

論文 / 著書情報
Article / Book Information

題目(和文)	海洋環境に暴露した海水練りコンクリート中の鉄筋腐食に及ぼす低温の影響に関する研究
Title(English)	Influence of Cold Temperature on Steel Corrosion in Seawater Mixed Concrete Exposed to Marine Environment
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出典(和文)	学位:博士(工学), 学位授与機関:東京工業大学, 報告番号:甲第10488号, 授与年月日:2017年3月26日, 学位の種別:課程博士, 審査員:岩波 光保,松川 圭輔,日野出 洋文,西方 篤,千々和 伸浩
Citation(English)	Degree:Doctor (Engineering), Conferring organization: Tokyo Institute of Technology, Report number:甲第10488号, Conferred date:2017/3/26, Degree Type:Course doctor, Examiner:,,,,
学位種別(和文)	博士論文
Category(English)	Doctoral Thesis
種別(和文)	審査の要旨
Type(English)	Exam Summary

(博士課程)

論文審査の要旨及び審査員

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論文審査の要旨（2000 字程度）

The doctoral thesis entitled “Influence of Cold Temperature on Steel Corrosion in Seawater Mixed Concrete Exposed to Marine Environment” has the objectives: (1) to study the material properties and durability of cast in-situ and anti-washout concrete mixed with seawater under cold temperature based on the results of short term experiment, (2) to clarify the material properties and durability of seawater mixed concrete based on the results of long term exposure test, (3) to propose the life time prediction method for seawater mixed concrete based on the results of objectives 1 and 2 above and predict the life time of seawater mixed concrete in cold temperature environment, and (4) to conduct the feasibility study on seawater mixed concrete in cold weather condition considering the factors such as strength, corrosion rate and life time. The contents of the thesis are summarized as follows:

Chapter 1- Introduction: Backgrounds, objectives and significance of the study are discussed.

Chapter 2- Literature Survey: A detailed literature review of previous related studies is presented.

Chapter 3- Investigation of Material Properties and Durability of Seawater Mixed Concrete in Cold Weather Condition: The material properties of seawater mixed concrete such as compressive strength development, volume of permeable voids and chloride diffusivity are investigated to clarify the effect of seawater mixing on material property of concrete especially constructed under the cold weather condition of subzero temperature (-5℃, -10℃). Additionally, in order to achieve more controlled and improved constructability and durability requirements of seawater mixed concrete, the effect of corrosion inhibitor and chloride fixing agent on seawater mixed concrete is also investigated. The electrochemical tests such as half-cell potential, polarization resistant, cathodic limit current measurement are performed to assess the durability performance against rebar corrosion. Finally, influence of cold temperature on the material properties and durability of seawater mixed concrete is discussed by comparing with freshwater mixed concrete.

Chapter 4- Investigation of Material Properties and Durability of Seawater Mixed Anti-washout Concrete in Cold Weather Condition: The material property tests of seawater mixed anti-washout underwater concrete such as compressive strength test and consistency flow test are conducted to investigate the constructability under cold weather condition (0℃seawater temperature). The electrochemical tests such as half-cell potential, polarization resistant, cathodic limit current measurement are performed to assess the durability performance against rebar corrosion. Finally, influence of cold temperature on the material properties and durability of seawater mixed anti-washout concrete is discussed by comparing with freshwater mixed anti-washout concrete.

Chapter 5- Investigation of Material Properties and Durability of Seawater Mixed Concrete Exposed to Marine Environment for 32 years: The seawater and freshwater mixed concrete specimens exposed to marine environment for 32 years are investigated to confirm the long term durability performance of seawater mixed concrete under marine environment. The electrochemical tests for half-cell potential, polarization resistant, cathodic limit current measurement are also performed to assess the actual durability performance against rebar corrosion after long term exposure to marine environment. Additionally, the residual compressive strength, corrosion crack occurrence condition, corroded surface area of rebar, and mass and cross section loss of rebar due to corrosion are investigated to clarify the actual deterioration condition and compared with the electrochemical test results, and the influence of factors on durability against rebar corrosion such as mixing water, cover thickness, crack width and cold temperature is discussed.

Chapter 6- Life Time Prediction of Seawater Mixed Concrete Exposed to Marine Environment under Cold Temperature Condition: Life time of seawater mixed concrete against rebar corrosion due to chloride attack is predicted by using the experimental results from Chapters 3, 4 and 5. Life time of seawater mixed concrete is discussed considering the effect of cold temperature, admixtures and cover thickness.

Chapter 7- Feasibility Study of Strength and Durability for Seawater Mixed Concrete in Cold Temperature Condition: Feasibility study of seawater usage in concrete mixing is conducted by consideration of factors such as strength, constructability, corrosion rate and expected life time.

Chapter 8- Conclusions and Recommendations: Conclusions of this study which will be useful for the usage of seawater in concrete mixing in terms of material properties and durability of concrete are outlined.

This study provides significant contribution to the usage of seawater in concrete under cold temperature environment. Therefore, this thesis is considered sufficient for the degree of Doctor of Engineering.

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