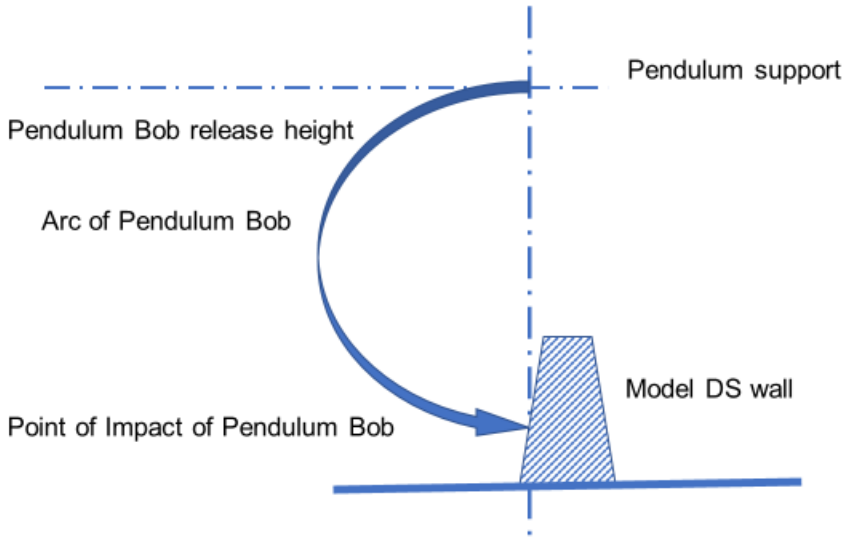
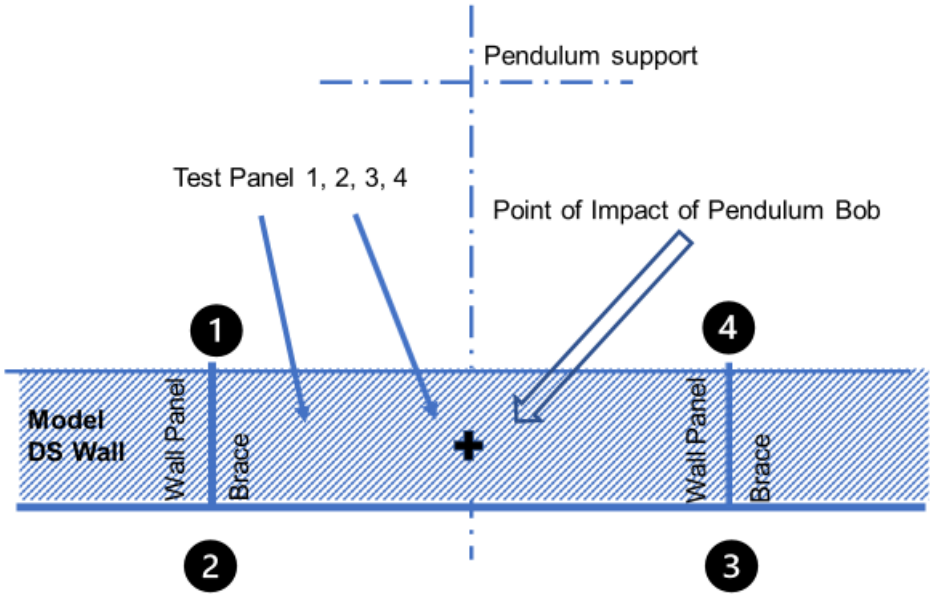
PROPOSED MODEL WALL TEST

*Using a **framed panel** of a model Wall and a **Pendulum***

Freestanding dry stone masonry wall	Model wall **120mm = 1/10 geometric scale**
Consider a **model wall panel**	**Length = 250mm,** aspect ratio = approx 2 : 1 One Free Edge at top Three Fixed Edges
Use **Pendulum Impact Test**	Point **Impact at 40mm** up from base/found. Similar to the full scale car impact position
Use **Pendulum PE**	Pendulum release height at wall failure is a a measure wall of wall strength
Impact/**Collision type**	**Inelastic** – so no pendulum Bob rebound **And Partially inelastic** – so temporary **coalescence** of Bob and wall after impact
Mechanics	1. Conservation of **momentum** $m_1v_1 = (m_1 + m_2)v_2$ **v_2** = $m_1 v_1 / (m_1 + m_2)$ 2. Conservation of **total energy, PE_0** But **no conservation of KE**.



SIDE VIEW OF MODEL WALL IMPACT TEST



FRONT VIEW OF MODEL WALL IMPACT TEST

SKETCHES OF THE SET UP

FOR THE MODEL WALL IMPACT TEST

Model Wall **Failure mechanisms**

1. Wall pushed over, **overtoppling**

With two Friction Slipline movements

2. **Block of wall pushed out** above 40mm

With three Friction Slipline movements

3. **Two rigid blocks pushed out** about 40mm

With four Friction Slipline movements

Pendulum bob Potential Energy

$\mathbf{PE_0}$ = Potential energy at release

$\mathbf{m_b}$ = Mass of Bob (g)

g = 9.81 m / s^2

h = (Bob height above base – 0.04) m

Factors affecting Wall strength

1. Unit weight of stone
2. Wall dimensions
3. Position of the Wall centreline
4. Batter (slopes) on faces
5. Interstone friction
6. Void Ratio, **e**, of wall
7. Interlocking of stone
8. Variation of friction with height
9. Orthogonal ratio of friction effect

System Energy

At pendulum release ➔ At impact ➔ Work Done to collapse Wall

PE_0 = KE_{impact} = $WD_{internal}$

Or, **PE_0 = $WD_{internal}$**

Energy Calculations

PE_0 = mgh — **m** = mass of pendulum bob, **h** = bob release height

$KE_{impact} = ½ mv^2$ — *We do not need to calculate this*

$WD_{internal}$ = $\Sigma F_i \Delta_i$ — Consider the 3 possible failure mechanisms above

F_i = frictional resistance around block **i** surfaces

Δ_i = the horizontal movement of block **i** CG for instability

Test Procedure

1. Put two braces around the ends of the panel section
2. Start with a low pendulum bob height and allow to swing on to wall
3. Increase bob height and allow to swing on to wall
4. Repeat until wall failure – record bob height at failure.
5. If required the pendulum bob mass, $\mathbf{m_b}$, can also be changed

The most Impact robust, model Wall is that with the highest bob height at failure.