

# DYNAMIC TESTING OF ALREADY INSTALLED SAFETY BARRIER POSTS



*Ing. Ottavia Calamani*

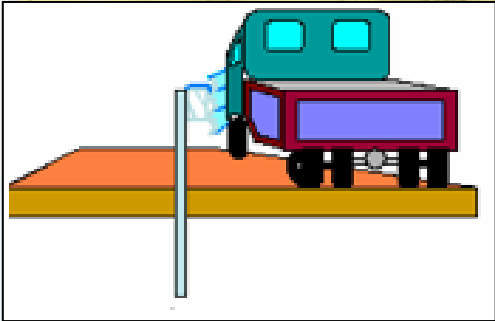


# Installation on side edge

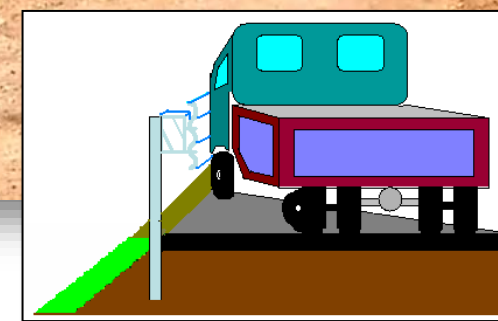
Test House Soil



On site Soil



- Shape
- Material
- Compaction
- Top soi
- Corrosion



# Installation on side edge

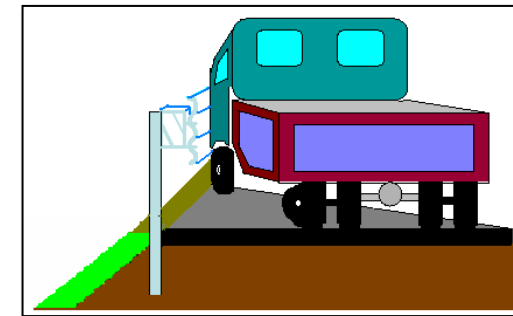
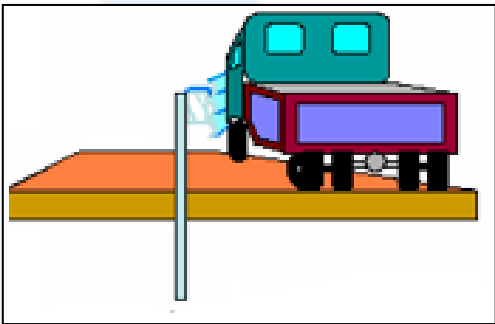
Test House Soil



On site Soil



- Shape
- Material
- Compaction
- Top soil
- Corrosion

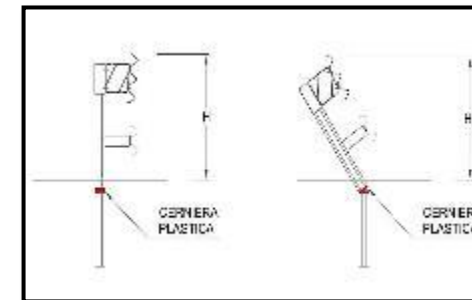




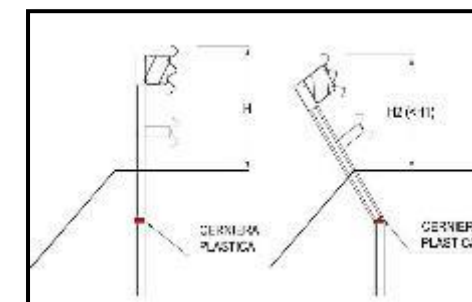
# Installation on s



**Flat and well-compacted soil with high mechanical characteristics**



**Weak embankment with a top soil layer**

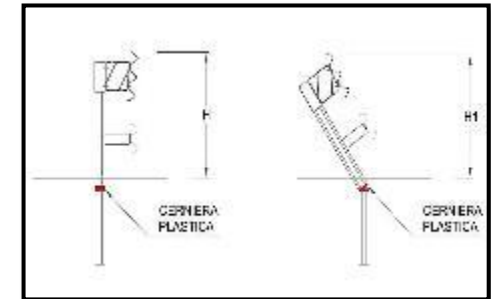


# Installation on side embankment

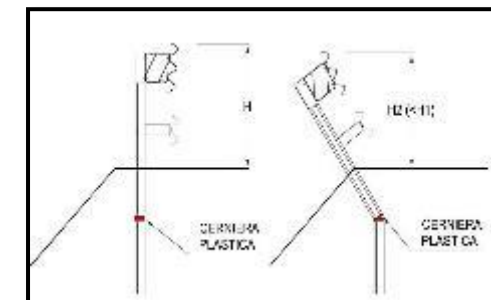


Not only guardrail structure, but **INTERACTION** between ground and posts

Installation on **stiff and well-compacted soil with high mechanical characteristics**

