

# Compaction Control for Open Graded Aggregate Using Light Weight Deflectometer

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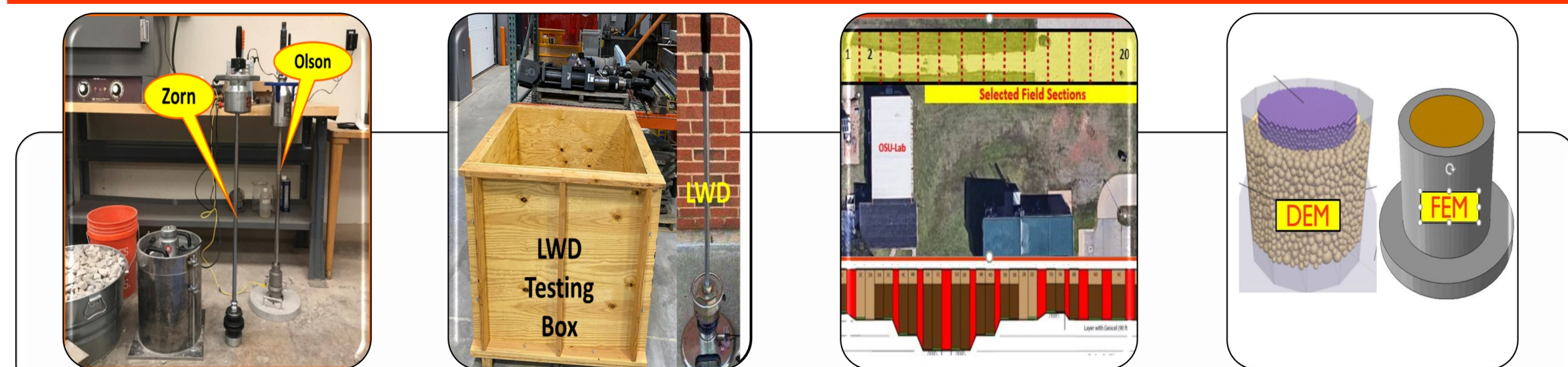
## 1. Motivation & Background

- ✓ Currently no compaction specifications available for Open-Graded (OG) base layers
  - Nuclear density gauge (backscatter mode) does not work
- ✓ Usually, compaction is carried out using a recipe approach
- ✓ Deflection-Based Compaction Control Specification for Open-Graded Aggregate Layers
  - Can provide a measure of degree of compaction
  - Can be directly related to pavement response
  - Will ensure uniform compaction leading to better performance under loading



