



SIKA AT WORK

MAPLE LEAF CEMENT FACTORY, ISKANDERABAD, DAUD KHEL

REFURBISHMENT OF CEMENT SILOS & CF SILOS

MAPLE LEAF CEMENT FACTORY, ISKANDERABAD, DAUD KHEL STRUCTURAL STRENGTHENING WITH SIKA CARBODUR® SYSTEM

Project:

Maple Leaf Cement Factory (MLCFL) is owned by Kohinoor Maple Leaf Group (KMLG) which is one of the largest cement manufacturers in Pakistan. Maple Leaf Cement Factory (MLCF) located in Iskanderabad, Mianwali, is a leading producer of Portland cement in the country with Installed capacity of 10,700 tons of Ordinary Portland Cement (OPC) per day. On 26th October 2015 an earthquake of magnitude 7.5 on Richter scale struck Afghanistan; the epicenter of the earthquake was 45 kilometers east of the City of Farkhar in Thakar Province which caused damages in two cement silos and one continuous feed mill silo in Maple Leaf Factory along with ancillary structures such as the packaging plant and the storage warehouse.

Project Requirements:

Maple Leaf Cement is the third largest cement factory in Pakistan. There are two cement production lines in the factory namely: Line-1 and Line-2, each having its own kiln for clinker production. The damages observed in the Line-2 cement silos and the CF silo following the 26 October 2015 Earthquake required Sika products worth Rs.90 Million. Damages comprised of vertical direction cracks in the silo walls at the ground level, the appearance of cracks on the underside of the material support slabs, and the cracks in the silo walls below the material support slab. Vertical direction cracks in the silo walls at the ground level were at fairly regular interval of 2 to 3 meters along the circumference of the silo walls and the height of the cracks ranges from 2 to 3 meters. This type of cracks was observed both in the two cement silos as well as the CF silo for the Line-2.

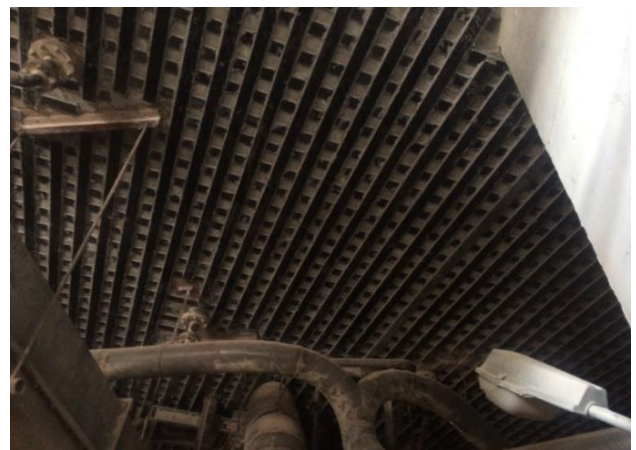


Where, the length of vertical cracks in Silo walls below the material support slab ranged from 1.5 to 2.0 meters and their width ranged from 0.15 mm to 1.0 mm. Cracks on the underside of the material support slabs were considered to be mostly flexure cracks and were concentrated in the area of the slab between the supporting columns. The width of these cracks ranged from 0.15 to 0.6 mm. In order to repair these cracks, Maple leaf demanded repair mortar based on a combination of epoxy resins. Adhesive for Bonding Reinforcement was also demanded for bonding CFRP plates to concrete. In addition to this, low viscosity Injection resins were also demanded to fill and seal voids and cracks in structures. Moreover, Maple leaf demanded CFRP plates for strengthening of material support slab of the CF Silo.

Sika Solution:

Sika strengthening system demonstrates performance, reliability and durability with sustained added value to building and civil engineering structure owners, consultants and contactors. In order to provide Maple Leaf a unique strengthening solution Sika suggested it's widely recognized and established Sika CarboDur® System- a carbon fiber reinforced polymer (CFRP) strengthening solution for the refurbishment of Cement Silos & CF Silos. The CF Silo is of critical importance for operation of the rotary kiln as the raw meal is fed to the kiln from the CF Silo. The material support slab of the CF Silo had to be strengthened during the routine 2 to 3 weeks maintenance shutdown of the rotary kiln. Sika CarboDur® S-812 plates were suggested for strengthening of the slab. Sika CarboDur® S-812 plates are pultruded carbon fibre reinforced polymer (CFRP) laminates designed for strengthening concrete, timber and masonry structures. Sika® CarboDur® plates are bonded onto the structure as externally bonded reinforcement using Sikadur®-30 LP structural adhesive. 14,800 linear meters Sika® CarboDur® plates were used for the refurbishment of 3 Silos. Further, Sikadur 30 LP which is an adhesive for Bonding Reinforcement was suggested. Sikadur®-30 LP is used for bonding structural reinforcement particularly in conjunction with Sika® CarboDur® Plates during structural strengthening works. It's a High strength adhesive. 9,000 Kg of Sikadur®- 30 LP was used for the bonding of CarboDur plates.