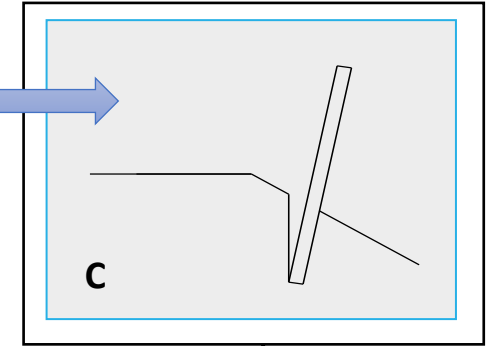
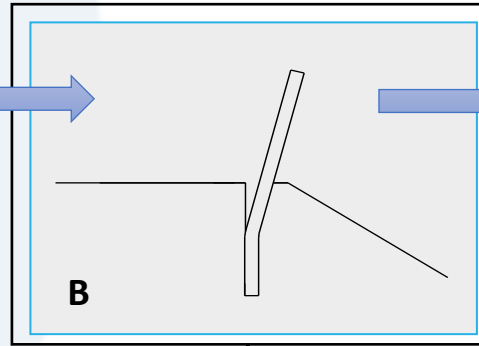
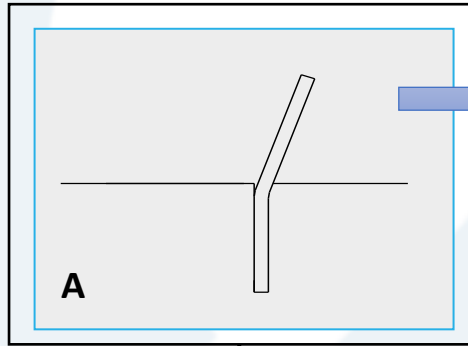


Installation on **Weak embankment with a top soil layer**





# Installation on side edge



*Worse* soil conditions, *worse* performance

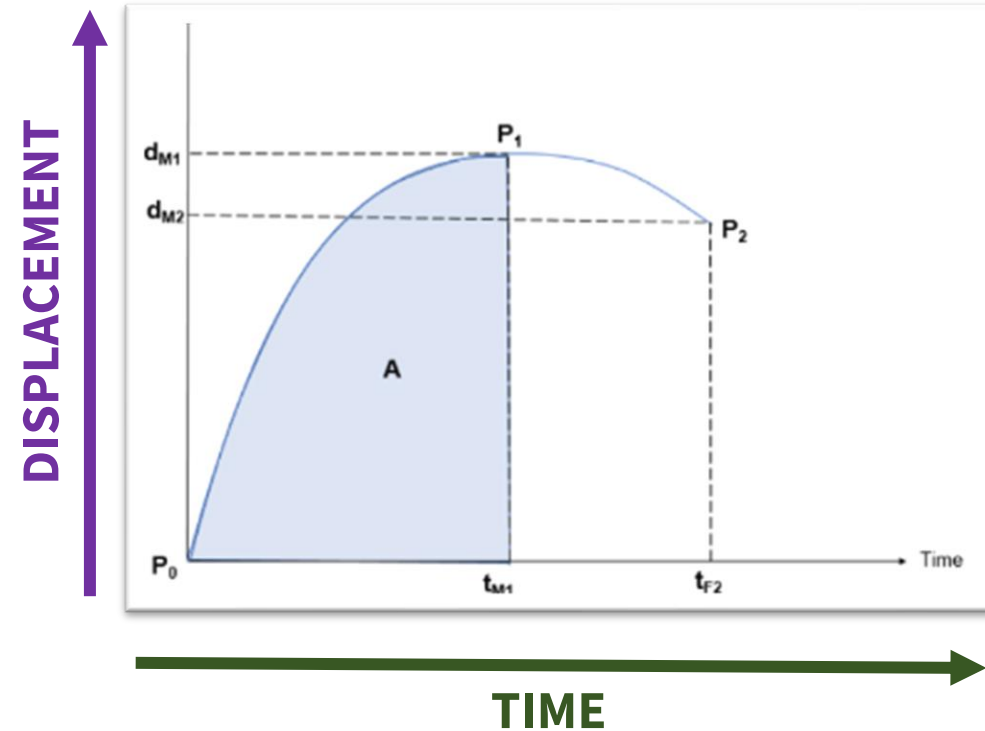


# How to evaluate this behaviour?

Through **Dynamic Testing – T.H.O.R.** (Testing Head Over Road)



