

## 【資料】

## 資料 1 調査団員・氏名

資料 1 調査団員・氏名

担当	氏名	所属	派遣期間
総括	杉山 茂	JICA 資金協力支援部 実施監理第一課長	1月22日～1月29日 8月13日～8月20日
技術アドバイザー (補修方法)	柿平 康伸	JICA 国際協力専門員	1月22日～1月31日
技術アドバイザー (コンクリート)	渡辺 博志	(独)土木研究所 上席研究員	1月22日～1月29日 8月13日～8月20日
計画管理	金縄 知樹	JICA 資金協力支援部 実施監理第一課	1月22日～1月29日 8月13日～8月20日
業務主任/補修計画/維持管理計画	米沢 栄二	(株)オリエンタルコンサル タantz	1月22日～2月4日 4月4日～5月11日 8月13日～8月20日
コンクリート診断	坂井 逸郎	(株)オリエンタルコンサル タantz	1月22日～2月4日 4月4日～5月11日 8月13日～8月20日
サイト状況調査	白石 秀幸	(株)長大	1月22日～2月4日 4月4日～5月11日
補修設計	田口 誠司	(株)オリエンタルコンサル タantz	4月18日～5月8日 8月13日～8月20日
施工計画/積算	小国 磨	(株)オリエンタルコンサル タantz	1月22日～2月4日 4月4日～5月11日 8月13日～8月20日

## 資料 2 調査行程

## 資料 2 調査行程

### 現地調査 1

		官団員				コンサルタント団員			
		総括	技術7ドバイ- 補修方法	技術7ドバイ- コンクリート	計画管理	業務主任/補修計画/維持管理計画	コンクリート診断	状況調査	施工計画/積算
		杉山 茂	柿平 康伸	渡辺 博志	金堀 知樹	米沢 栄二	坂井 逸郎	白石 秀幸	小国 磨
1	1月22日 土	MS965 成田13:10 ⇒14:40	KQ320 14:17:20 ⇒14:22:35	MS965 成田13:10⇒14:19:40					
2	1月23日 日	AM: JICA事務所・大使館 事後現状調査結果報告・FU調査内容説明 PM: 関係機関 (運輸省、国際協力省) 表敬							
3	1月24日 月	AM: GARBLT 事後現状調査結果報告・FU調査内容説明 PM: ミニッツ協議・ミニッツ署名							
4	1月25日 火	AM: 移動 PM: 現地調査							
5	1月26日 水	現地調査							
6	1月27日 木	AM: 移動 PM: JICA事務所・大使館報告	現地調査		AM: 移動 PM: JICA事務所・大使館報告	現地調査		現地調査	
7	1月28日 金	MS964 14:16:55	団内会議	AM: 移動 MS964 14:16:55	MS964 14:16:55	団内会議			
8	1月29日 土	⇒成田12:00	団内会議	⇒成田12:00	⇒成田12:00	団内会議			
9	1月30日 日		団内会議			団内会議			
10	1月31日 月		KQ321 14:23:25			団内会議			
11	2月1日 火		⇒14:07:00			現地調査			
12	2月2日 水					AZ897 14:13:10⇒15:30			
13	2月3日 木					AZ782 14:10:40			
14	2月4日 金					⇒成田07:00			