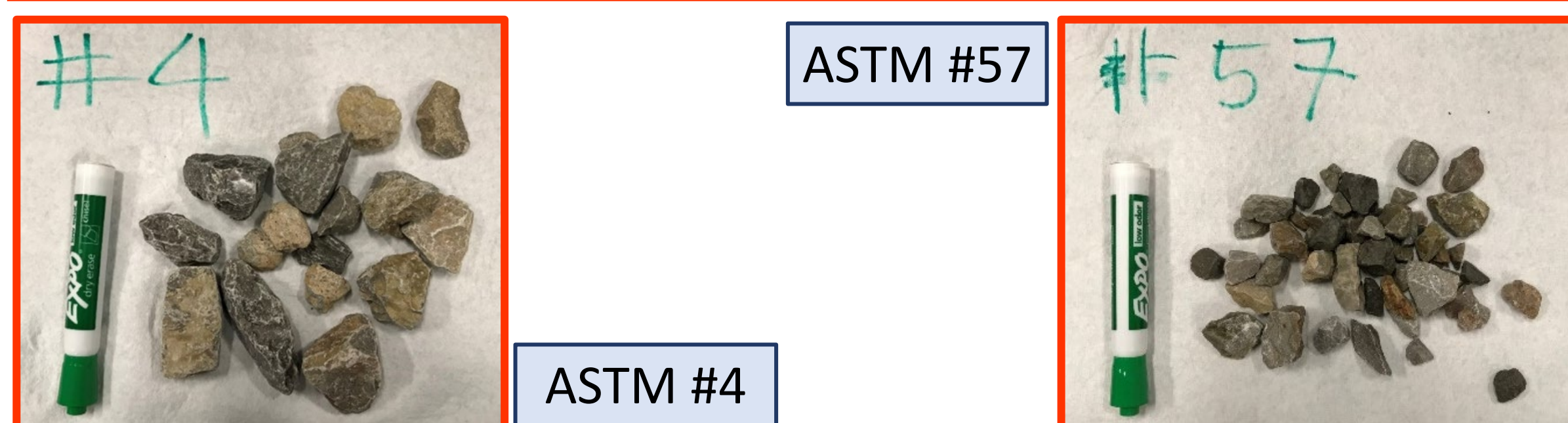
**Deflection-Based Compaction Control**

## 2. Research Design




- Small-Scale Laboratory Testing**
  - ASTM#4 and #57 Aggregate
  - Custom-Made Molds
- Intermediate-Scale Laboratory Testing**
  - ASTM#4 and #57 Aggregate
  - 4 ft. x 4 ft. Wooden Box
- Full-Scale Testing**
  - ASTM#4 and #57 Aggregate
  - Geocell Reinforcement
- Numerical Modeling**
  - ASTM#4 and #57 Aggregate
  - Distinct-Element (PFC)

