Restoration of Historic Massive Masonry

A lecture given by Dr. Casper Groot under Healthy Construction Series organised by Dr.Fixit Institute of structural protection & Rehabilitation at Kolkata & Delhi in June 25 / 26, 2009 on "Restoration of Historic Massive Masonry". The following is the zeast of his lecture based on work done by RILEM Technical Committee. (International Union of Laboratories and Experts in Construction Materials, Systems and Structures.).The main objective of the Technical Committee is to provide Technical guidance for consultants and practitioners through publication of required characteristics of the various types of repair mortars (pending mortar, render and plasters, repainting mortar etc). Since many mistakes are made in practice in choosing repair mortars for historic (pre-existing) masonry which results in damage of the existing historic masonry.

The major repair problems are multiferous types of degradation phenomena which are depicted in figure 1.

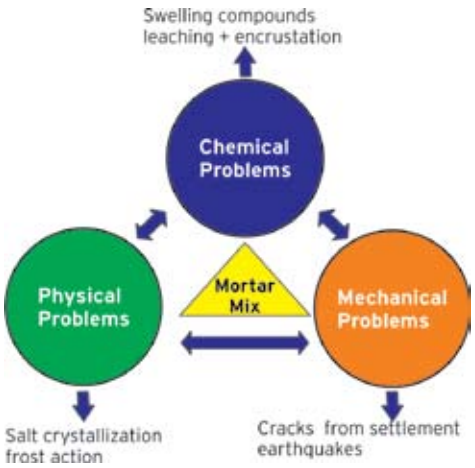

Fig: 1 Degradation phenomena

The damage cases explaining phenomena such as salt damages due to presence of salt in material or from other sources, Moisture in salt solution, it's drying & moves towards drying face, surper-saturation & crystallization / dissolution cycles, lime leaching, mechanical problems such as cracks from settlement, earthquakes etc., physical & chemical problems, and detachment through plant grow & freeze thaw cycling were elaborated. (Figure 1)

Apart from predominant focus on the technical aspects of restoration masonry, other elements such as values, authenticity should also be considered. In order to obtain better insight into influence of different technical factors on the choice of repair materials the analysis of damage cases may be of great help. In fact a keen understanding of the causes of damage is a requisite for taking sound repair measures. A number of damage cases indicated above were highlighted in figures 2 & 3.

Fig: 2 Salt damage of weak pointing material

Fig: 3 Damage through salt Crystallization

From the damage analysis it can be concluded that a lack of compatibility between repair material and the existing fabric is often a premature decay of adjutant's material. In this respect the porosity and moisture transport characteristics are often more important than strength properties. Compatibility and retreatability / repair ability (no negative effects of the current intervention on future interventions e.g. bond between old & new material) are important conceptual as well as practical notions for the choice of repair materials, which in daily practice are often neglected. Compatibility of applied repair material should be such that to protect the adjacent material from premature decay and also be durable taking into considerations physical & chemical behavior between old & new repair material. Some

examples of incompatibility are shown in figures 4 & 5.

Fig: 4 Dense repointing leading to frost damage

Fig: 5 Subflorescence caused by water repellents

The functional requirements for the walls is also elaborated such as to ensure load bearing capacity of the wall, prevent water penetration through wall, resist different kinds of environmental influences and processes acting on wall, to contribute to the aesthetic appearance of a facade & durable performance of the wall. The technical requirements related to surface features, composition (type of binder, aggregate, grain size distribution) strength (compressive, tensile & bond), elasticity, porosity properties, coefficient of thermal / hygienic dilation always with relationship to adjacent materials were also elaborated.

Apart from material characterization the execution of the work is an essential element of the soundness of proposed repair. The repointing practices such as raking (manual & machine) expansion groove, mortar joint section repointing etc. has been highlighted in figures 6 and 7.For this a clear rectangular space instead of a V-shaped joint must be raked in the mortar joint of width not less than twice the joint thickness for placing the repointing mortar.

The prevention of moisture ingress, influence of water repellent to drying was also delt upon.

Fig: 6 Raking out of joints mechanically

Fig: 7 Repointing

The prevention of moisture ingress, influence of water repellent to drying was also delt upon. Some examples of mineral grout, polymer injection, anti staining coating and techniques used for this were also discussed.

India has a large number of historic masonry structures which are not only beautiful, but also integral part of socio-political history of pre-independent era. Restoration of those beautiful architectural marvels with the present generation materials are of great challenge and can be effectively addressed to maintain their aesthetic, dignity and heritage.

The full paper of Dr. Casper Groot on “Choosing Repair Mortars for Historic Masonry : a case study” can be refered in our forthcoming International Journal of 3R’s (Repair, Restoration and Renewal of Built Environment)