現地調査 2

			コンサルタント団員				
			業務主任/補修計画/維持管理計画 米沢 栄二	コンクリート診断 坂井 逸郎	サト状況調査 白石 秀幸	施工計画/積算 小国 磨	補修設計 田口 誠司
1	4月4日	月	QR803 成田20:50⇒				
2	4月5日	火	⇒ト^-ハ05:15、QR514 ト^-ハ13:50⇒カ16:15				
3	4月6日	水	JICA事務所、関係機関表敬				
4	4月7日	木	AM：移動 PM：現地調査				
5	4月8日	金	団内会議				
6	4月9日	土	団内会議				
7	4月10日	日	現地調査				
8	4月11日	月	現地調査				
9	4月12日	火	現地調査				
10	4月13日	水	現地調査				
11	4月14日	木	現地調査				
12	4月15日	金	団内会議				
13	4月16日	土	団内会議				
14	4月17日	日	現地調査				
15	4月18日	月	現地調査				QR803 成田20:50⇒
16	4月19日	火	現地調査				⇒ト^-ハ05:15、QR514 ト^-ハ13:50⇒カ16:15
17	4月20日	水	現地調査				
18	4月21日	木	現地調査				
19	4月22日	金	団内会議				
20	4月23日	土	団内会議				
21	4月24日	日	現地調査				
22	4月25日	月	現地調査				
23	4月26日	火	現地調査				
24	4月27日	水	現地調査				
25	4月28日	木	現地調査				
26	4月29日	金	団内会議				
27	4月30日	土	団内会議				
28	5月1日	日	現地調査				
29	5月2日	月	現地調査				
30	5月3日	火	現地調査				
31	5月4日	水	現地調査				
32	5月5日	木	現地調査				
33	5月6日	金	団内会議				
34	5月7日	土	現地調査				QR515 カ18:45⇒ ト^-ハ22:00
35	5月8日	日	現地調査				QR802 ト^-ハ00:50⇒ 成田19:20
36	5月9日	月	JICA事務所・GARBLT 現地調査結果報告				
37	5月10日	火	QR515 カ18:45⇒ト^-ハ22:00				
38	5月11日	水	QR802 ト^-ハ00:50⇒成田19:20				

調査結果概要説明

	JICA団員			コンサルタント団員			
	総括	技術アドバイザー コンクリート	計画管理	業務主任/補修 計画/維持管理 計画	コンクリート診断	補修設計	施工計画/積算
	杉山 茂	渡辺 博志	金縄 知樹	米沢 栄二	坂井 逸郎	田口 誠司	小国 磨
1	8月13日	土	EK319 成田 22:00 ⇒ ドバイ 翌03:50		OZ105 成田 19:00 ⇒ EK323 インチョン 23:55 ⇒ ドバイ		
2	8月14日	日	EK927 ドバイ 08:50 ⇒ カイロ 10:40 13:00 JICA事務所				
3	8月15日	月	10:00 GARBLT 調査結果概要説明 PM: 移動 (カイロ ⇒ イスマイリア)				
4	8月16日	火	10:00 GARBLT現地管理事務所 調査結果概要説明 PM: 移動 (イスマイリア ⇒ カイロ)				
5	8月17日	水	10:00 GARBLT フォローアップ協力S/W協議 / S/W署名				
6	8月18日	木	10:00 JICA事務所報告 13:30 大使館報告				
7	8月19日	金	14:45 移動 (ホテル ⇒ 空港) EK924 カイロ 17:50 ⇒ ドバイ 23:30				
8	8月20日	土	EK318 ドバイ 02:50 ⇒ 成田 17:35		EK322 ドバイ 03:30 ⇒ OZ108 インチョン 18:50 ⇒ 成田 21:00		

### 資料3 関係者（面会者）リスト

### 資料 3 関係者（面会者）リスト

#### (1) GARBLT (General Authority For Roads, Bridges And Land Transport)

Hon. Eng. Mahmoud Ezz El-Din	Chairman
Hon. Eng. Mahmoud Atef Albelok	Chairman
Mr. Ibrahim Ismail Amer	Head sector for Bridge section
Eng. (Ms.) Hala Sayed Helmy	H. G. M. for Bridge Maintenance
Mr. Aly Elsafty Abdalla	G. M. for Bridge Maintenance
Eng. (Ms.) Wafaa Mubarak	G. M. for Bridge Construction
Mr. Ibrahim Khalil Ibrahim	G. M. for Bridges Design
Mr. Mohamed Gouda	G. M. for Maintenance Researches of Bridge
Mr. Ashraf Hammad	G. M. for Building
Mr. Usama Ali Fahmy	G. M. for Excuting of Bridges
Eng. Desoky Osman Desoky	Peace Bridge Manager
Eng. Ahmed Mohamed Hassan	Bridges Researches Sector

#### (2) 在エジプト日本大使館

久田 成昭	一等書記官
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#### (3) JICA エジプト事務所

井黒 伸宏	所長
大竹 茂	次長
東 太郎	次長
柳 竜也	所員
高橋 哲雄	所員
水草 浩一	所員

資料 4 討議議事録 (M/D)

資料4 討議議事録 (M/D)