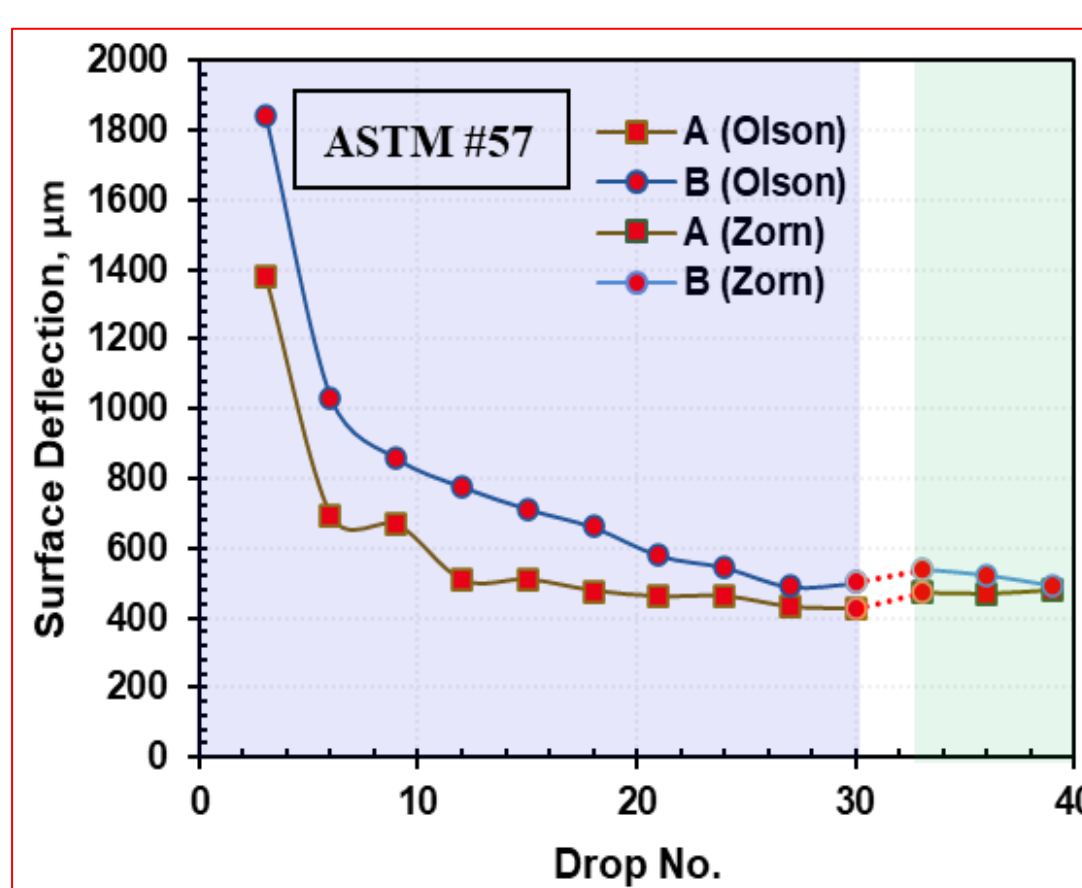
## 3. Materials Selections



## 4. Establishing Independence from LWD Type



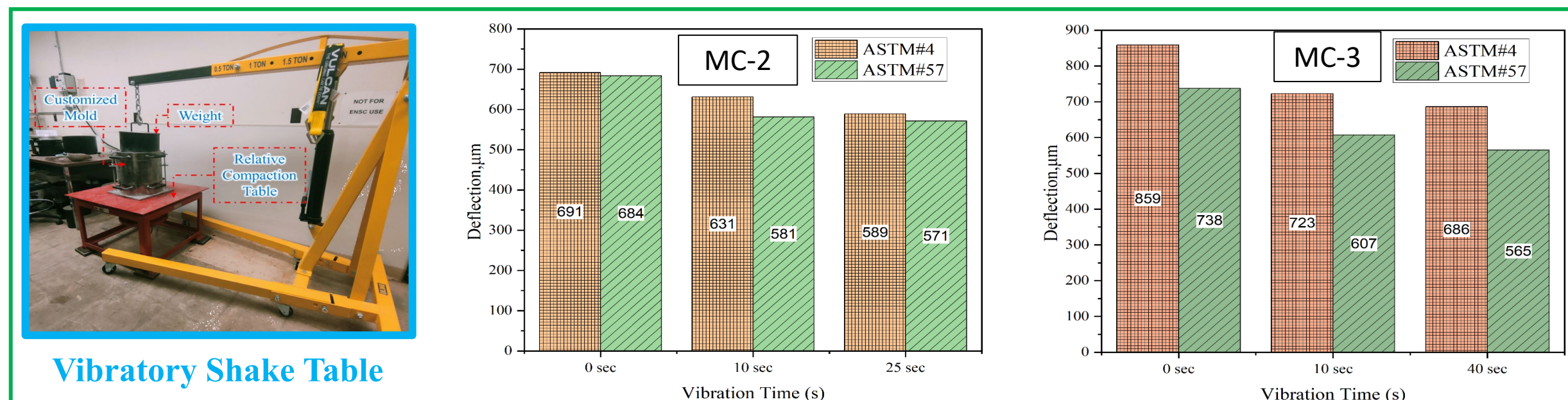
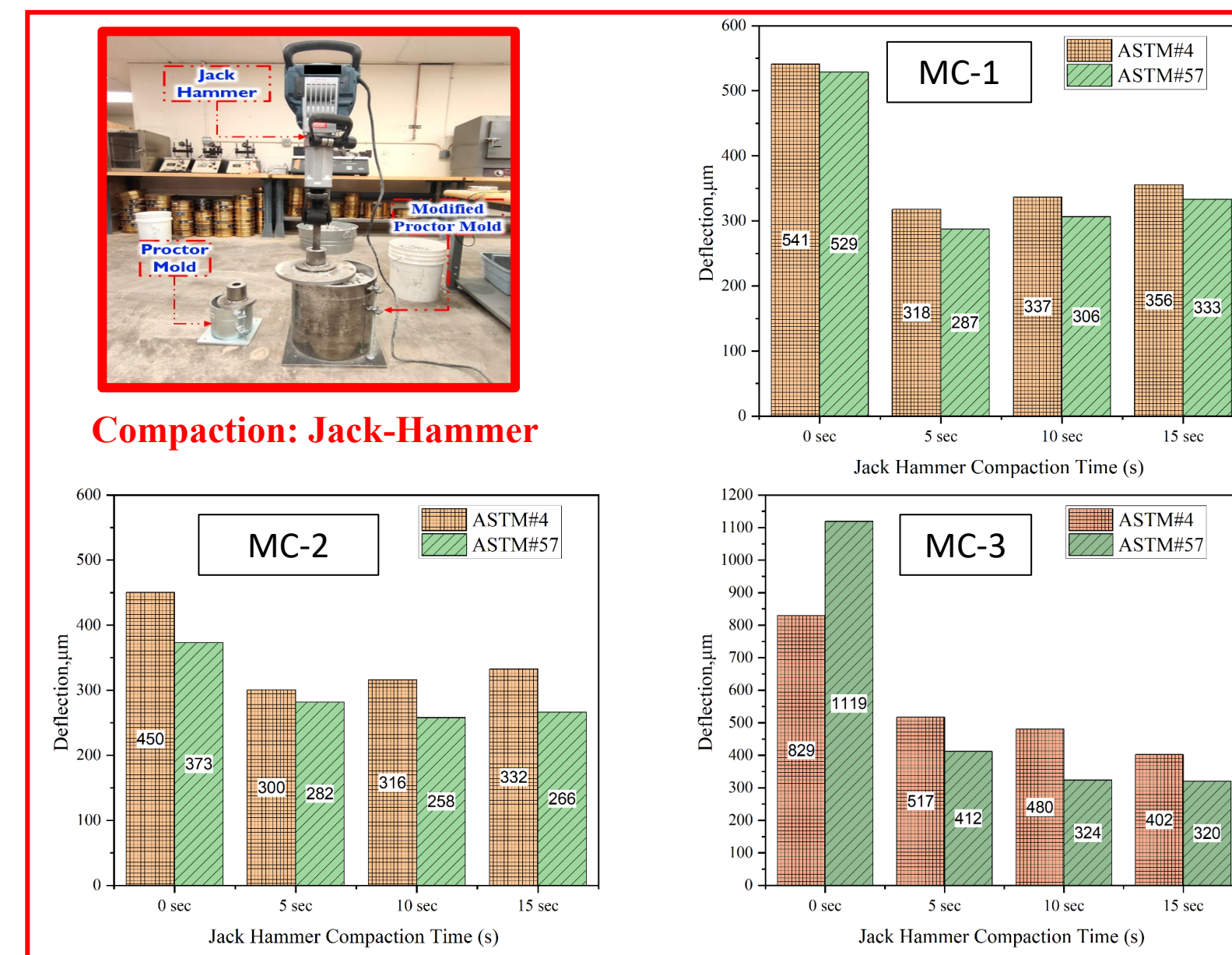
**Device-Agnostic:** The difference in measured surface deflection from Zorn and Olson is negligible which makes this compaction control method Device Agnostic



