# Early Opening of Concrete Pavements to Traffic

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# The Research Problem

- Current traffic-opening criteria
  - empirical
  - overly conservative (Crovetti and Khazanovich, 2005)
  - causing unnecessary construction delays and cost
- Concrete strength measurements
  - indirect (based on strength of cast aside beams or cylinders) or destructive (coring)
  - expensive

# Strength Opening Criteria

| State | Age for Opening (days) | Minimum Compressive Strength (psi) | Minimum Flexural Strength (psi) | Comments |
|---|---|---|---|---|
| DE | | 3500 | | |
| IL | 14 | 3500 | 650 | |
| MD | 7 | 3000 | | |
| MI | 7 | 2600 | 550 | -Flexural strength must be met before opening regardless of other values |
| NJ | 10 | 3000 | | |
| NY (Construction) | 7 | 2500 | | -Min 3 days if meets strength |
| NY (Traffic) | 10 | 3050 | | -Min 4 days if meets strength<br>-15 days if not between 6/1-9/15 |
| OH | | | 400 | |
| PA | 7 | 3000 | | |
| TX (Construction) | 2 | 2800 | 450 | |
| TX (Traffic) | 7 | 3500 | 750 | |
| VA | 14 | | 600 | |

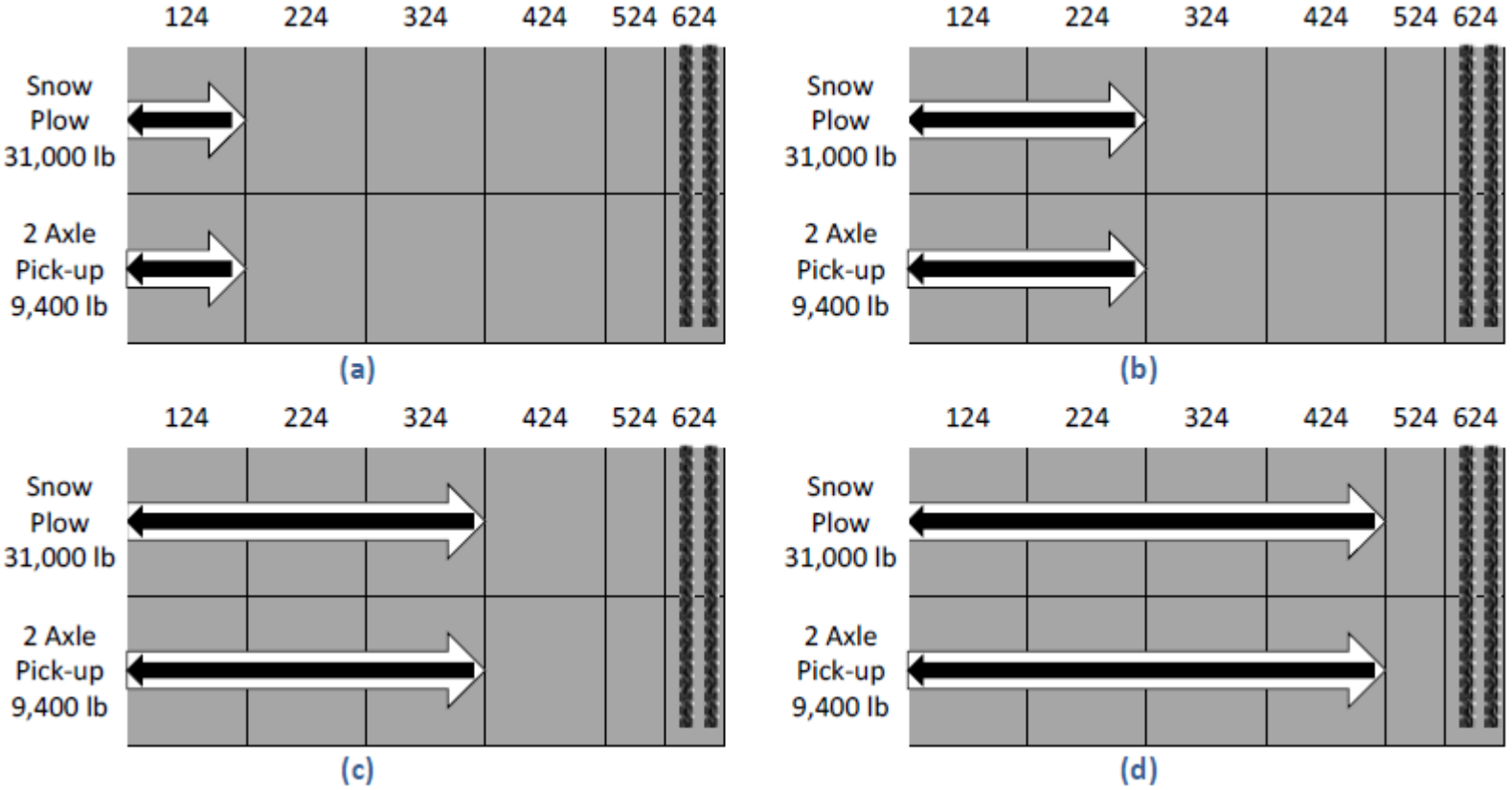
# MnROAD Study

Loading 2 hours after paving

Van Deusen et al, 2018

# MnROAD Study

Loading 3-11 hours after paving




No visible damage!

Van Deusen et al, 2018

# Research objectives

Develop a strategy that can be implemented by the IRISE members for optimal timing of traffic opening.