# Dynamic Testing of Safety Barrier – T.H.O.R.



## CAPACITY OF DISSIPATING ENERGY ( $C_E$ )

Capacity of the post of dissipating all the energy coming from the dynamic impact

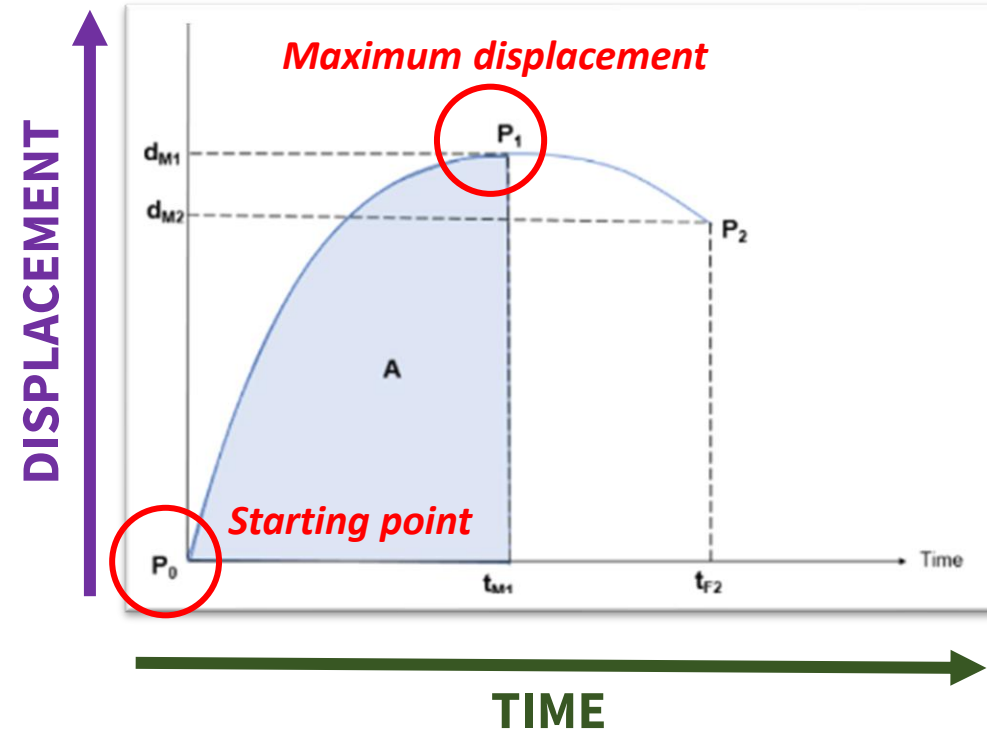


# Dynamic Testing of Safety Barrier – T.H.O.R.

*P0 - Starting point*



*P1 – Max displacement*

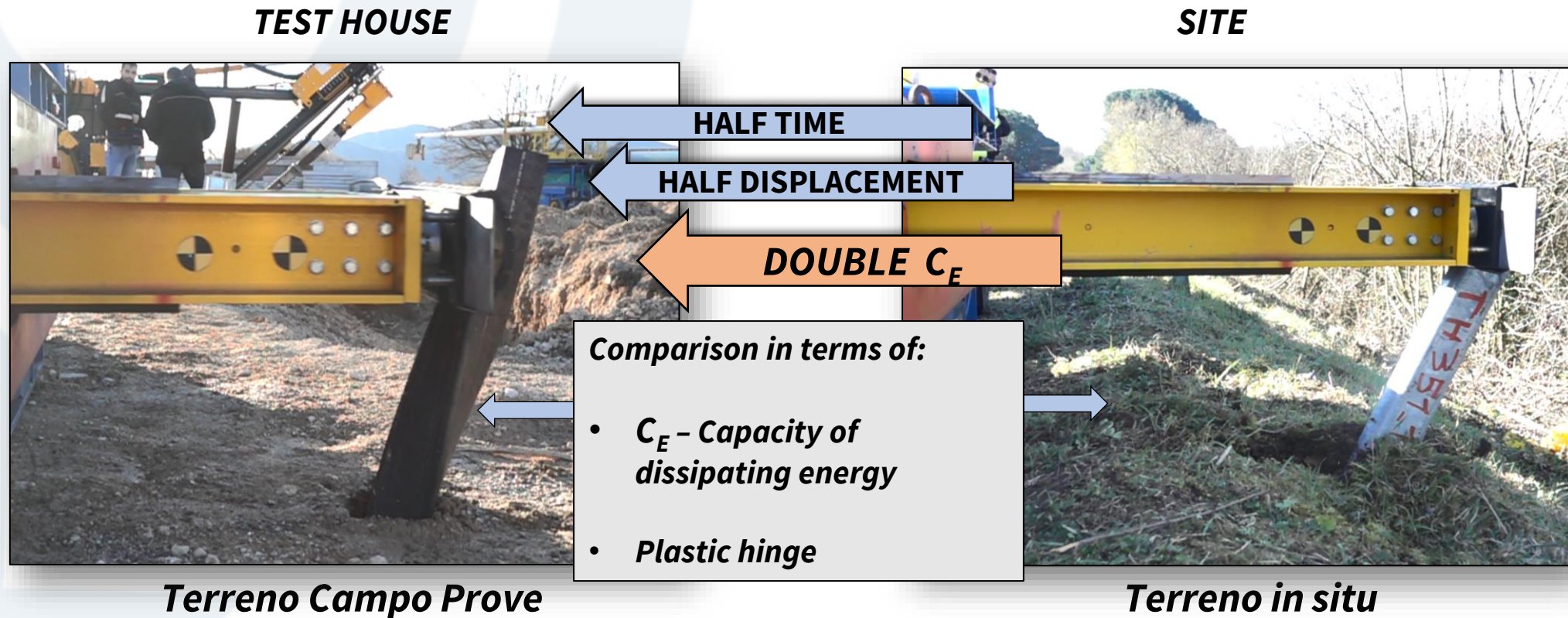