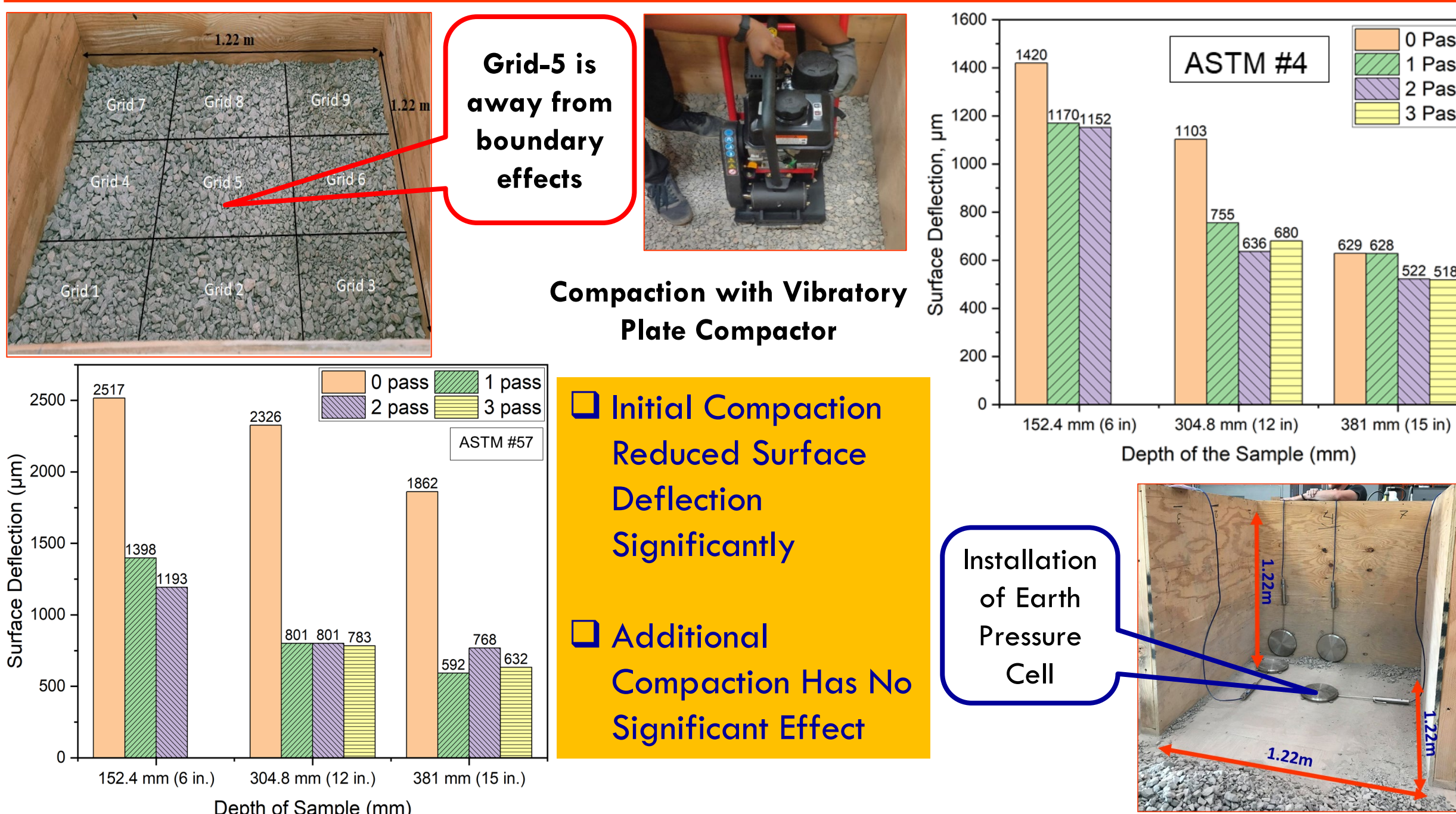
## 5. Laboratory Testing with LWDs in Proctor Molds

