# The anisotropy of Leighton Buzzard sand under general stress conditions

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## Introduction

A hollow cylinder apparatus (HCA) was used to investigate the inherent anisotropy and membrane penetration of Leighton Buzzard sand. The test-specimens were formed using a wet pluviation technique. Tapping was used to increase the relative density to a target value.

The HCA is ideal for investigating anisotropy as it allows independent control of the three principal stresses and recording of the three principal strains. The deformational response of the test-specimen was recorded using both internal (for inherent anisotropy) and external (for membrane penetration) instrumentation.

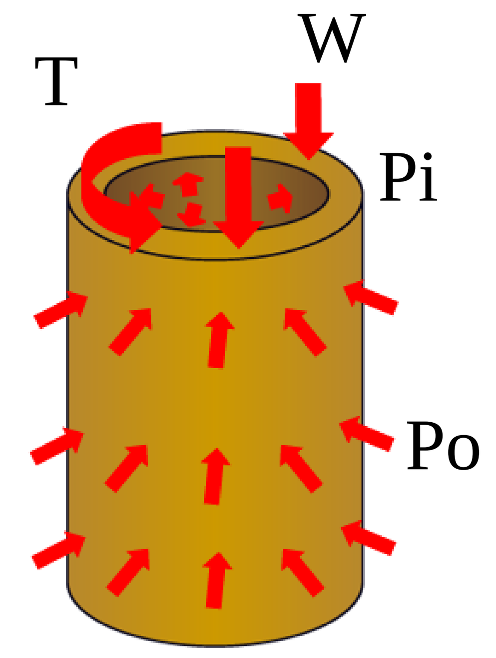
## Objectives

To determine the magnitude of inherent anisotropy in wet pluviated sand test-specimens subjected to isotropic loading.

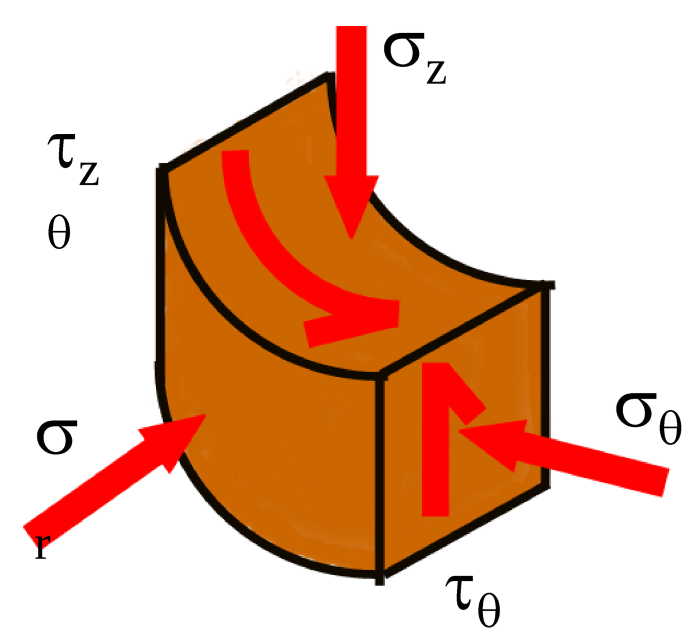
To quantify the magnitude of membrane penetration in wet pluviated sand test-specimens.

To compare the experimental data with other method of quantifying the magnitude of membrane penetration.

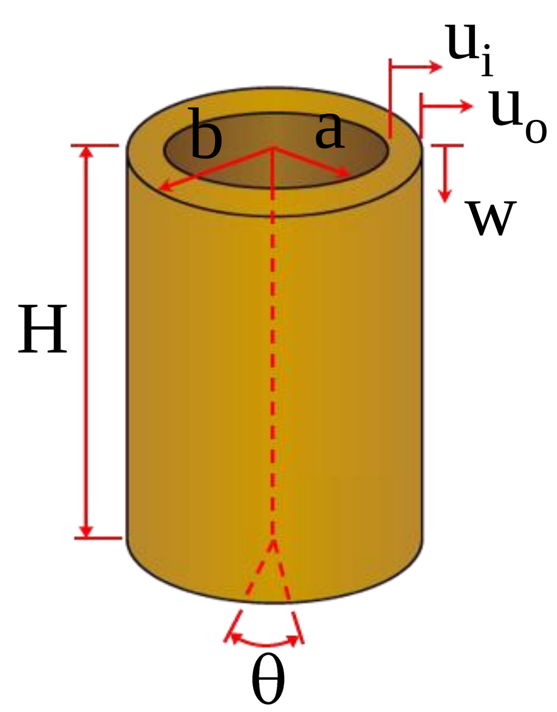
## Stress and deformation in a HCA sample



