Pile Integrity Testing (PIT) is a low-strain and non-destructive integrity test method which only involves the impact from a small hand-held hammer. This low-strain test can be applied to any concrete piles (eg. Pre-stressed concrete piles, drilled shafts, auger cast piles, concrete filled pipe piles). Acceleration and stress wave which generated by the impact of small hand held hammer is the input of this test method.

Based on stress wave propagation and reflection theory; a stress wave (compression / tension) in a uniform rod is reflected if the wave encounters an impedance change. Structurally sound shafts made with concrete should have reflection wave from shaft toe with only minor variations of the record amplitudes between impact and toe reflection. Sound shafts may also be indicated by negative velocity reflections which are often caused by bulges (softer soils), auger-wobble or excess grout pressure allow for an enlargement of the bored hole.

PILE INTEGRITY TESTING ASSESSMENT CATEGORIES

Generally, if the toe reflection is observed, this indicates that the shaft integrity is acceptable. However, when shaft material has a high resistance; or the shaft is relatively long compare to its diameter; or the shaft has numerous cross-sectional changes, it is difficult to draw conclusions regarding the length of shaft or the integrity of the entire shaft. Test shafts can be categorized into one of the following categories:

- **AA: Sound shaft integrity indicated**; a clear toe reflection can be identified corresponding to the reported length and wave speed within an acceptable range.
- **BB: No major defect indicated**; the records indicate neither reflections from unexpected significant reduction of pile size or material quality nor a clear toe response. In this case, there is no indication of major deficiency.
- **ABx: No major defect indicated to a depth of x (m)**; due to the limitation of PIT, interpretation of the full length is not possible. A large bulge or high soil resistance may cause the shafts fall into this category.
- **PFx: Indication of a probable flaw at approximate depth of x (m)**; at least one reflection corresponding to an unplanned reduction of size or material quality and toe relection is apparent.
- **PDx: Indication of a probable defect at an approximate depth of x (m)**; a major reduction of size or material cause a strong reflection in the PIT records and toe reflection can not be located.
- **IR: Inconclusive record**; PIT data is unable to be interpreted caused by the following reasons:
  - poor pile or shaft top quality (concrete curing period too short)
  - Joints or planned caisson diameter changes which prevent toe signal identification

PILE INTEGRITY TESTING LIMITATIONS

PIT testing method is limited to shaft integrity assessment of major shaft defects or material quality changes. The location of the defect is only as accurate as our knowledge of applicable wave speeds. PIT test results should not be the only means for checking the quality of foundations. Field installation observations including grout or concrete volume and analysis of standard geotechnical borings,should be included in the foundation evaluation process.