❖ The 152.4-mm diameter mold (MC-1) provides proportional relation between the deflection with compaction which is an indication of destruction of the packing

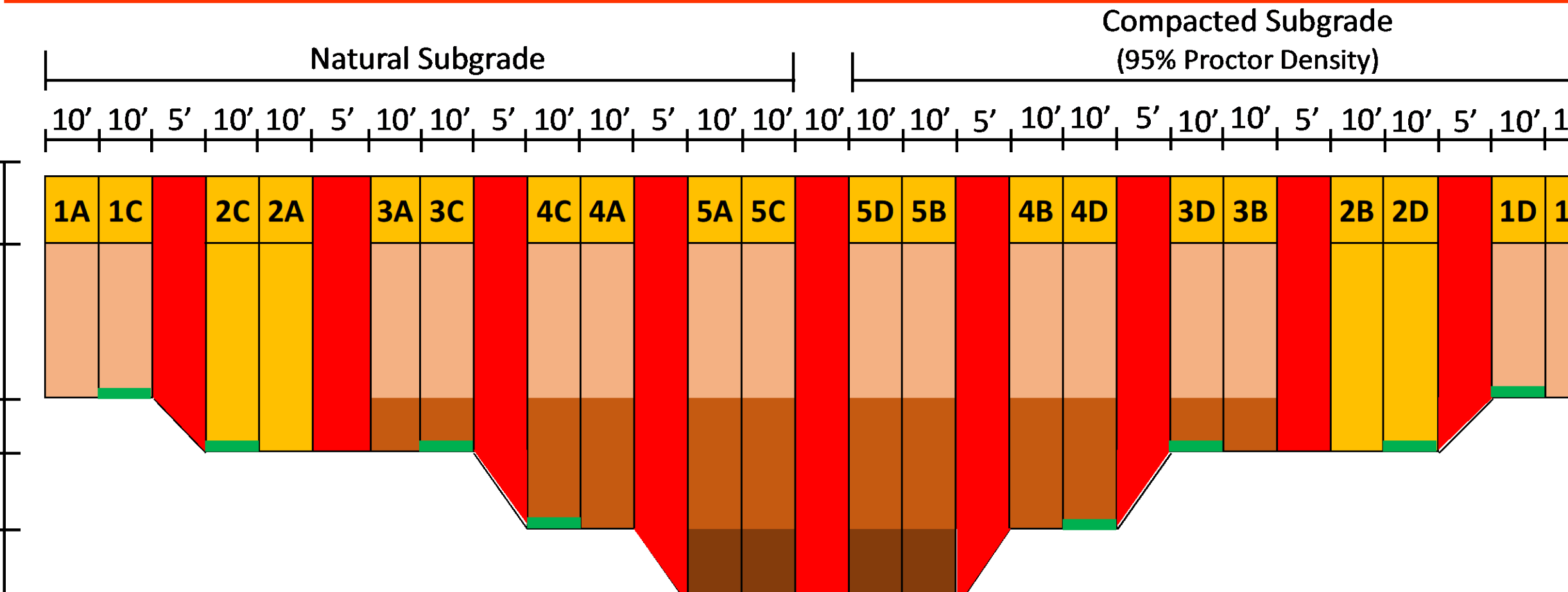
❖ Compaction using vibratory shake table requires more time to reach the similar level of compaction as Jack Hammer