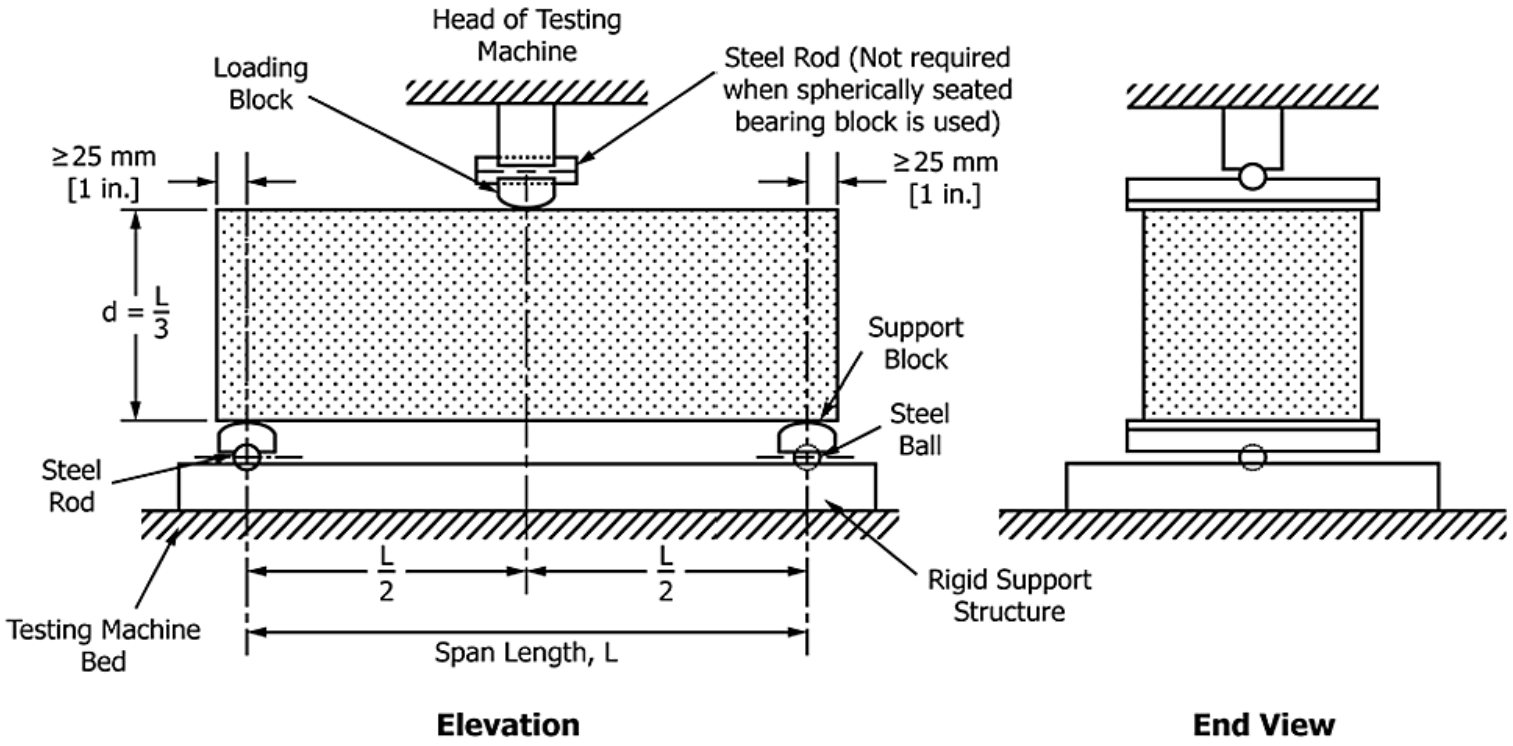
# Project Objectives

- Provide effective, localized design tool to Pennsylvania pavement engineers compatible with the AASHTOWare Pavement ME program similar to MnPAVE Rigid, the tool used by MnDOT
- Accelerate implementation of the AASHTO Mechanistic-Empirical Pavement Design Guide (MEPDG)
- Reduce potential of design errors from the improper use of the AASHTOWare Pavement ME software
