete durability problems in the field practice(Mays, 2003). Secondly, oceans make up 80% of the Earth's surface area; therefore, a large number of structures are exposed to seawater either directly or indirectly (e.g., winds can carry seawater spray for several miles inland from the coast).

Marine environments influencing the concrete may lead to deteriorate as a result of the combined effects of the chemical action of seawater constituents on the cement hydration products, alkali-aggregate expansion (when reactive aggregates are present), and the crystallization pressure of salts within concrete if the concrete structure is subject to wetting and drying conditions(Spiratos and Jolicoeur, 2000). Contrarily, frost action within cold climates is represented by corrosion of the embedded concrete and steel, especially where wave action and sea spray have pre-stressed the structures through physical erosion and chemical weathering (Hardoy *et al.*, 2013).

Influences on the concrete surface due to any of these causes tends to increase the permeability. That will not only make the material progressively more susceptible to further action by the same destructive factor, but also by some other types of stress. Thus, a maze of interwoven chemical and physical causes of deterioration is combined, which is an advanced stage of vulnerability degradation(Spiratos and Jolicoeur, 2000). That can influence the whole body of the concrete structure, such as the contracted dams infrastructure on riverine systems, which will even have an impact on the associated ecosystem particularly within the estuarine-coastal section (Al-Nasrawi *et al.*, 2016; Al-Nasrawi *et al.*, 2018).

6.3. Cement and colorant-weather interactions

The standard grey colored cement, such as Portland cement products, limits a constructor opportunity for creating surfaces with various appearances(López *et al.*, 2016; Min'ko *et al.*, 2018). White cement incorporated into the exposed surface, can be useful in minimizing weather effects, as it reduces the destructive effect solar waves have on concrete, compared to dark colored cement, for example (Rose *et al.*, 2016).Furthermore, by adding appropriate pigments, white cement can be used as a base for producing cements with varying colors(López *et al.*, 2016; Rose *et al.*, 2016).

The grey color of ordinary Portland-cement clinker is generally due to the presence of iron. Thus, by lowering the iron content of clinker, light-colored cement can be produced(López *et al.*, 2016). When the total iron in clinker corresponds to less than 0.5 percent Fe_2O_3, and the iron is held in the reduced Fe^{2+} state, the clinker is usually white. These conditions can be achieved within cement manufacturing by using iron-free clay and carbonate rock as raw materials, special ball mills, with ceramic liners and balls for grinding the raw mix, and clean fuel such as oil or gas for production of clinker under a reducing environment in the high-temperature zone of the cement rotary kiln. Consequently, white cement is approximately three times more expensive than conventional Portland cement(López *et al.*, 2016; Rose *et al.*, 2016).

7. PROPOSED SOLUTIONS

There are many possible solutions for concrete sustainability. One of the least costly solutions (within a long-term run) is planting a vegetation canopy that belongs to the local environmental conditions (native plants) to cover the concrete surfaces. The buildings with one or two floors can be covered by surrounding big trees to take advantage of their environmental attributes to absorb the solar radiation influences (Akbari *et al.*, 2001). Whereas, higher buildings can plant the vegetation canopy on the top, side, and balconies as shelves (see figure 6).

Figure 6 Vegetation canopy solution, by planting/cultivation native-green covers on top, sides and around buildings within high-temperature regions.

This is more recommended within higher temperatures regions of the tropics, to reduce the heat effects on buildings and inhabitants and the multiple consequential problems (Akbari *et al.*, 2001; Hardoy *et al.*, 2013).

Treating concrete in humid areas will be proposed by using isolating materials, which can make the concrete paste to be attributed with low porosity and high density during the construction stage. This will minimise the impact of permeability and porosity variables within humid environments.

Additional suggested treatment

Below, there are several suggestions for materials listed which can be utilised as treatment solutions to the raised problems;

(a) Plastiment -BV 40 BV 40 - Blastmant

This is Modified Lignosulfonate Engoulvent rate to produce Brown color. It will assist to produce light colored concrete, and the water content B in 40 multi-annealed and economic Concrete. Where it is a description Blastmant Different for different applications(Neville and Brooks, 1987; Spiratos and Jolicoeur, 2000; Shetty, 2005).