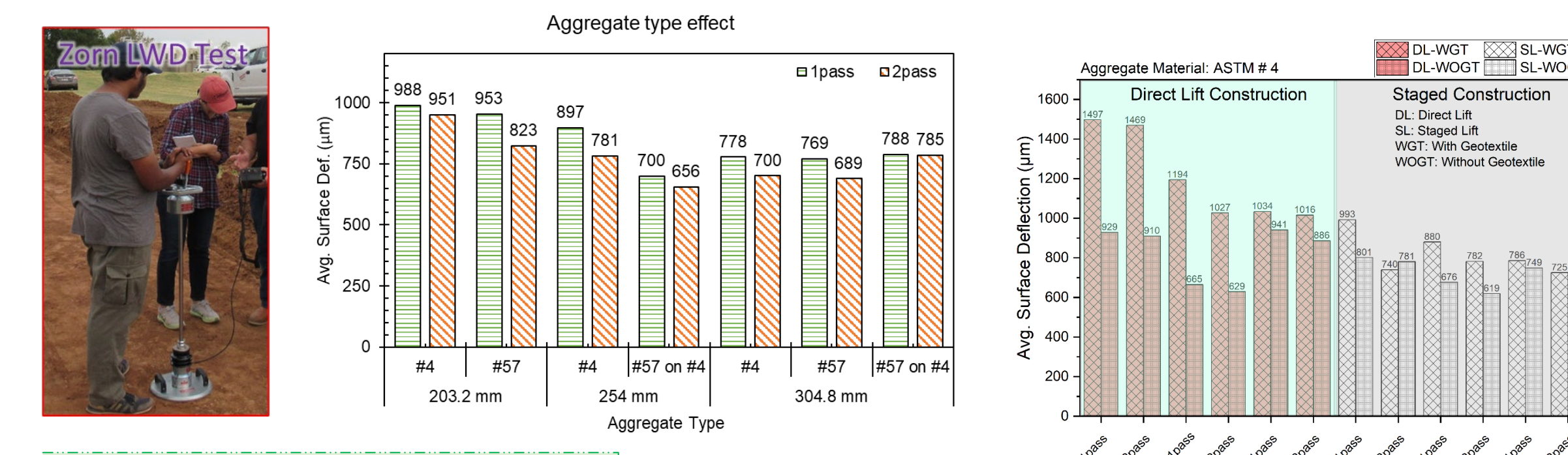
## 6. Laboratory Testing with LWDs in Wooden Box