(1) 第1次現地調査時 (2011年1月27日)

**MINUTES OF DISCUSSIONS  
ON THE FOLLOW-UP COOPERATION STUDY  
ON  
THE PROJECT FOR CONSTRUCTION OF THE SUEZ CANAL BRIDGE**

In response to a request from the Government of the Arab Republic of Egypt (hereinafter referred to as "Egypt"), the Japan International Cooperation Agency (hereinafter referred to as "JICA") decided to conduct a Follow-up Cooperation Study (hereinafter referred to as "the Study") on "the Project for Construction of the Suez Canal Bridge" and "the Project for Expansion of the Suez Canal Bridge" (hereinafter referred to as "the Original Project").

JICA dispatched the Follow-up Cooperation Study Team (hereinafter referred to as "the Team") headed by Mr. Shigeru SUGIYAMA, Director, Grant Aid Project Management Division 1, Financing Facilitation and Procurement Supervision Department, JICA, and the Team is scheduled to conduct the study from January 22 to March 7, 2011.

The Team held a series of discussions with the officials concerned of the Government of Egypt and conducted a field survey.

In the course of discussions and field survey, both sides confirmed the main items described on the attached sheets. The Team will proceed to further works and prepare the Final Report.

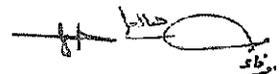
Cairo, January 27, 2011



Shigeru SUGIYAMA  
Team Leader  
Follow-up Cooperation Study Team  
Japan International Cooperation Agency  
JAPAN



Hon. Eng. Mahmoud Atef Albelok  
Chairman  
General Authority for Roads, Bridges,  
and Land Transport  
Arab Republic of Egypt



## ATTACHMENT

### 1. Outline of the Follow-up Cooperation Project

- 1-1. The objective of the Follow-up Cooperation Project ("the Project") is to repair the damages having occurred in the piers of the Suez Canal Bridge (Mubarak Peace Bridge) constructed with assistance of Japanese grant aid, "the Project for Construction of the Suez Canal Bridge" in 1997 and "the Project for Expansion of the Suez Canal Bridge" in 2000.
- 1-2. The viability of the implementation of the Follow-up Cooperation Project will be determined after further analysis in Japan. In principle, Follow-up Cooperation Project can be applied to the Japanese grant aid portion under the projects, "the Project for Construction of the Suez Canal Bridge" in 1997 and "the Project for Expansion of the Suez Canal Bridge" in 2000.
- 1-3. The objectives of the Study are as follows;
  - To conduct further investigations on damages having occurred in the piers of the Suez Canal Bridge to identify extent of damages and their causes, to evaluate soundness of all piers, and to determine appropriate repair and maintenance method
  - To carry out the detailed design of repair works, and
  - To suggest the necessary preventive measures for maintenance in the future

### 2. Schedule of the Study

- 2-1. The Team will proceed to further investigations in Egypt until 7th March, 2011.
- 2-2. JICA will prepare the draft Interim Report in English and dispatch a mission in order to explain and discuss its contents around June 2011.
- 2-3. Based on the results of discussions of the draft Interim Report, JICA will proceed to further examination of the study results and detailed design and the tender document on the Follow-up Cooperation.
- 2-4. JICA will finalize the Final Report including the detailed design by September 2011 and hand it to Egyptian side through the JICA Egypt office.

### 3. Others

- 3-1. The Team explained the result of the first investigations implemented in March and April 2010 and the necessity of further investigations, described in the Inception Report, for in-depth identification and analysis of damages having occurred in the piers of the Suez Canal Bridge and in order to come up with appropriate measures, and Egyptian side agreed.
- 3-2. Both sides agreed to discuss the roles of both Egyptian and Japanese sides on repair works based on the draft Interim Report during the period of the next mission dispatched around June 2011.
- 3-3. The Egyptian side shall provide necessary numbers of counterpart personnel to the Team and conduct necessary coordination with concerned government authorities as required, for the smooth implementation of site survey, during the period of their studies in Egypt.