This material has been coded as ASTM C 494 type A and BS 5075, and are partly identical to the specifications of the American and British first-quality concrete (In addition to the ordinary low water content that it can be used with).

In user terms, B in 40 is used when construction requires high-quality concrete with the effect of the Plasticizer - used Blastmant.

Useful for the following:

- Concrete surfaces exposed to significantly varying weather conditions.
- Provides the maximum performance efficiency.
- In poor-quality aggregate/concrete body.

- In the production of prefabricated concrete elements.

Using B in 40 will result in the following properties:

- Improves the employability without increasing water portion.
- Reduces the water content without reducing the operability.
- Increases strength.
- Improves the finished surface.
- Minimizes concrete permeability.
- Durations of the mixing or drying processes stay constant.
- Reduces shrinkage and creep.
- Free of chlorides, iron, and disintegrate materials.

(b) Plastiment -ER 340 ARD 340 - Blastmant

This is Modified Lignosulphonate LEGNO Sulvenat rate to produce Brown color. It is added to reduce the water content and the back of the doubt concrete Er R 340 is used as a factor in the annealed and the nape of the forces of doubt, where concrete requires high-material Blastaiment quality in the difficult climatic conditions(Neville and Brooks, 1987; Spiratos and Jolicoeur, 2000; Shetty, 2005).

This material has been coded asASTM C 494 type A + D and BS 5075 and are partly identical to the specified American and British highest-quality.

Useful for the following:

- Concrete exposed to high temperatures.
- Enhancing the concrete surface with good looking and better finishing.
- Within difficult casting conditionsEr R 340 is easier maintained.
- Where long transport durationsoccur between the mixing and casting sites.

Using Er R 340 will result in the following properties:

- Control over the operational problems at high temperatures.
- Certainty over time at high temperatures.
- Stiffens after quick mixing.
- Decrease in water content without loss of interoperability.
- Increased strength.
- Reduced shrinkage and creep.
- Improved finished surfaces.
- Free from chlorides and does not damage the rebar.

8. CONCLUSION

This study analysed and drown some suggested solutions to address the raised problems. Main problems that can be controlled are:

Surfaces within extreme temperatures and drought proposed to apply Heat-reduction processes at the construction site. It is advisable to increase plant cover atop concrete surfaces and around buildings to reduce the direct heat/radiation influences. This should be paid more attention to, especially during mixing and construction processes.

In addition, cold water and other substances, such as using a specific material to cool down the concrete during early stages of concrete mixing and construction within hot weathers including use of ice or/and liquid nitrogen, can be used to reduce the negative impact of high temperatures on the durability and strength of concrete during construction.

Weakness-elimination and selection of durable materials. Cracks need to be peeled and refilled. At the same time, under extreme temperatures, the use of radiation-reflecting light-coloured silicates is advisable or even the application of surface-coating materials which can reduce heat transfer into the concrete. Conversely, dark concrete colorants and silicates are more absorbing the solar radiations and are more vulnerable to be heated.

Wheras, concrete surfaces problems within wet conition, partically within coastal zone, this research suggests a fundamental solution using high-density, low-porous concrete to prevent the diffusion of water into concrete surfaces are affected by environmental conditions.

REFERENCES

[1] Akbari, H., Pomerantz, M. & Taha, H., 2001. Cool surfaces and shade trees to reduce energy use and improve air quality in urban areas. Solar energy, 70, 295-310.

[2] Al-Nasrawi, A. K. M., Hamylton, S. M. & Jones, B. G., 2018. An assessment of anthropogenic and climatic stressors on estuaries using a spatio-temporal GIS-modelling approach for sustainability: Towamba estuary, southeastern Australia. Environmental Monitoring and Assessment, 190(7), 1-26.

[3] Al-Nasrawi, A. K. M., Jones, B. G., Alyazichi, Y. M., Hamylton, S. M., Jameel, M. T. & Hammadi, A. F., 2016. Civil-GIS incorporated approach for water resource management in a developed catchment for urban-geomorphic sustainability: Tallowa Dam, southeastern Australia. International Soil and Water Conservation Research, 4(4), 304-313.

