

**BEHAVIOUR OF INTERLOCKING GROUTED
STABILISED BRICK MASONRY UNDER CYCLIC
AND FATIGUE LOADING**

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**DEPARTMENT OF CIVIL ENGINEERING
INDIAN INSTITUTE OF TECHNOLOGY, DELHI**

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by

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DEPARTMENT OF CIVIL ENGINEERING

*Submitted in fulfillment of the requirements
for the award of the degree of*

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DECEMBER, 2005

CERTIFICATE

This is to certify that the thesis entitled “**Behaviour of Interlocking Grouted Stabilised Brick Masonry Under Cyclic and Fatigue Loading**” being submitted by **Maqsd E Nazar** to the Indian Institute of Technology, Delhi for the award of the Degree of Philosophy in Civil Engineering, is a record of bonafide research work carried out by him. **Mr. Maqsd E Nazar** has worked under my guidance and supervision and has fulfilled the requirements for the submission of this thesis, which to my knowledge, has reached the requisite standard.

This thesis, or any part thereof, has not been submitted to any other University or Institute for the award of any degree or diploma.



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(Maqsood E Nazar)

ABSTRACT

This thesis presents an experimental investigation of interlocking grouted stabilised brick masonry under cyclic and fatigue loading inclined to bed joints. It is totally different type of brick masonry made with interlocking bricks by putting it above other or by the sides. Then a gap is created around four faces of the bricks. Thereafter, it is grouted without slurry. It consume about 20 percent mortar than the conventional masonry and quality of work is good being semi-automatic. Therefore, there is need to establish behaviour of such masonry. Two types of bricks i.e. interlocking grouted stabilised sand-flyash and interlocking grouted stabilised mud-flyash bricks were used in this investigation. The study commenced by investigating the stress-strain characteristics of interlocking grouted stabilised brick masonry under uniaxial cyclic compressive loading. Then, the study was extended to investigate the behaviour under fatigue compressive loading.

In the first phase of the study, an experimental program was conducted on interlocking grouted brick masonry specimens to investigate the behaviour of masonry under uniaxial cyclic compressive loading with five cases of loading at 0° , 22.5° , 45° , 67.5° and 90° to the bed joints. For the cyclic test under uniaxial compression, three types of test were conducted for each loading case : (i) Monotonic test. (ii) Cyclic test consisting of repeated loading-unloading, in which peak of each loading cycle coincided approximately with the monotonic curve. The stress strain hysteresis obtained from this test exhibited a locus of common points known as common point curve. (iii) Cyclic test consisting of repeated loading-unloading, wherein the load was released in each cycle when the

(iii)

reloading curve intersected the initial unloading curve, until the points of intersection stabilises at a lower bound point. The locus of these lower bound points is called as the stability point curve.

A general mathematical formulation was proposed for the envelope stress-strain curve, common point stress-strain curve and the stability point stress-strain curve. Mathematical models were also presented to obtain loading-unloading curves at any given plastic (residual) strain.

Cyclic tests were conducted on interlocking grouted brick masonry specimens due to partial unloading for two unloading stress levels. Three cases of loading at 0° , 45° and 90° to the bed joints were considered. The locus of common point curve and stability point curve were determined for each case of loading. One general equation, similar to the equation used in cyclic loading with unloading to zero stress level, was proposed for the determination of locus of common points and stability points.

An experimental investigation consisting of test on interlocking grouted brick masonry specimens loaded at 0° , 45° and 90° to the bed joints was done to study the behaviour under repeated uniaxial compressive loading between maximum and minimum stress levels. Load cycles were applied between fixed stress levels until the strain accumulated to produce failure. The fatigue tests conducted in this study were limited upto approximately 8000 load cycles.

TABLE OF CONTENTS

	Page No.
TABLE OF CONTENTS	(v)
LIST OF FIGURES	(viii)
LIST OF TABLES	(xvi)
NOTATIONS	(xvii)
CHAPTER 1 INTRODUCTION	
1.1 General	1
1.2 Tests under Cyclic Uniaxial Load	4
1.3 Tests under Fatigue Compression	8
CHAPTER 2 LITERATURE REVIEW	
2.1 Introduction	9
2.2 State of Stress of Uniaxially Loaded Brickwork	11
2.3 Compressive Strength	12
2.4 Tensile Strength	12
2.5 Shear Strength	14
2.6 Failure Criteria	17
2.7 Empirical Studies	19
2.8 Deformation Characteristics	21
2.9 Behaviour under Biaxial Stress	25
2.10 Behaviour under Cyclic and Fatigue Loading	27
2.11 Objective and Scope of the Present Study	30
2.12 Summary	33
CHAPTER 3 BEHAVIOUR OF INTERLOCKING GROUTED BRICK MASONRY UNDER UNIAXIAL CYCLIC COMPRESSIVE LOADING	
3.1 Introduction	34
3.2 Study on Interlocking Grouted Sand and Mud Flyash Brick Masonry	37
3.2.1 Experimental Program	37
3.2.2 Tests Results and Evaluation	45

3.3	Permissible Stress Level	70
3.4	Comparison of Study on Sand-Flyash and Mud-Flyash Brick Masonry	76
	3.4.1 Stress-Strain Parameters	76
	3.4.2 Envelope, Common Point and Stability Point Curves	77
3.5	Comparison of Present Study with Other Studies on Brickwork	80
3.6	Summary	85
CHAPTER 4	ENERGY DISSIPATION CHARACTERISTICS OF INTERLOCKING GROUTED BRICK MASONRY	
4.1	Introduction	87
4.2	Energy Dissipation Characteristics	88
4.3	Energy Dissipation of Interlocking Grouted Brick Masonry	89
	4.3.1 R_n versus Envelope Strain	89
	4.3.2 R_n versus Residual Strain	96
4.4	Summary	105
CHAPTER 5	LOADING AND UNLOADING STRESS-STRAIN CURVES OF INTERLOCKING GROUTED BRICK MASONRY	
5.1	Introduction	106
5.2	Stress-Strain Coordinate System	108
5.3	Analytical Stress-Strain Model for Interlocking grouted Brick Masonry	109
	5.3.1 Reloading-Unloading Stress-Strain Curves	109
5.4	Summary	128
CHAPTER 6	BEHAVIOUR OF INTERLOCKING GROUTED BRICK MASONRY UNDER PARTIAL UNLOADING	
6.1	Introduction	129
6.2	Partial Unloading	130
6.3	Experimental Program	131
	6.3.1 Test Specimens	131
	6.3.2 Loading Arrangement	131
	6.3.3 Instrumentation	132
	6.3.4 Test Procedure	132
	6.3.5 Test Results and Evaluation	135

6.4	Summary	156
CHAPTER 7	FATIGUE BEHAVIOUR OF INTERLOCKING GROUTED BRICK MASONRY	
7.1	Introduction	160
7.2	Fatigue Behaviour of Interlocking-Grouted Brick Masonry	161
	7.2.1 Experimental Program	161
	7.2.2 Tests Results and Evaluation	166
7.3	Summary	181
CHAPTER 8	CONCLUSIONS AND RECOMMENDATIONS	
8.1	Conclusions	185
8.2	Recommendations for Future Works	188
APPENDICES		
Appendix-I	Properties and Sieve Analysis of Results of Soil used in Mud-Flyash Bricks	189
Appendix-II	Axial Stress vs Axial Strain and Lateral Strain vs Axial Strain Curves from LVDT's on both faces of the specimen.	190
Appendix-III	Peak values of Stress and Strain of all the specimen	191
REFERENCES		192