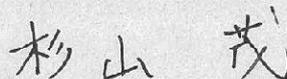
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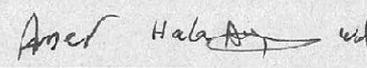
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(2) 調査結果概要説明時 (2011年8月17日)

SCOPE OF WORK  
ON FOLLOW-UP COOPERATION  
FOR  
THE PROJECT FOR CONSTRUCTION  
OF THE SUEZ CANAL BRIDGE  
AGREED UPON  
BETWEEN  
JAPAN INTERNATIONAL COOPERATION AGENCY  
AND  
THE GENERAL AUTHORITY FOR ROADS, BRIDGES,  
AND LAND TRANSPORT,  
THE ARAB REPUBLIC OF EGYPT

Cairo, August 17, 2011

  
Mr. Shigeru SUGIYAMA  
Team Leader  
Follow-up Cooperation Study Team  
Japan International Cooperation Agency  
Japan

  
Eng. Mahmoud Ezz El-Din  
Chairman  
General Authority for Roads, Bridges,  
and Land Transport  
Arab Republic of Egypt

17 / 08 / 2011

## 1. Introduction

In response to the request of the Government of the Arab Republic of Egypt (hereinafter referred to as "Egypt"), the Japan International Cooperation Agency (hereinafter referred to as "JICA") decided to extend the Follow-up Cooperation on the Project for Construction of the Suez Canal Bridge (hereinafter referred to as "the Work").

Accordingly, JICA will undertake the Work in cooperation with the General Authority for Roads, Bridges and Land Transport (hereinafter referred to as "GARBLT").

The present document sets forth the Scope of Work for the Work as agreed upon between JICA and GARBLT.

## 2. Portions to be repaired by JICA and Contractor

Both sides agreed portions to be repaired by JICA and Contractor (Kajima Corporation) as shown in Annex 1, and agreed that each agency should implement each repair work by each budget. After the conclusion of S/W, JICA will execute detailed design of repair works and will deliver the final report including documents of detailed design and maintenance manual of concrete substructure to GARBLT through JICA Egypt office by December, 2011.

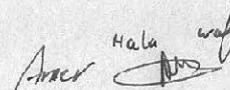
## 3. Scope of Work

The Work shall cover the following:

1. Tender and contract of portions to be repaired by JICA
2. Repair work of portions to be repaired by JICA
3. Supervision of repair work by JICA

## 4. Work Schedule

The Work will be carried out in accordance with the tentative work schedule as shown in Annex 2.



## **5. Release of JICA's Defect Liabilities**

Both sides agreed that JICA shall have no obligation for any defects on the Work.

## **6. Major Undertakings to be taken by JICA and GARBLT**

Both sides confirmed that, for the smooth implementation of the Work, JICA and GARBLT should particularly implement major undertakings as described in Annex 3.

Furthermore, GARBLT agreed upon its proactive involvement and OJT (On-the-Job Training) of its officials directly involved through the repair work.

## **7. Mutual Consultations**

Both sides shall consult with each other on any matters that may arise from or be connected with the Work prior to actual response to the matters.

## **8. Recommendations for Operation and Maintenance**

JICA has proposed "Operation and Maintenance Plan for Concrete Substructure (Piers and Abutment) of the Suez Canal Bridge" (as shown in Annex 4) through the Follow-up Cooperation Study. For the safe and appropriate operation of the Suez Canal Bridge, it is recommended that GARBLT should follow this Operation and Maintenance Plan after repair works.