In addition to this, Sikadur®- 31 LP was suggested for repairing the cracks. 9,500 Kg of Sikadur®- 31 was used for crack filling in Cement & CF Silos. All the cracks were to be cut open to start with, approximately 2 cm wide and 2 cm deep. Sikadur®31 is a Thixotropic Epoxy Resin Adhesive and repair mortar, based on a combination of epoxy resins and specially selected high strength fillers. Sikadur®-31 LP is an extremely versatile product as it provides excellent mechanical strengths. For repairing of the cracks, they were injected using low viscosity material Sikadur® 52 LP Slow. Sikadur® 52 LP Injection are used to fill and seal voids and cracks in structures such as bridges and other civil engineering buildings, industrial and residential buildings.



It not only forms an effective barrier against water infiltration and corrosion promoting media, but it also structurally bonds the concrete sections together. Lastly, Sikadur[®] -42 MP Slow was recommended for grouting of anchors & steel re-bars. Sikadur[®]-42 MP is a multi- purpose moisture tolerant, epoxy grouting system.



Final look of Silos after the application of Sika CarboDur[®] structural strengthening system

FOR DETAIL
(REFER DWG.4G421)



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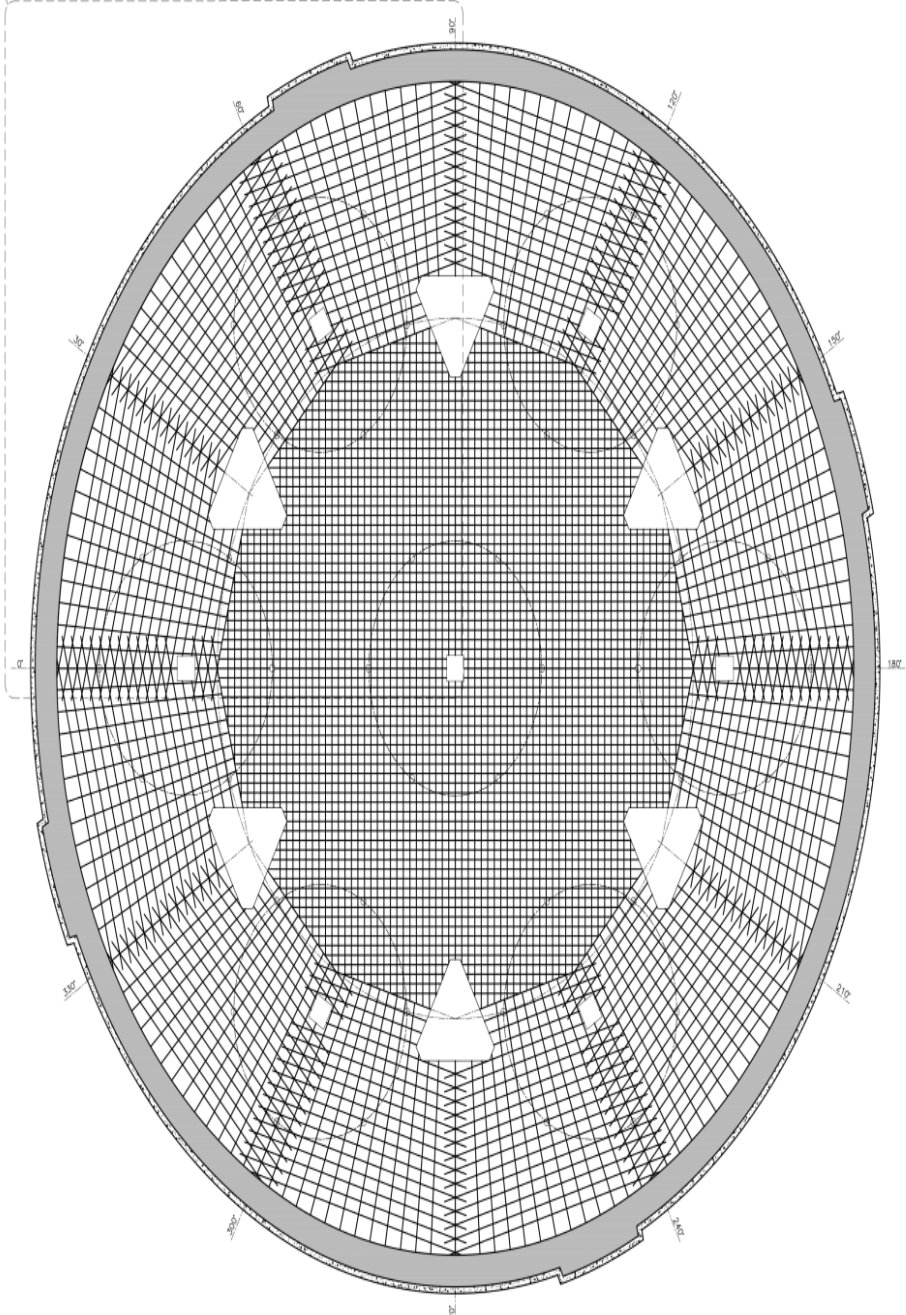
NOT TO BE USED FOR CONSTRUCTION
FOR TENDER PURPOSE ONLY