- Reduce or eliminate license fees required to perform MEPDG design using the AASHTOWare Pavement ME software

# Project Approach/Deliverables

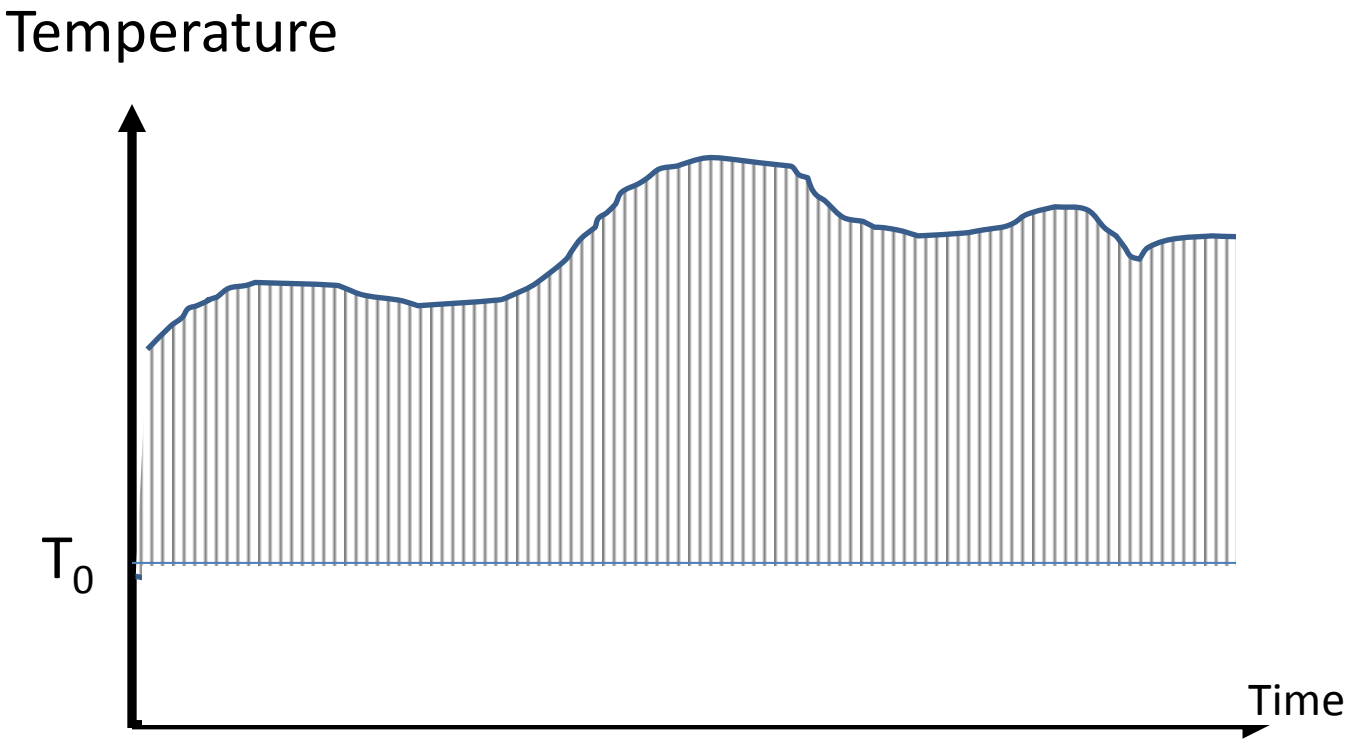
- ❑ Task A: Literature review
- ❑ Task B: Laboratory and field testing
- ❑ Task C: Develop mechanistic-empirical model
- ❑ Task D: Conduct traffic simulation
- ❑ Task E: Final Report

