MONSOON PREPARATION WORK AT DK-G AREA MOENJODARO DURING 2005

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Introduction

Moenjodaro, an important metropolis of the Indus valley civilization located 500 Kms north of Karachi in Pakistan on the right bank of River Indus. Moenjodaro is universally recognized as a land mark in the development of human civilization and is the most prominent third millennium Bronze Age City in the world. Excavation in 1920s revealed one of the most ancient cities in the World, built in accordance with carefully designed urban planning.

Moenjodaro have had active commercial contact with Mesopotamia- the Indus civilization is believed to have existed from 2350 to 1800 BC. Moenjodaro is divided in to the citadel and a lower city, or residential area; most of the buildings were made of backed bricks. In the citadel important buildings are Granary, Great Bath, Pillared Hall & the place of learning. One can see a row of bathrooms, interpreted to be the priest baths. Stupa dated to 2nd century AD in the citadel also having Buddhist Monastery.

Lower city also well planned transverse by its backbone, (First Street). Both wide and narrow streets run across from north to south, with connecting streets running east to west. Houses oriented towards north–south and east- west directions with meticulously arranged drainage system & large number of wells.

Though several years of research by different nations and different scientists have been invested, we still know very little about the largest Bronze Age City in the World. Scientific conservation can only be carried out in coordination with research. Moenjodaro is the only city in the World supplying such a wealth of information about what life was like in the third millennium.

DK-G Area

DK-G Area lies in the north of the site named after its first excavator Mr. Dikshit who started excavation in this area in the winter season 1924-25.

During the second excavation campaign guided by E.J.H. Mackay (1927-31) the area of excavation was extended and in the southern part brought deeper until it reached ground water in some zones. A network of broad streets structures the DK-G Area. The biggest one called First Street marks the eastern end of the excavated area of DK-G and can be traced southwards to the southern limits of the city.

A second broad path “Central Street” is dividing whole DK-G Area in a northern and southern section running almost straight in E-W direction leading, perpendicular to First Street. The extension in N-S direction is approx. 220m and 120m in E-W direction. The mound reaches a height of 52m amsl on the northern edge and the “deep area” is going down to 48m amsl.

Main intention of the deep diggings executed in this southern section was to clarify the different habitation periods during time leaving us nowadays up to 5m high walls and wells exposed to heavy environmental conditions.

Main feature of the DK-G Area is the readable signs of occupation levels, which appear by different architectonic elements like doorsills and drain outlets on different heights of the walls.

Status 1987

The DK-G Area was treated on at large scale. Therefore, it is important to identify these zones of primary importance documented as original structures in the Condition Report of 1987 prepared by RWTH Aachen.

Only 20% of the brickwork of almost 28.000 m² of excavated area can be regarded as original [Jansen2001]. On the Condition plan of 1987, there is Block 29 to mention in the west and Blocks 19-20-23-24-27-28 in the north-eastern part, which are stated to be original fabric in state of danger (Red).

In these zones, wells and pavements were to be found in the way they have been excavated. In addition, Block 17 on the north-western edge of the site is marked endangered (Orange), though treated or reconstructed brickwork.

Block 18 is the largest coherent habitation entity with many small subdivisions formed by thin brickwork. It is marked almost entirely as treated brickwork (yellow) with remains of original fabric, some of, which are marked endangered also.

Blocks 14-15-16-17, all on the west side of Central Street have undergone large reconstruction as almost in all walls horizontal Damp Proof Courses (DPC) has been applied. As the height of these walls is within 1m to 1,60m it is very likely that they have been dismantled completely while introducing the DPC and reconstructed afterwards, they are classified treated (yellow).

The part of DK-G southern to Central Street is the zone where the deep diggings took place. Already during excavation walls had to be stabilized and partly been removed as the excavation went deeper.

As this part of the city is also visited by many tourists, interventions have been taken at large scale during time leaving only very little parts in original condition. These are to find mainly in the south-western part close to the high rising slope of the mound and in the parts, which are the deepest in the middle of Long Lane.

This area on the north of Long Lane shows the highest inclination going down from the level of 51m at Central Street to 48.5m amsl [SMARS survey map 2004].

In addition, some houses still are filled with soil, while the surrounding surface level was brought deeper. In some cases, this soil is not touch by any excavation or conservation treatment and holds archaeological valuable substance on its surface.

Status 2004

A mayor impact to the original fabric is the effect of the crystallizing salts in the soil in conjunction with humidity.