NOTES:

1. FOR GENERAL NOTES REFER DRAWING NO. 3594/031/C/G002.
2. ALL DIMENSIONS ARE IN MILLIMETER AND LEVELS IN METER.
3. FOR OTHER NOTES REFER DRAWING NO. 3594/031/TD/5G01.
4. SUBSTRATES MUST BE SOUND, DRY, CLEAN AND FREE FROM LAITANCE, GREASE, OILS, OLD SURFACE TREATMENTS OR COATINGS AND ANY LOOSELY ADHERING PARTICLES.
5. CONCRETE MUST BE CLEANED AND PREPARED TO ACHIEVE A LAITANCE AND CONTAMINANT FREE, OPEN TEXTURED SURFACE.
6. THE SURFACE TO BE STRENGTHENED MUST BE LEVELLED, WITH VARIATIONS AND FORMWORK MARKS NOT GREATER THAN 0.5mm. PLANE AND LEVEL OF THE SUBSTRATE TO BE CHECKED WITH A METAL BATTEN. TOLERANCE FOR 2m LENGTH MAX. 10mm.
7. THE SIKA CARBODUR®-S812 MAY BE SLIGHTLY ADJUSTED AT SITE TO AVOID INTERFERENCE WITH THE FIXTURES UNDER THE SLAB.
8. CENTERLINE OF SIKA CARBODUR®-S812 ARE SHOWN FOR CLARITY.