## CAPACITY OF DISSIPATING ENERGY (C<sub>E</sub>)

Capacity of the post of dissipating all the energy coming from the dynamic impact

# Dynamic Testing of Safety Barrier – T.H.O.R.

## Comparison between site and Test House





# Dynamic Testing of Safety Barrier – T.H.O.R.

HOW TO DEVELOP A  
**PROCEDURE**  
WHICH ENSURES  
**THE CORRECT INSTALLATION  
OF BARRIERS??**



# Test equipment

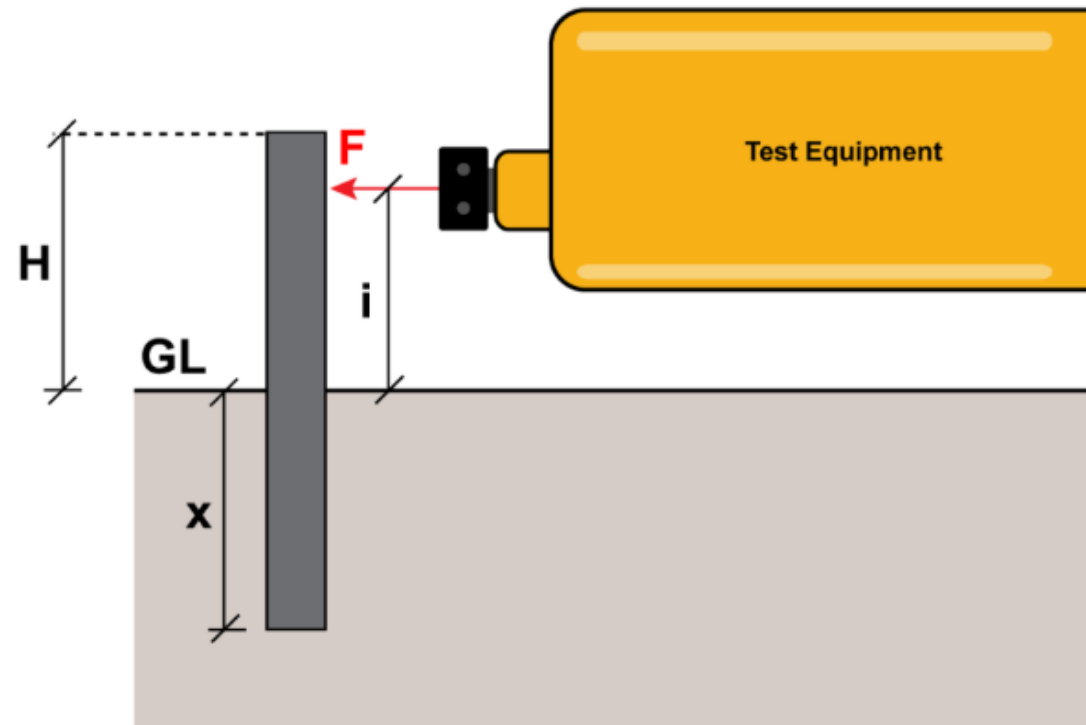
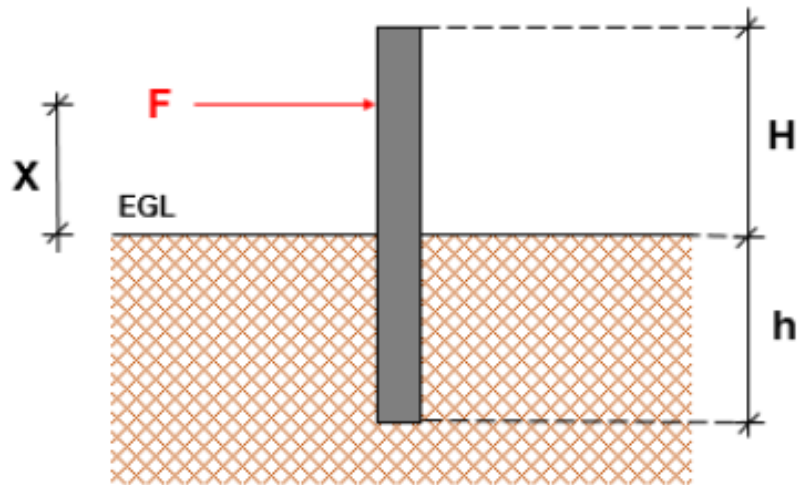