This is the case in the very north-eastern part of DK-G north, an area with standing walls in 1987. It occurs in Block 21 and 25 at the end of Central Street as well as in the upper north of Block 18. Block 20 highly endangered and will disappear as the adjunct blocks to the east already did. The salt effect is worsened by water running down the slope from the north and is being captured by the first walls on Block 19.

Because of the water captured in between the room pattern, base zones of walls are heavily affected by erosion. Restoration measures undertaken still include the installing of DPC too high above ground level. The erosion process below is not affected by this means, therefore leading to a total disintegration of the base zone.

UNESCO Mission – RWTH Aachen – Moenjodaro 2004

The most harmful damages occur through decomposition of brickwork within the range of flowing water.

DK-G north is much less affected (end of West Street and its adjunct higher topography) than the centre of DK-G south. Because of the deep diggings and its current topography, a lot of water is gathered within the blocks south of Central Street during rainfalls.

As it is evident from the topographic survey of Pierre Smars the central part of the southern section is some 4m lower than the northern section, leading rainfall water to speed up on the ground and causing heavy damages.

Damages caused by flowing water

Deep tunnels are washed out endangering structures and also persons walking on this instable ground.

Fine grain is washed away leaving holes in which debris and brickwork is visible. Beside the structural damage, occurring to the walls also still unexcavated material of archaeological interest is affected as it is washed away from its original location or even destroyed.

Effect of water tunnels

Repair actions taken are of very poor quality and do not take pre-existing bonding system in account. It is to doubt if they last the next rain season.

Especially affected by this are the Blocks 8, 8a, 9a, and 9, which communicate on the northern site directly with Central Street, thus collecting all the rainfall water coming from the upper north part of DK-G.

The water drains through walls or flows superficially to the deepest part until it gets captured in the courtyard of House VI in Block 9 at 48m amsl. [Survey map Smars 2004].

As the general level within the centre of DK-G south area remains at this height water flow stops here and is pouring into the ground and/or evaporates. As it can be seen from the survey map the drainage canal in the west (continuation of Long Lane) goes quite even at 47.5m amsl having no effect on the centre part of DK-G.

In the DK-G South area there are to find some blocks, in which the soil remained within the houses while the excavation outside the boundary masonry went deeper mostly following the street pattern.

Accelerated salt action on partly excavated walls is visible especially along First Street where almost any house has a higher surface level then the outside. In these areas in some cases vertical Damp Proof Courses have been applied along the inner surface of the houses.

Uneven excavation and drainage flow

Due to uncontrolled drain of collected water along the inside of the wall there have appeared dangerous movements. Walls are bulging because of horizontal pressure combined with washing out of the bonding brick structure. This leads in one case to a delicate top-heavy situation on a very narrow place in between Low Lane and First Street thus increasing possibility of hurting visitors from down falling pieces.

Disappeared Structure: DK-G North-Area

Condition 1987 Code Length (m)

Original structure White 10 m

Endangered structure Red 260 m

Treated + endangered structure Orange 35 m

Treated structure Yellow 45 m

Totally 370 m

Disappeared Structure: DK-G South-Area

Condition 1987 Code Length (m)

Original structure White 30 m

Endangered structure Red 35 m

Treated + endangered structure Orange 35 m

Treated structure Yellow 30 m

Totally 130 m

Conclusion

Recommendations for Short Term Action

Prevent water from entering into blocks heavily suffering from water erosion by sealing door openings with mud bricks forming a concave shape.

Introduce low barriers of condensed mud bricks along the same isohyptic lines on the ground to break up water speed and control direction of water flow.

Stabilize of already damaged structures by underpinning.

Removal of failing mud slurry and its re-application; application of mud plaster on the walls heavily affected by erosion below DPC level.

Use highly compressed mud bricks to fill the water tunnel after previously laying out geo-textiles as a separation indicator.

Following the recommendations, during the monsoon season 2005 the following measures undertaken keeping in view safeguarding the structures from damage of monsoon rains.

Water from north through Central street towards south, blocked properly and diverted towards drain on the west side.

Gullies, holes, furrows and ditches properly closed using appropriate material to survive the heavy rains of monsoon.

Wall topping carried out with sweet earth for closing the cracks, openings to block penetration of rainwater.

Levelling of courtyards carried out to improve the drainage of the area.

Shallow ponding provided to collect rainwater with out harming the structures, in rooms where there were no way to improve drainage.