### **List of Annexes**

Annex 1: Portions to be repaired by JICA and Contractor

Annex 2: Tentative Schedule

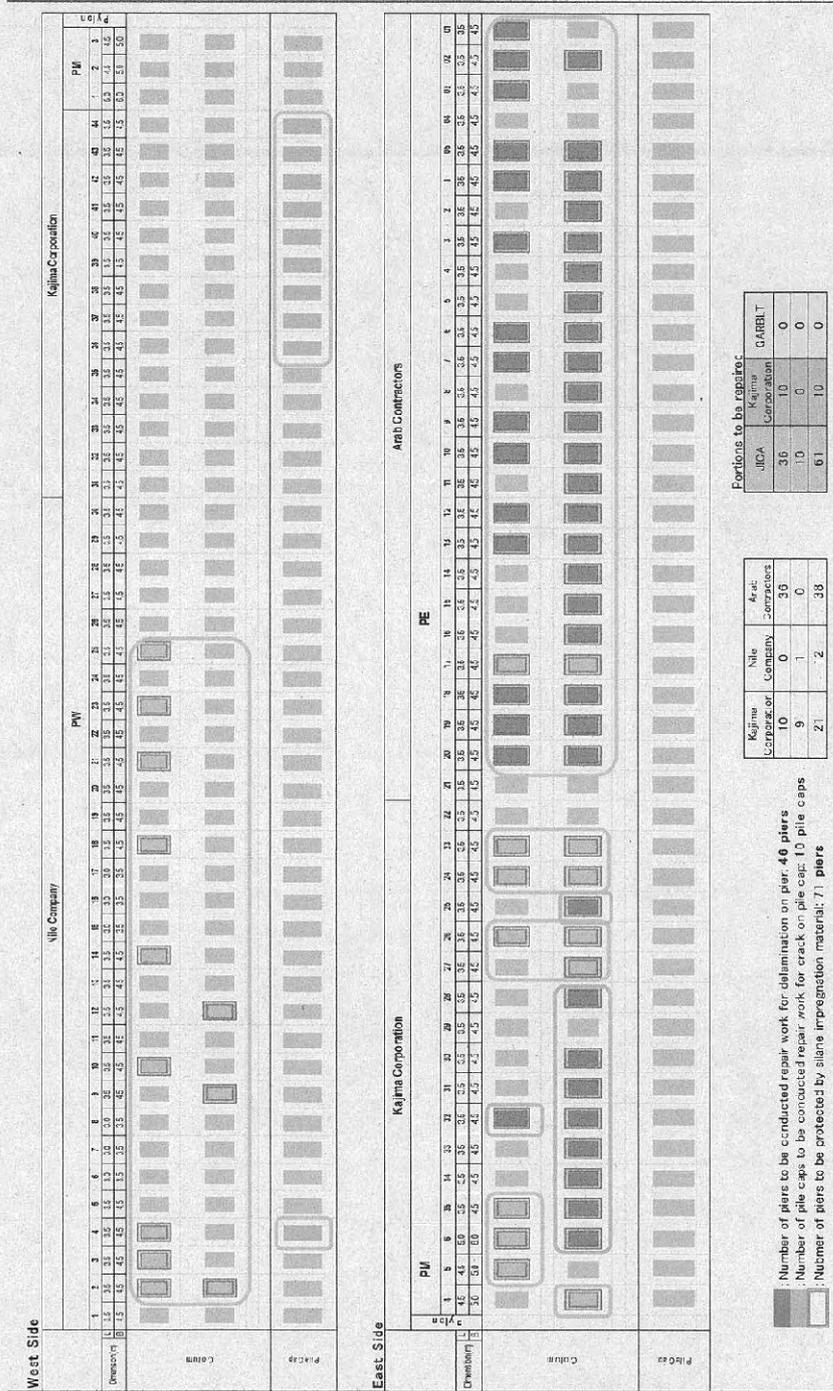
Annex 3: Major Undertakings to be taken by JICA and GARBLT

Annex 4: Operation and Maintenance Plan for Concrete Substructure (Piers and Abutment)  
of the Suez Canal Bridge



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Annex 1. Portions to be repaired by JICA and Contractor



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Amer Hala *waf*

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Annex 2. Tentative Schedule

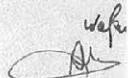
Item	2011			2012						2013														
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun		
JICA																								
Detailed Design																								
Delivery of Final Report to GARBLT																								
Procurement of Consultant on Supervision																								
Tender and Contract on Repair Work																								
Repair Work by JICA																								
Contractor																								
Repair Work by Contractor																								

Approved Hala 

Annex 3. Major Undertakings to be taken by JICA and GARBLT

No.	Items	To be covered by JICA	To be covered by GARBLT
1	To ensure unloading and customs clearance at port of disembarkation in recipient country		
1)	Marine (Air) transportation of the products from Japan to the recipient country	●	
2)	Tax exemption and custom clearance of the products at the port of disembarkation		●
3)	Internal transportation from the port of disembarkation to the project site	●	
2	To accord Japanese nationals, whose service may be required in connection with the supply of the products and the services under the contract, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		●
3	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contracts		●
4	To maintain and use properly and effectively the facilities constructed and equipment provided under the Work		●
5	To bear all the expenses, other than those to be borne by the Work, necessary for the construction of the facilities as well as for the transportation and installation of the equipment		●
6	To provide necessary information, such as tender schedule of repair work by GARBLT, to JICA. Information which may affect the basic concept of the Work is especially important.		●
7	To acquire necessary permission, such as acquisition of permission to enter the project site.		●