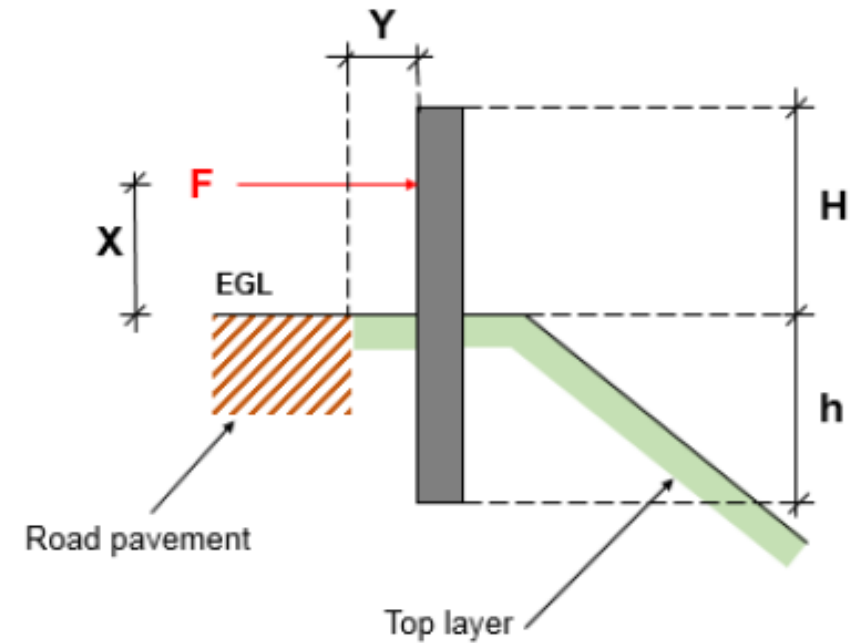
Figure 3.1 - Test configuration



# Methodology



Test House



Site

# Testing parameters – input and output

Table 4.1 - Containment Levels and Associated Impact Energies

Containment Level	Impact Energy [kJ]
N2	7 kJ ± 0.3
H1/L1	8 kJ ± 0.3
H2/L2	9 kJ ± 0.3
H3/L3	11 kJ ± 0.3
H4a/H4b	12 kJ ± 0.3