Crakes, empty spaces in walls properly filled to avoid penetration of rainwater that resulting in washing away of mortar and eventual collapse of wall.

Provide mud pushtas at certain locations that needed for the protection of structures.

Structures that were in advance state of decay applied with slurry for the purpose of consolidation.

General cleaning of the area carried out, to enhance an outlook and improve the drainage of the area.

Removal of saline earth & replacement with sweet earth for improvement of drainage, outlook & consolidation of surfaces carried out.

DPC in most places imbedded in the soil, the same exposed by removing the saline earth & level properly maintained with sweet earth.

Improvement of drainage room to room & house to house carried out & rainwater trained to flow safely out side the excavated remains.

In certain lanes water were creating problems of undercutting wall basis so the flow of water instead of the sides diverted to the middle of the drain by maintaining the drain in concave shape properly rammed and slowing the speed of flow of water through change in gradient.

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MOENJODARO
DK-G North Area
CONDITION REPORT


UNESCO
MOENJODARO
DK-G South Area
CONDITION REPORT


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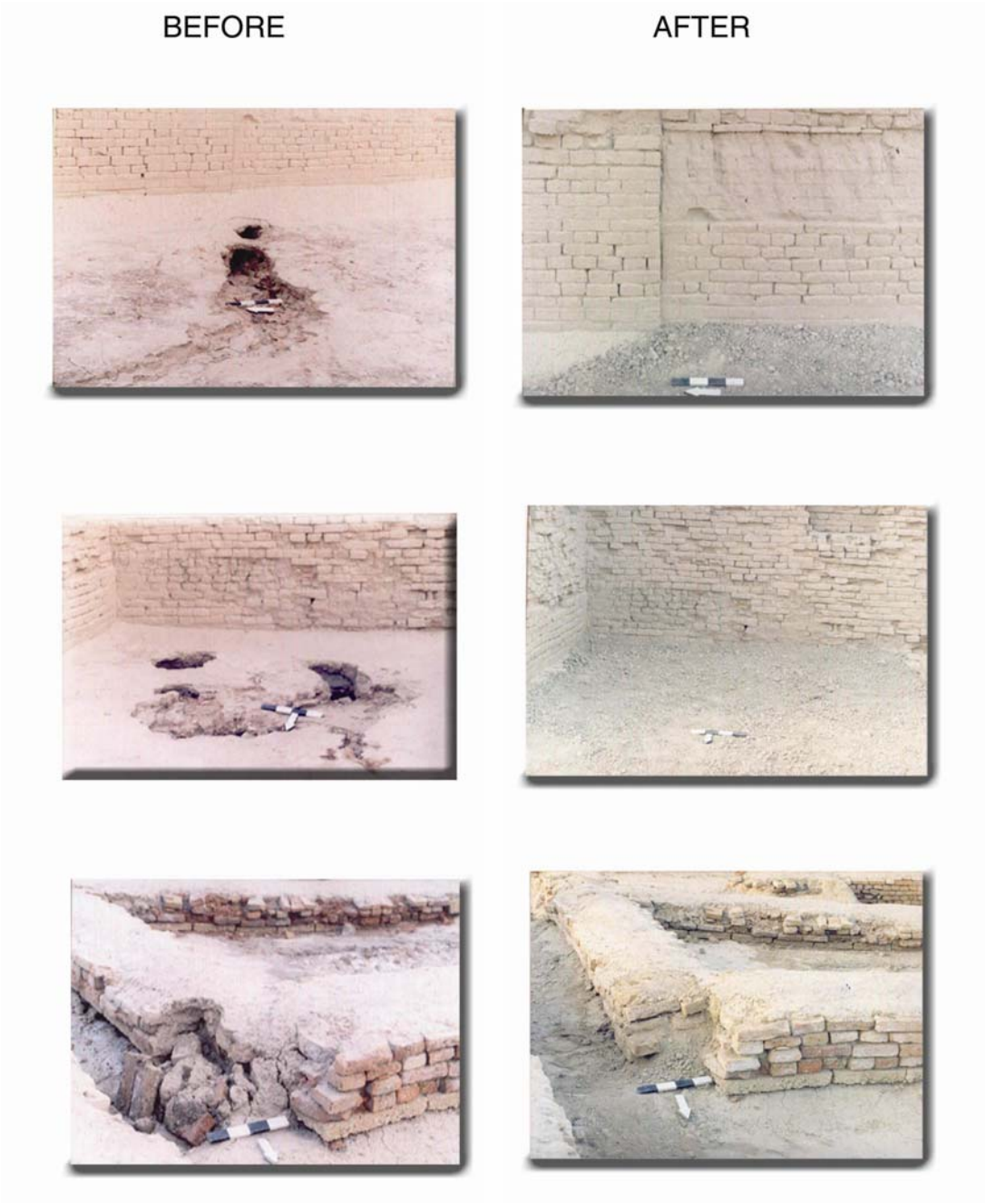
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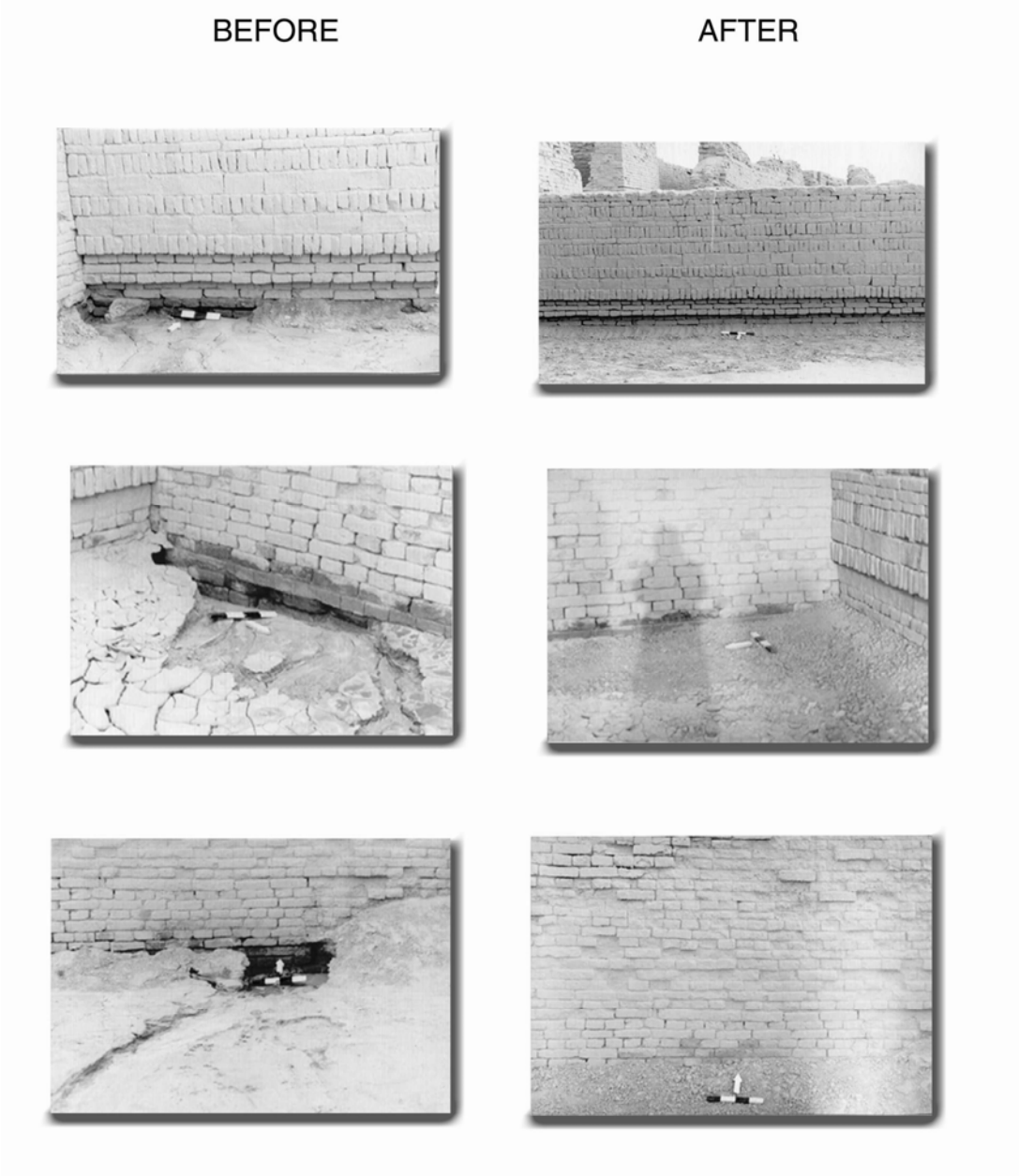
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