## 7. Full-Scale Field-Testing Plan

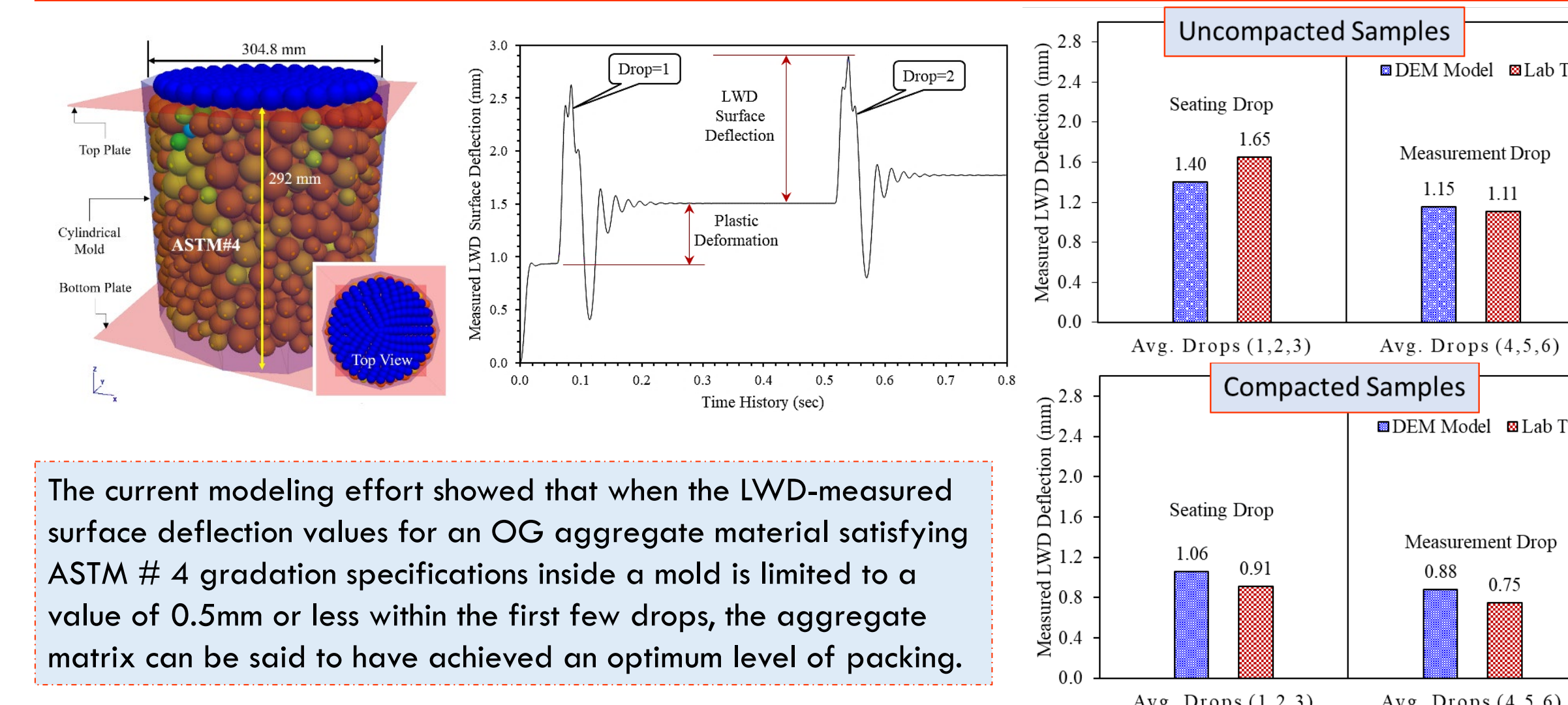


## 8. Field Construction and Testing

- Surface deflection of a layer is not significantly affected by the type of aggregate material, rather is affected by the height of the layer.
- With geotextile use, there is a reduction in surface deflection with increasing layer thickness. However, when no geotextile is used, an exception to this trend is found (primarily due to aggregate penetration into the subgrade).
- Vibratory shake table compaction in a customized mold closely replicates the compaction scenario in the box and field in terms of surface deflection.

## 9. Discrete Element-based Numerical Study



## 10. Summary

- ✓ LWD can be used as an alternative Deflection-based QC/QA for Open Graded Aggregate Materials.
- ✓ Vibratory shake table compaction successfully captures the field scenario providing similar surface deflection.

## 11. Acknowledgement

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