SCALE 0 1 2 3 4 METERS

SCALE 1 : 50
UNLESS OTHER WISE NOTED



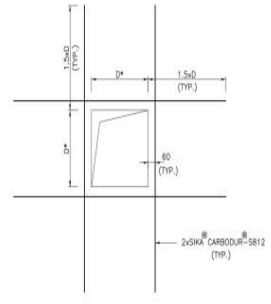
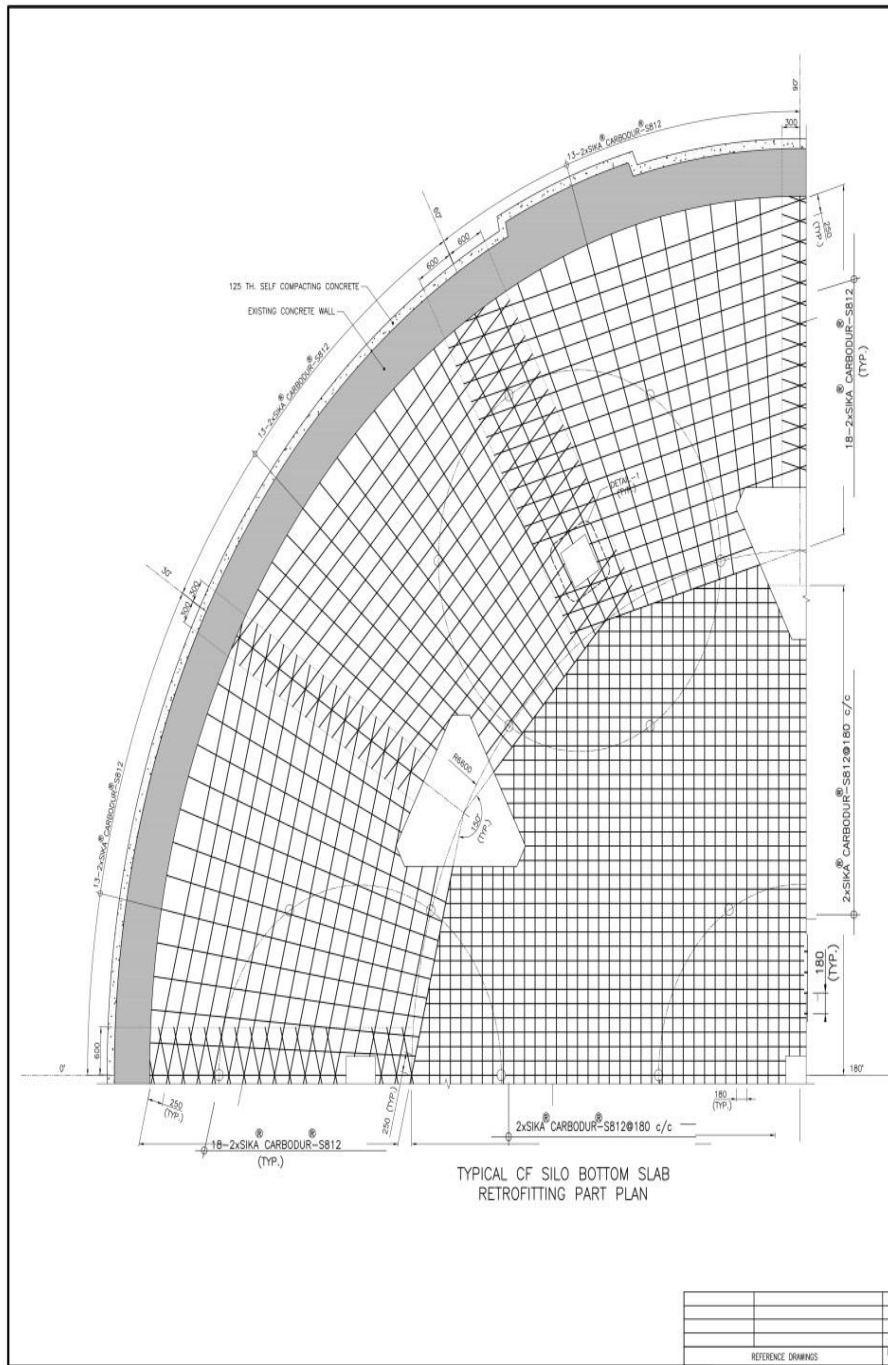
TYPICAL CF SILO BOTTOM
SLAB RETROFITTING DETAIL

MAPLE LEAF CEMENT FACTORY LTD.
CONTINUOUS FEED (CF) SILO
BOTTOM SLAB RETROFITTING PLAN
LEVEL AT(+) 258.800

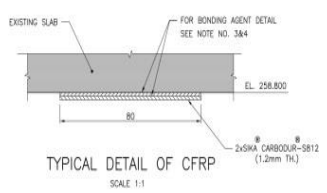
NIES NATIONAL ENGINEERING SERVICES
PAKISTAN (PVT.) LTD. LAHORE

DESK	NE/PAK	RECOMMENDED	VER./CHKD.	APPROVED
DWN.	AHMED/SA			
CHKD.		DATE	DRAWING NO.	REV.
DATE	08/05/2015	3594/031/TD/5G07		

Design of Sika CarboDur® strengthening system



DETAIL-A
 ADDITIONAL CFRP FOR OPENING
 10 ± 1000
 SCALE 1:15



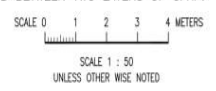
TYPICAL DETAIL OF CFRP
 SCALE 1:1

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NOT TO BE USED FOR CONSTRUCTION
 FOR TENDER PURPOSE ONLY

NOTES:

1. FOR GENERAL NOTES REFER DRAWING NO. 3594/031/C/G002.
2. ALL DIMENSIONS ARE IN MILLIMETER AND LEVELS IN METER.
3. FOR OTHER NOTES REFER DRAWING NO. 3594/031/TD/5G01.
4. USE SIKADUR®-30 FOR BOND BETWEEN CFRP AND CONCRETE SLAB.
5. USE SIKADUR®-30 FOR BOND BETWEEN TWO LAYERS OF CFRP.



MAPLE LEAF CEMENT FACTORY LTD.			
CONTINUOUS FEED (CF) SILO BOTTOM SLAB RETROFITTING PART PLAN LEVEL AT(+) 258.800			
DESN.	INSP.	RECOMMENDED	VER./CHK.
DNK	JHMS/SA		
CHK.		DATE	DRAWING NO.
		DEC, 2015	3594/031/TD/5G08
BY	CHK.	APPR.	RET.

REFERENCE DRAWINGS	REV.	DATE	DESCRIPTION	BY	CHK.	APPR.

Project Name: Maple Leaf Cement Factory
Project Owner: Maple Leaf Cement
Consultant: Naional Engineering Services of Pakistan
Contractor: Maple Leaf Cement

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