# Laboratory and Field Testing
# Strength Testing



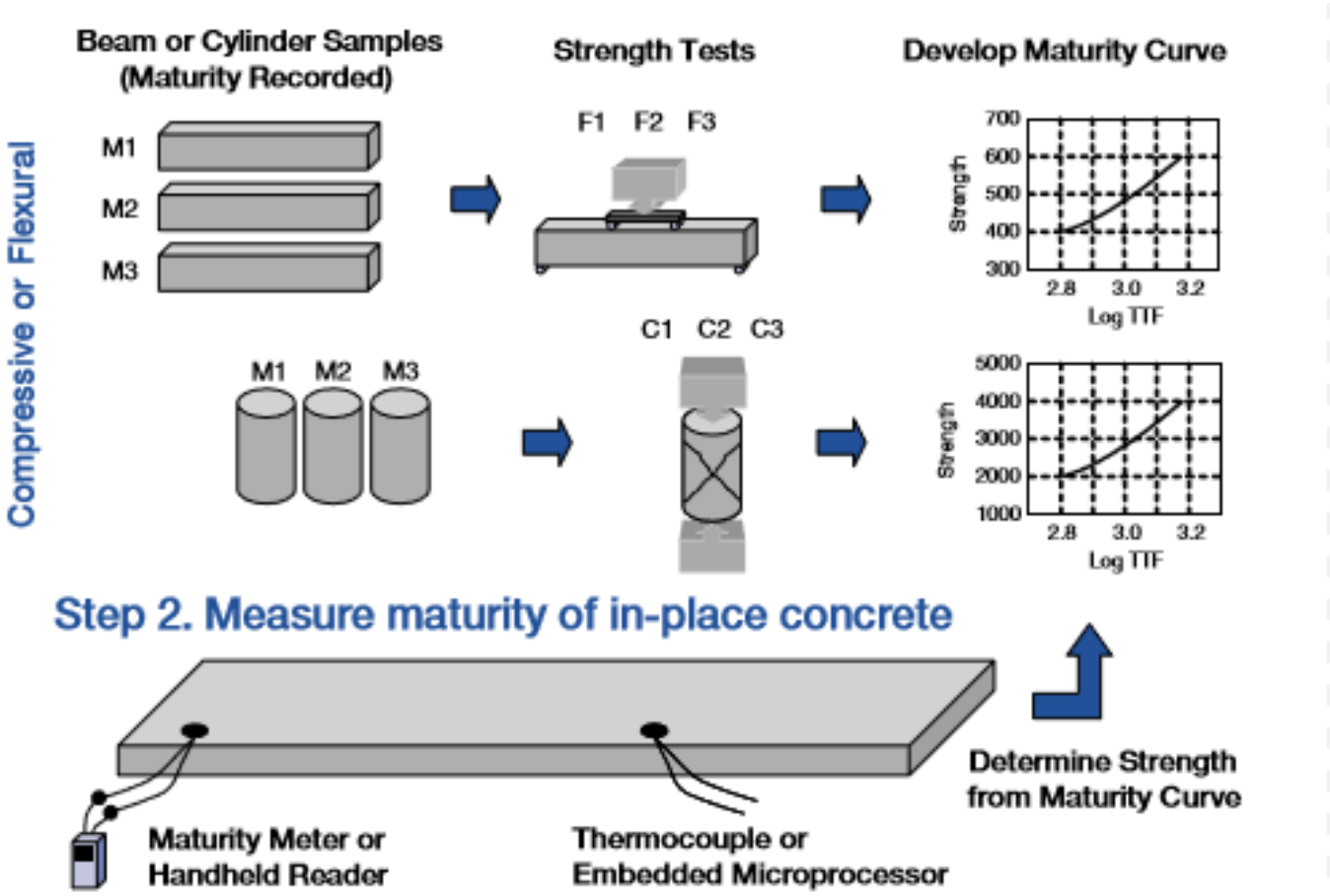

ASTM

# Laboratory and Field Testing
# Maturity Testing



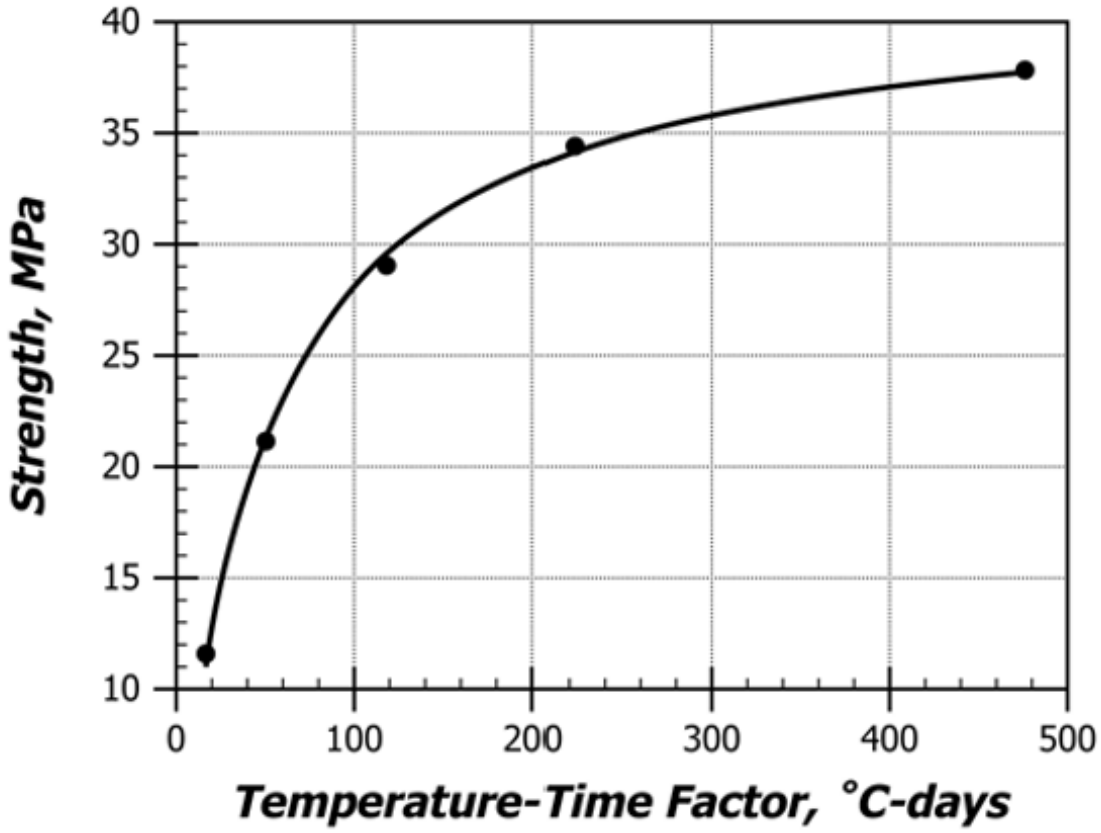

$$M(t) = \Sigma(T_a - T_o) \cdot \Delta t$$