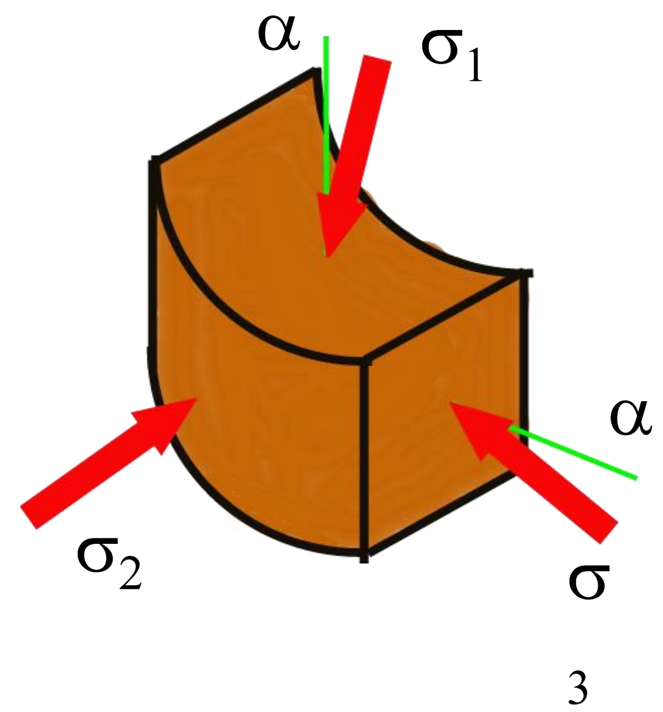

Applied surface tractions




Sample normal stresses

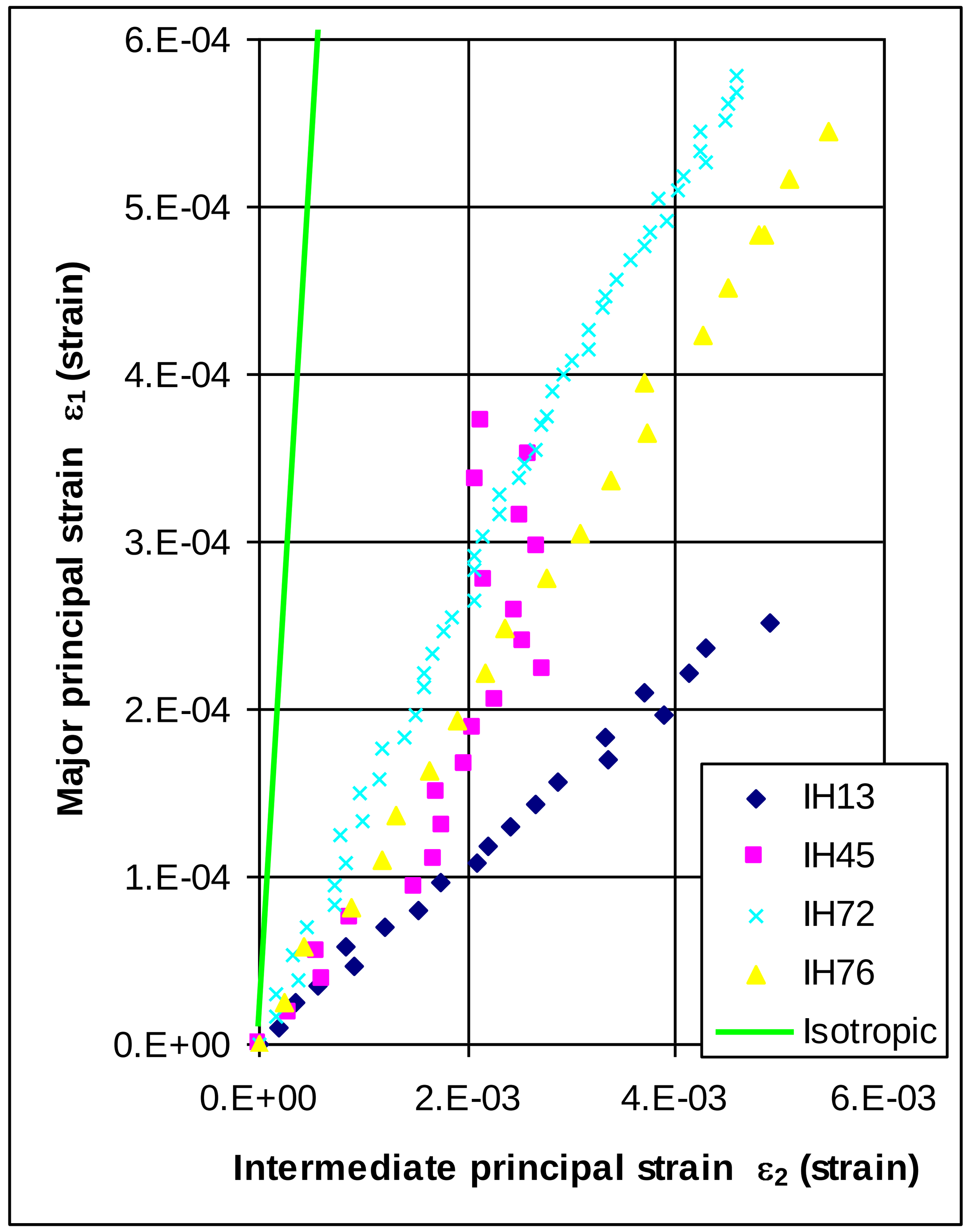


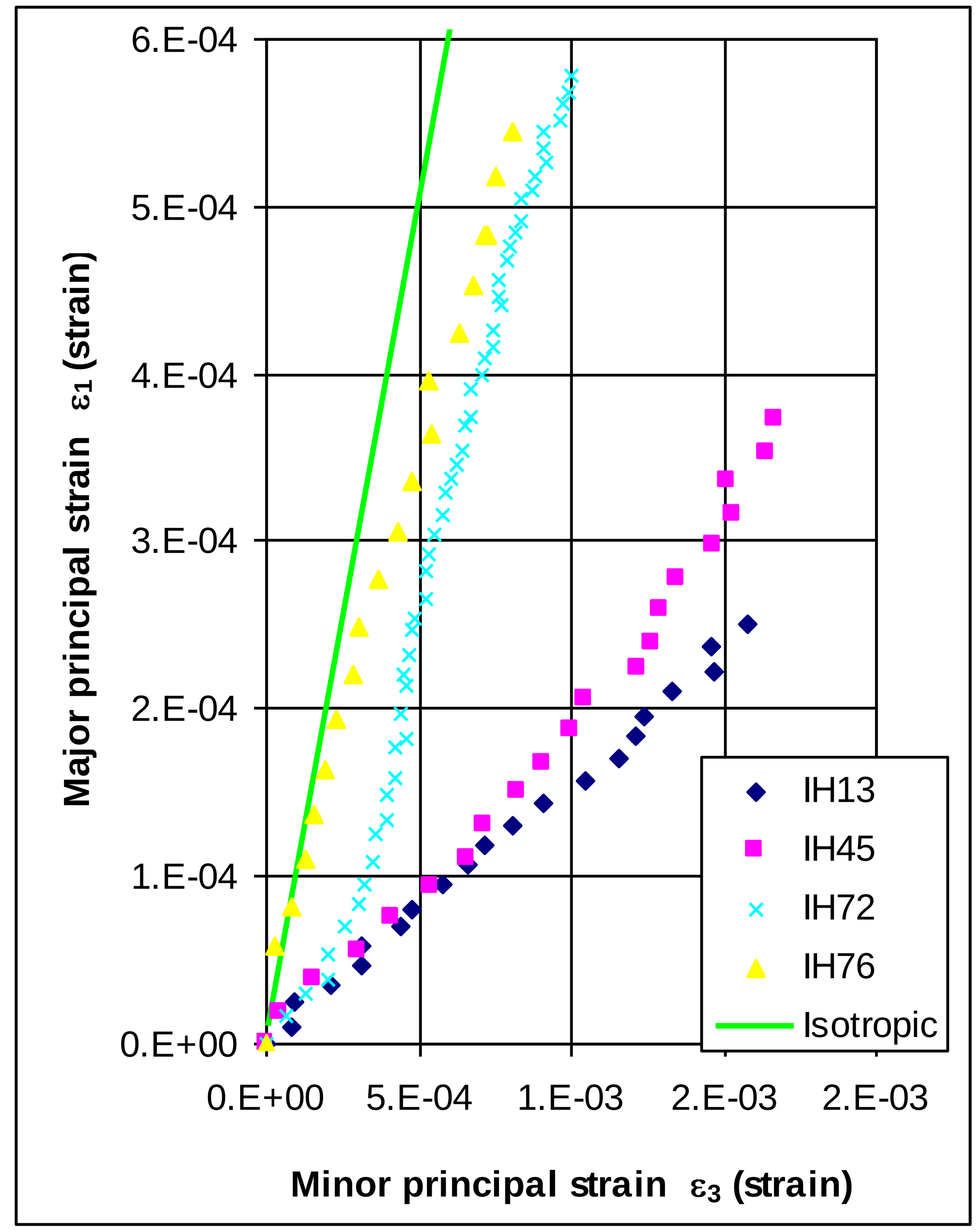

Sample geometry
and deformational response

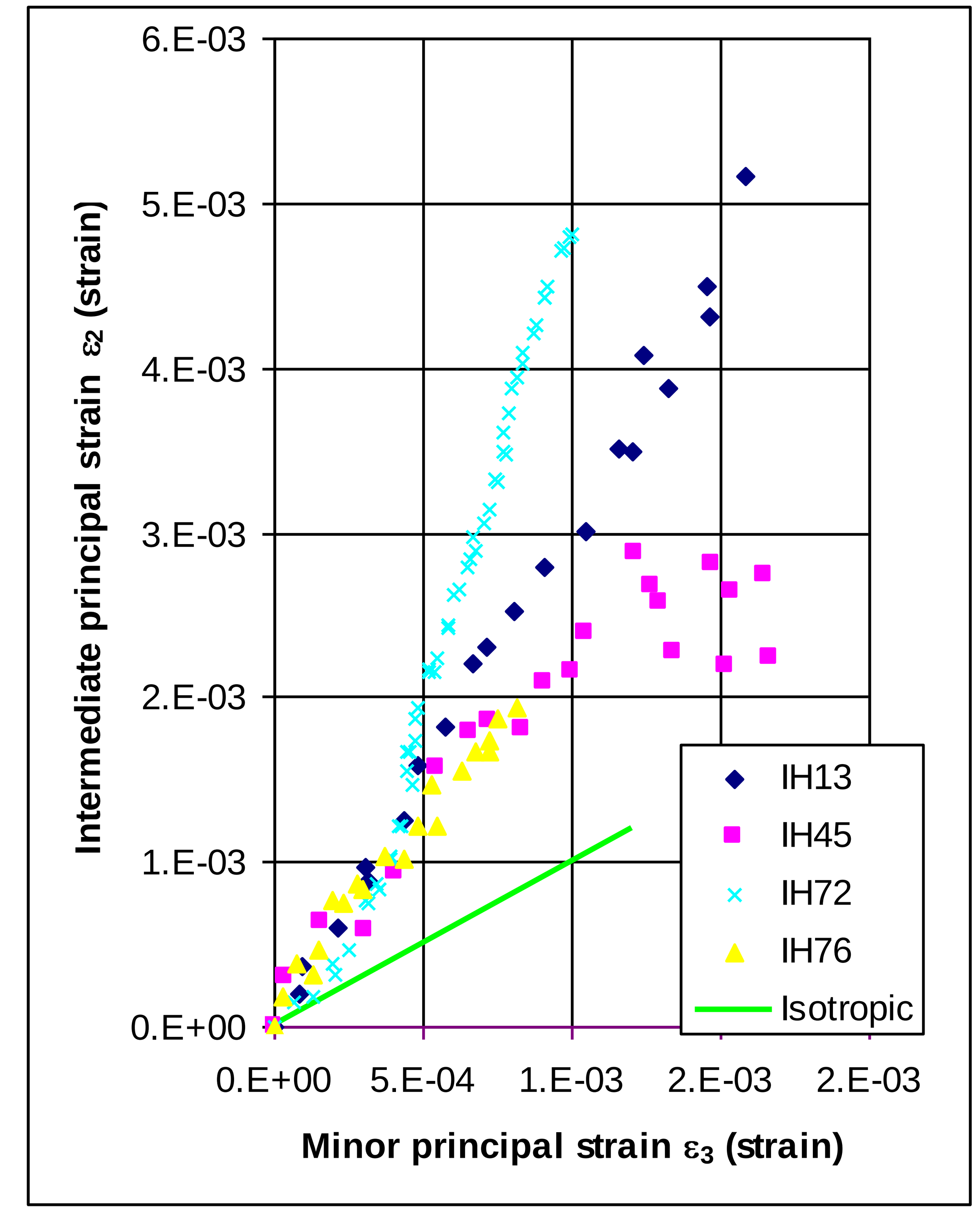



Principal stresses

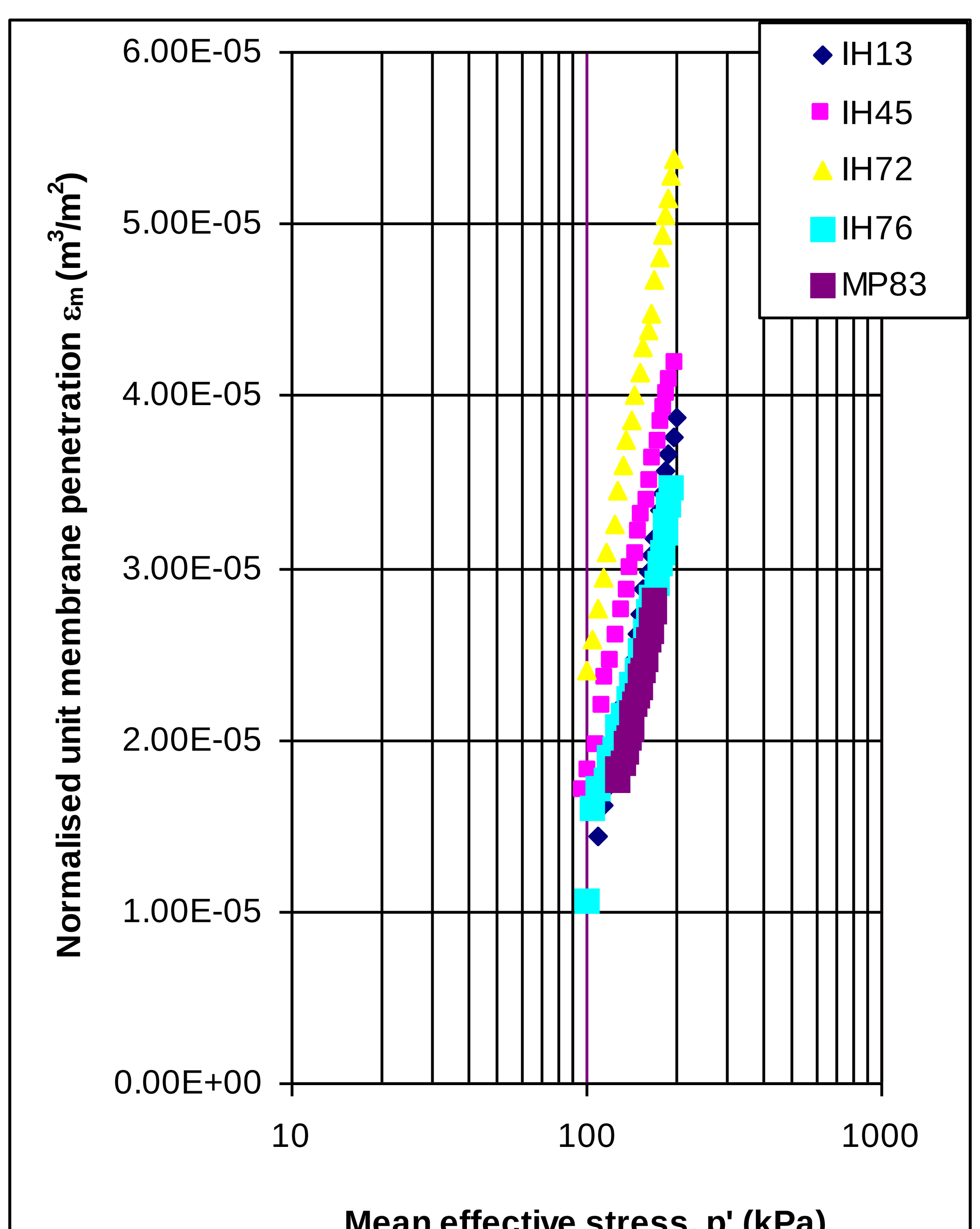
## Inherent Anisotropy




## Membrane Penetration




## Conclusions

### *Inherent Anisotropy, under isotropic loading*

1. The inherent anisotropy of the Leighton Buzzard sand was found to dependent on the initial relative density of the test-specimen.

2. The inherent anisotropy in the vertical-to-horizontal directions was found to decrease as the initial relative density increased.

3. A wet pluviation technique resulted in a cross-anisotropy response which was independent of both the initial relative density of the test-specimen and the mean effective stress.

### *Membrane Penetration*

1. The magnitude of membrane penetration was successfully calculated using a non-destructive, specimen specific, test procedure.

2. The magnitude of membrane penetration was found to be independent of both the relative density and mean test-specimen stress.

3. Reasonable agreement was observed between the experimental normalised unit membrane penetration and that determined from other methods, which are based on the mean particle diameter of the sand.