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Amer Hala 

Annex 4: Operation and Maintenance Plan for Concrete Substructure (Piers and Abutment)  
of the Suez Canal Bridge

Method of Inspection

“OPERATION AND MAINTENANCE MANUAL”, which was prepared by The Kajima-NKK Nippon Steel Consortium July 2001, has not described on the inspection methods for concrete structure therefore these are provided hereunder as the results of Study.

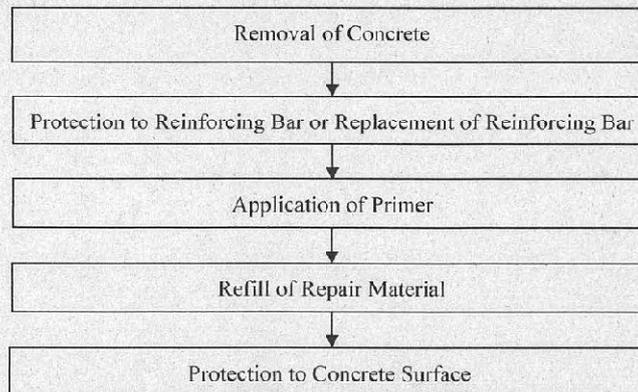
Object	To be inspected	Method of Inspection	Maintenance period
Concrete (Damage, Deterioration)	Efflorescence	Visual inspection	Daily/Periodical (every year)
	Delamination	Test hammering	Periodical (every five year)
	Carbonation	Chipping	Periodical (every five year)
	Chloride content	Drilling, Coring	Periodical (every five year)
	Generation of cracks	Crack scale	Periodical (every five year)
Reinforcement (Corrosion)	Rate of corrosion	Chipping, Half-cell potential	Special/Emergency

Method of Repair works

When delamination is observed at the inspection, the repair work shall be carried out based on the following work procedure.

In case the area of repair is larger than 300 mm x 300 mm, grout material shall be applied to refill repair material by form.

In case the area of repair is smaller than 300 mm x 300 mm, polymer cement mortar shall be applied to refill repair material by plastering.



*SS*

Amer Hala *wat*

## 資料 5 協議資料

## 資料5 協議資料

調査結果概要説明時 (2011年8月17日)

ORIENTAL CONSULTANTS CO., LTD.  
CHODAI CO., LTD.

### Follow-up Cooperation Study on the the Project for Construction of the Suez Canal Bridge




#### SITE SURVEY REPORT (INTERIM REPORT)



17th August, 2011  
Oriental Consultants Co., Ltd.  
Chodai Co., Ltd.

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ORIENTAL CONSULTANTS CO., LTD.  
CHODAI CO., LTD.

### Contents

1. Results of Survey
2. Cause of Deterioration
3. Evaluation of Structural Soundness
4. Place of Preventive Work
5. Method of Repair Work
6. Portions to be Repaired by JICA, GARBLT and Contractor
7. Work Schedule (Tentative)
8. Recommendation for Operation and Maintenance

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CHODAI CO., LTD.

### 1. Results of Survey (1/2)

#### (1) Delamination on Pier and Pile Cap (1/2)

- Number of **damaged piers** to be repaired was **46 out of 180**.
- **Insufficient concrete covers** were **approximately 50% of total**.  
(Only lowest parts of pier, less than 4 m)
- ⇒ It is difficult to blame contractor's responsibility for this insufficient concrete cover at this stage after 10 years of completion because;
  - No critical impact on structural soundness
  - Defects liability period was expired.
- **No tendency of corrosion of reinforcing bar** was found at all chipping points including with minimum cover depth and minimum natural potential.

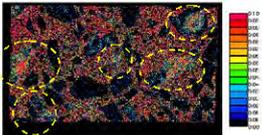
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CHODAI CO., LTD.