[4] A. S. B. A. and M. A. A. Abdullah Hasan Jabbar, Maytham Qabel Hamzah, Salim Oudah Mezan, “Green Synthesis of Silver / Polystyrene Nano Composite (Ag / PS NCs) via Plant Extracts Beginning a New Era in Drug Delivery,” Indian J. Sci. Technol., vol. 11, no. 22 June 2018, pp. 1–9.

[5] Committee, A. Building code requirements for structural concrete (ACI 318-05) and commentary (ACI 318R-05). 2005. American Concrete Institute.

[6] Gallé, C., 2001. Effect of drying on cement-based materials pore structure as identified by mercury intrusion porosimetry: a comparative study between oven-, vacuum-, and freeze-drying. Cement and Concrete Research, 31, 1467-1477.

[7] Hardoy, J. E., Mitlin, D. & Satterthwaite, D., 2013. Environmental problems in an urbanizing world: finding solutions in cities in Africa, Asia and Latin America, Routledge.

[8] Ismail H & Al-Zubaidi S.A., 1999. laboratory tests for Concrete Technology, Ministry of Higher Education and Scientific Research Foundation, Technical Institutes, Baghdad, Dar technical Printing and Publishing, pp. 53, 36-66, 102, 106, 168-169.

[9] Kamei, K., Ahn, T.-H., Park, J.-H., Hashimoto, T., Ogura, N. & Kishi, T. 2018. Investigation of New Repair Countermeasure Methods Using Crack Self-healing Technologies for Water Leakage Prevention on Subway Tunnels. High Tech Concrete: Where Technology and Engineering Meet. Springer.

[10] López, A., Guzmán, G. A. & Di Sarli, A. R., 2016. Color stability in mortars and concretes. Part 1: Study on architectural mortars. Construction and Building Materials, 120, 617-622.

[11] Malhotra, V. M., 1976. Testing hardened concrete: nondestructive methods, Iowa State Press.

[12] Mays, G. C., 2003. Durability of concrete structures: investigation, repair, protection, School of mechanical, materials and civil Engineering RMCS (Cranfild), second edition. ISBN: 0-203-47347-7, CRC Press.

[13] Mehta, P. K. & Gerwick, B. C., 1982. Cracking-corrosion interaction in concrete exposed to marine environment. Concrete International, 4, 45-51.

[14] Mehta, P. K. & Monteiro, P. J., 2006. Concrete: microstructure, properties, and materials. 2006, Department of Civil and Environmental Engineering, University of California, Berkeley, New York: McGraw-Hill, fourth edition. ISBN: 978-0-07-179787-0.

[15] Michael, M. R. 1963. Building in hot zones. Doctoral Thesis, SWISS FEDERAL INSTITUTE OF TECHNOLOGY, ZURICH, Germany.

[16] Min'ko, N., Dobrinskaya, O. & Bulgakov, A., 2018. Technological Features of Using Secondary Products in the Production of Silicate Materials. Glass Physics and Chemistry, 44, 238-243.

[17] Neville, A. M. & Brooks, J. J., 1987. Concrete technology.

[18] Nord, A. G., 1973. Refinement of the crystal structure of thenardite, Na2SO4 (V). Acta Chemica Scandinavica, 27, 814-822.

[19] Rizzo, E. M. & Sobelman, M. B., 1989. Selection criteria for concrete repair materials. Concrete international, 11, 46-49.

[20] Rose, J. M., Hutchins, C. S., Wyant, T. S. & Karwas, C. P., 2016. Process for manufacturing coated filler particles. Google Patents.

[21] Shetty, M., 2005. Concrete technology. S. chand & company LTD, 420-453.

[22] Spiratos, N. & Jolicoeur, C., 2000. Trends in concrete chemical admixtures for the 21st century. Special Publication, 195, 1-16.

[23] Supplee Sr, W. W., 2003. Concrete admixture with improved durability and efflorescence control containing a highly resilient colorant. Google Patents.

[24] Talbot, D. E. & Talbot, J. D., 2018. Corrosion science and technology, CRC press.