# Testing parameters – input and output

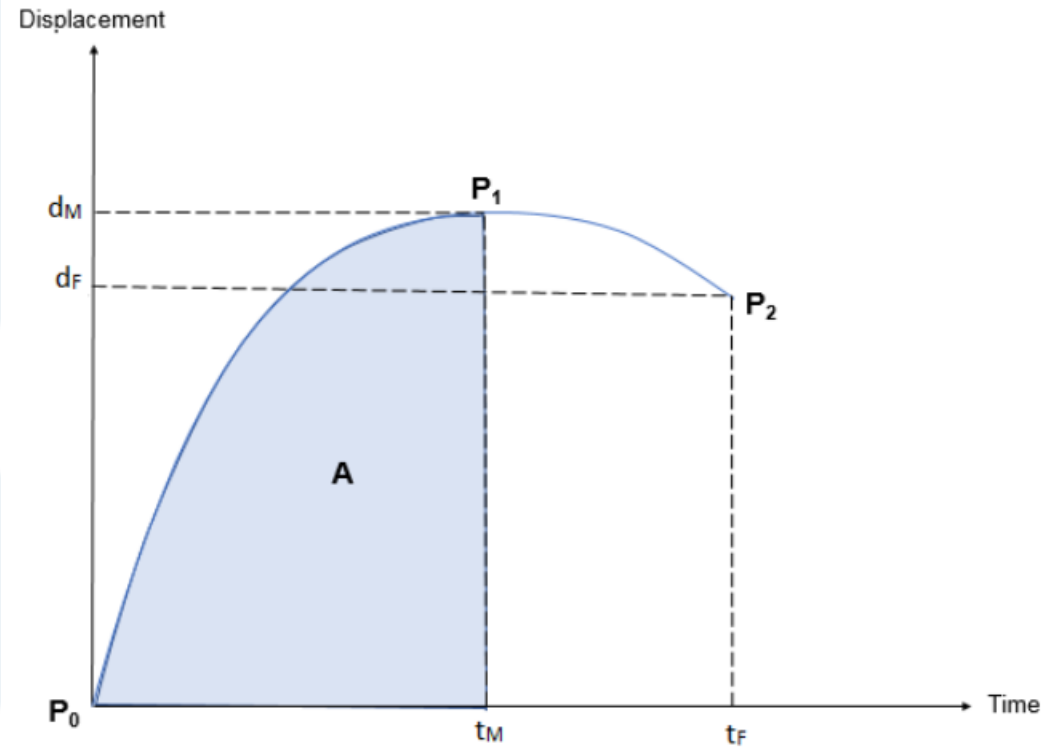
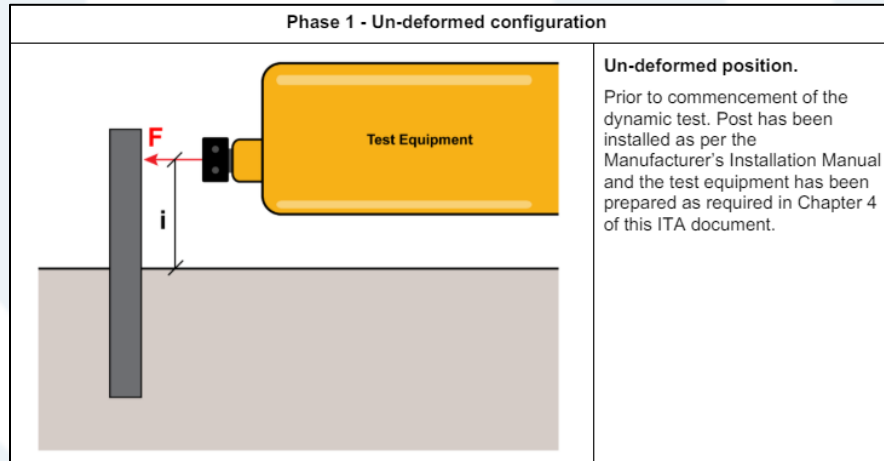
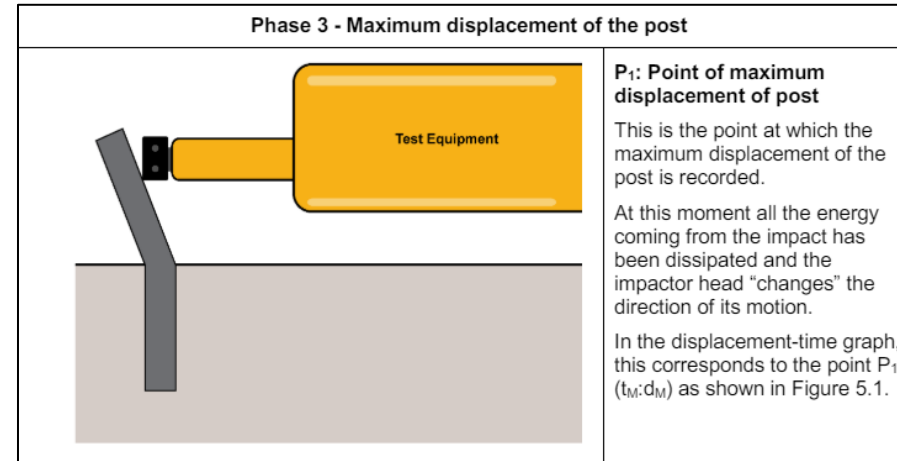