### 1. Results of Survey (2/2)

#### (1) Delamination on Pier and Pile Cap (2/2)

- **Carbonation depths** will not reach to the design cover depth of 70 mm in 100 years.
- **Chloride contents** in deeper than 60 mm were **less than critical value of 1.2 kg/m<sup>3</sup>**, approximately 1.0 kg/m<sup>3</sup> in average.
- High chloride content of 1.5 kg/m<sup>3</sup> in PE21 **will not influence on corrosion of reinforcing bar** because it is still stable inside coarse aggregates.



#### (2) Crack on Pile Cap

- Number of **cracked pile cap** to be repaired was **10**.

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### 2. Cause of Deterioration

#### (1) Delamination on Pier and Pile Cap

- It is considered from following survey results that delaminations have occurred by **chloride attack** with water and oxygen supply from ground surface.
- Chloride content on the concrete surface exceeds 1.2 kg/m<sup>3</sup> by chloride attack.
- Carbonation depth is deep, 15 to 20 mm.
- Concrete cover is less than 50 mm at delamination points.

#### (2) Crack on Pile Cap

- It is considered from following survey results that cracks have occurred by **thermal restraint** with heat of cement hydration.
  - Cracks on upper surface have grillage-like regular pattern, namely, at orthogonal regular intervals (1 to 2 m).
  - Depth of crack exceeds 200 mm at the 0.5 mm width of crack.

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### 3. Evaluation of Structural Soundness

#### (1) Delamination on Pier and Pile Cap

<ul style="list-style-type: none"> <li>➢ <b>Damage</b> on concrete surface</li> <li>➢ <b>No damage</b> on concrete surface, but <b>insufficient concrete cover</b></li> <li>➢ <b>No damage</b> on concrete surface, and <b>sufficient concrete cover</b></li> </ul>	⇒ <b>Grade III (Repair and preventive works are required.)</b> ⇒ <b>Grade I (No repair work) or Grade II (Preventive work is required.)</b> ⇒ <b>Grade I (No repair work)</b>
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→ **Preventive work** shall be determined according to the following pier conditions.

- Concrete Cover Depth (Measured by RC Radar)
- Chloride Content
- Carbonation Depth

#### (2) Crack on Pile Cap

- **Repair work** is required for cracks with **wider than 0.35 mm**.

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## 4. Place of Preventive Work

### (1) Place to be prevented

Place of preventive work shall be determined according to the following pier conditions.

- Carbonation reaches existing reinforcing bar, and chloride content becomes more than 1.2 kg/m<sup>3</sup> because of insufficient concrete cover in the following target years.
- As target years, 20, 50 and 100 years from completion of construction (10, 40 and 90 years from now) shall be considered.

### (2) Options for Preventive Work

Option 1: Target years 20 (50 piers), 0.55 million USD  
 Option 2: Target years 50 (71 piers), 0.73 million USD => Most Recommendable  
 Option 3: Target years 100 (101 piers), 0.95 million USD  
 Option 4: All piers with insufficient concrete cover (172 piers), 1.51 million USD

\* Durability of preventive work is assumed around 20 years.

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## 5. Method of Repair Work

### (1) Delamination on Pier and Pile Cap

- Repair work shall be conducted for damaged places based on the work procedure. (46 piers)
- Preventive work shall be applied on concrete surface using silane impregnation material which facilitates surface inspection with its transparency. (71 piers)

Repair Work Procedure

```

      graph TD
      A[Removal of Concrete] --> B[Protection to Reinforcing Bar or Replacement of Reinforcing Bar]
      B --> C[Application of Primer]
      C --> D[Refill of Repair Material]
      D --> E[Protection to Concrete Surface]
    
```

### (2) Crack on Pile Cap

- Filling material shall be refilled in cracks after U-shape cut of cracks.(10 pile caps)

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## 6. Portions to be Repaired by JICA, GARBLT and Contractor

### (1) Portion to be Repaired

#### Original Contractor-wise

Sponsor of Original Construction	GOJ	GOE	GOE
Contractor	Kajima Corporation	Nile Company	Arab Contractors
Refill of Repair Material	10 piers	0 piers	36 piers
Repair of Crack	9 pile caps	1 pile caps	0 pile caps
Protection to Concrete Surface (Option 2)	21 piers	12 piers	38 piers