Figure 5.1 - Displacement - Time graph construction

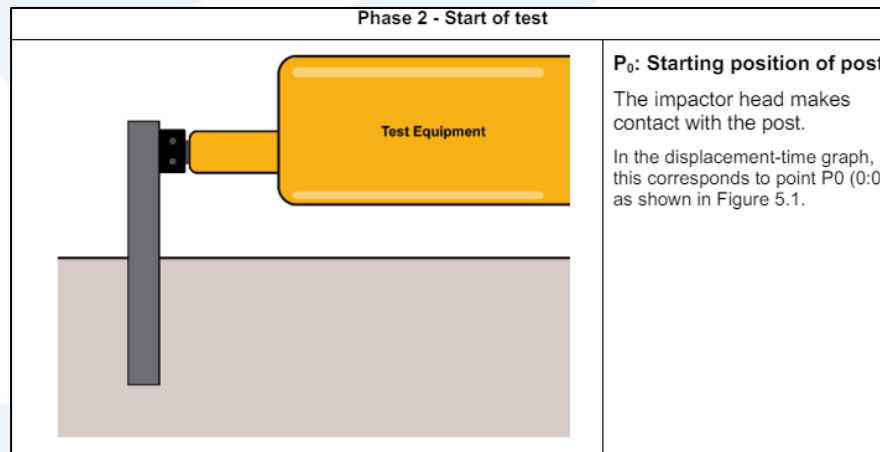
# How to build the curve



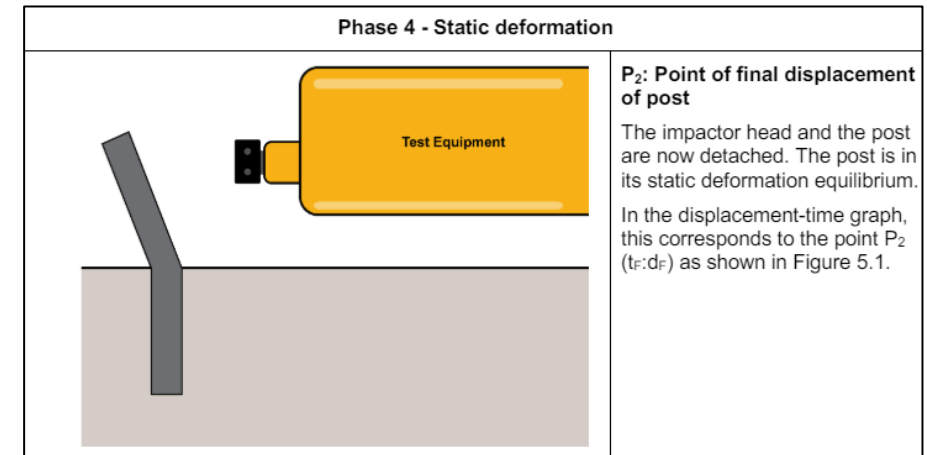
**Phase 1**



**Phase 3**



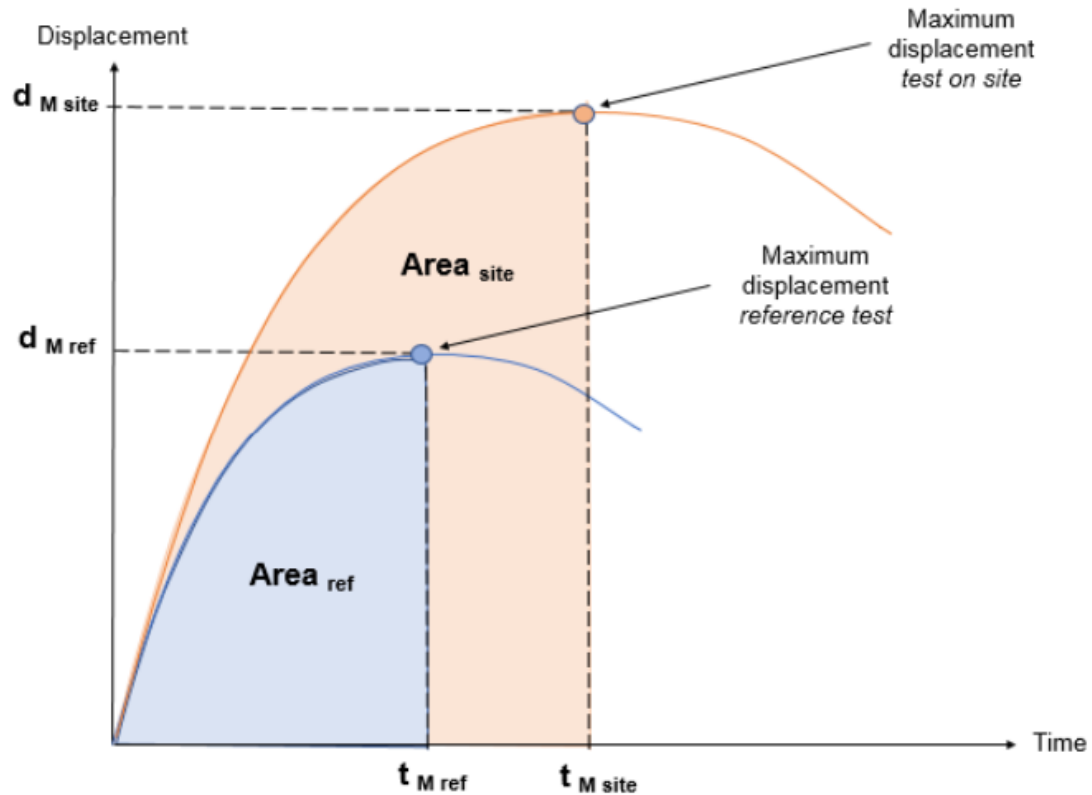
**Phase 2**



**Phase 4**



# Results



$$CE_{ref} = \frac{1}{A_{ref}}$$

$$CE_{site} = \frac{1}{A_{site}}$$

Figure 5.4 - Example of a Displacement – Time graph for comparison between a comparable reference dynamic test and a site dynamic test