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## 6. Portions to be Repaired by JICA, GARBLT and Contractor

### (2) Demarcation of Repair(1/3)

#### Initial

Sponsor of Original Construction	GOJ	GOE
Implementing Organization for Repair	JICA	GARBLT
Refill of Repair Material	10 piers	36 piers
Repair of Crack	9 pile caps	1 pile caps
Protection to Concrete Surface (Option 2)	21 piers	50 piers
Cost (Draft)	0.20 Million USD (1.2 Million EGP)	0.53 Million USD (3 Million EGP)

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### (2) Demarcation of Repair(2/3)

- 1) GARBLT agreed that no significant violation by construction was found.
- 2) GARBLT requested JICA to undertake GARBLT portion because of technical difficulty (no experience, need Japanese expertise, financial difficulty, probably can not conduct).

=> JICA will accept it on the following conditions;

- Repair work to be conducted with proactive involvement and OJT of GARBLT officials, and
- Subsequent maintenance work to be committed by GARBLT.

- 3) Kajima offers that they repair damaged portion.

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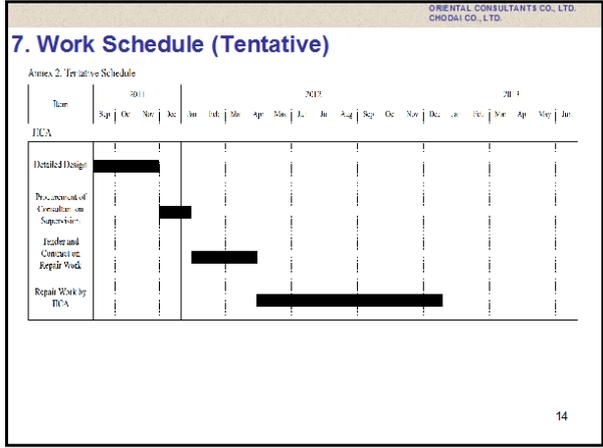
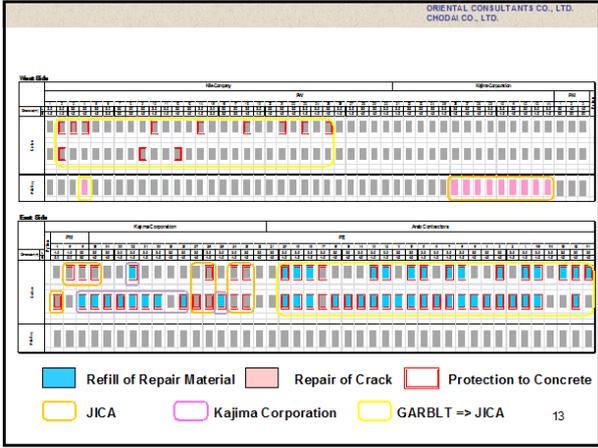
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### (2) Demarcation of Repair(3/3)

#### Final

Sponsor of Original Construction	GOJ	GOJ	GOE
Implementing Organization for Repair	JICA	Kajima Corporation	JICA
Refill of Repair Material	0 piers	10 piers (Damaged)	36 piers
Repair of Crack	9 pile caps	0 pile caps	1 pile caps
Protection to Concrete Surface (Option 2)	11 piers	10 piers	50 piers
Cost (Draft)	0.11 Million USD (0.7 Million EGP)	0.09 Million USD (0.5 Million EGP)	0.53 Million USD (3 Million EGP)

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### 8. Recommendation for Operation and Maintenance

**Method of Inspection**

Object	To be inspected	Method of inspection	Maintenance period
Concrete (Damage, Deterioration)	Efflorescence	Visual inspection	Daily/Periodical (every year)
	Delamination	Test hammering	Periodical (every five year)
	Carbonation	Chipping	Periodical (every five year)
	Chloride content	Drilling, Coring	Periodical (every five year)
	Generation of cracks	Crack scale	Periodical (every five year)
Reinforcement (Corrosion)	Rate of corrosion	Chipping, Half-cell potential	Special/Emergency

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