# Test Report

1. Description of the test equipment and data acquisition used, material of impactor head and mass of impactor head (kg)
2. Specified and actual impact energy (kJ)
3. Specified and actual impact velocity (m/s)
4. Details of the proposed safety barrier and its performance parameters, including post details (post type, containment type, dimensions, total length)
5. Measurements of the post (recorded in m) before and after the dynamic test as shown in Figure 6.1:
  - o Post embedment length ( $x$ )
  - o Post height from ground level ( $H$ )
  - o Post height from ground level after impact ( $H_f$ )
  - o Static deflection of the head of the post after impact ( $dh$ )
  - o Post displacement measured at ground level ( $db$ )
  - o Position of the plastic hinge measured from ground level. If the plastic hinge did not develop, this shall also be noted (refer to Section 3 for more information on plastic hinge)

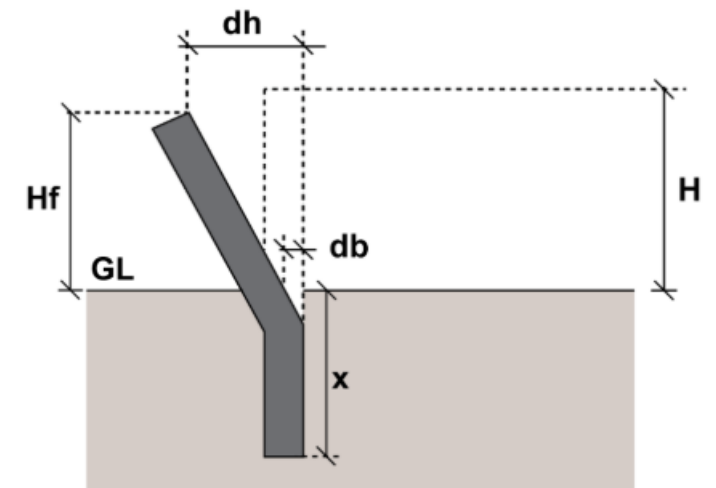
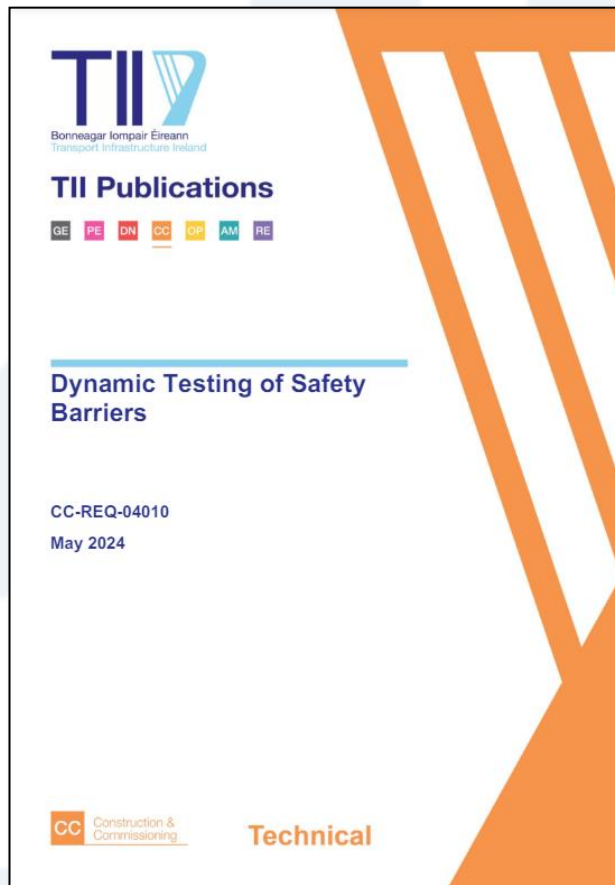


Figure 6.1 - Before and after impact static measurements



# Dynamic Testing of Safety Barrier



<https://www.tiipublications.ie/advanced-search/results/document/?id=3333>



**THANKS FOR  
THE ATTENTION**

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