# Laboratory and Field Testing
# Maturity Testing




http://wikipave.org/index.php?title=Maturity_Testing

# Laboratory and Field Testing
# Maturity Testing

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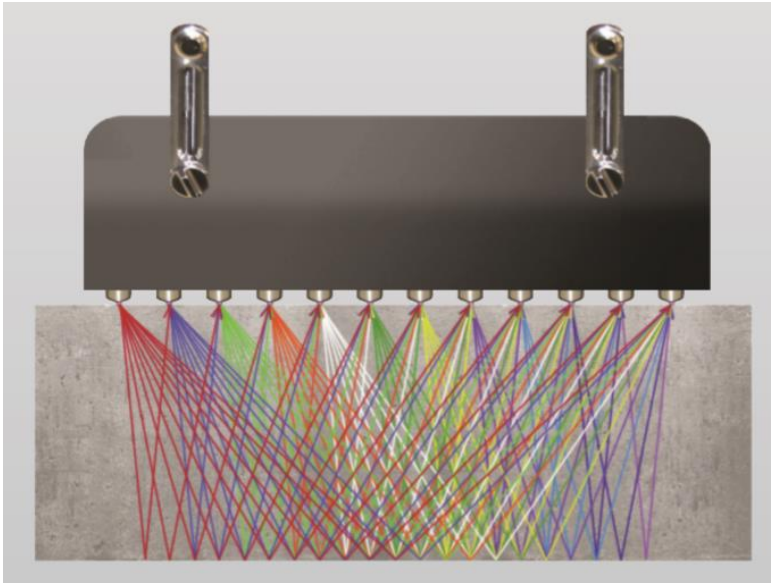
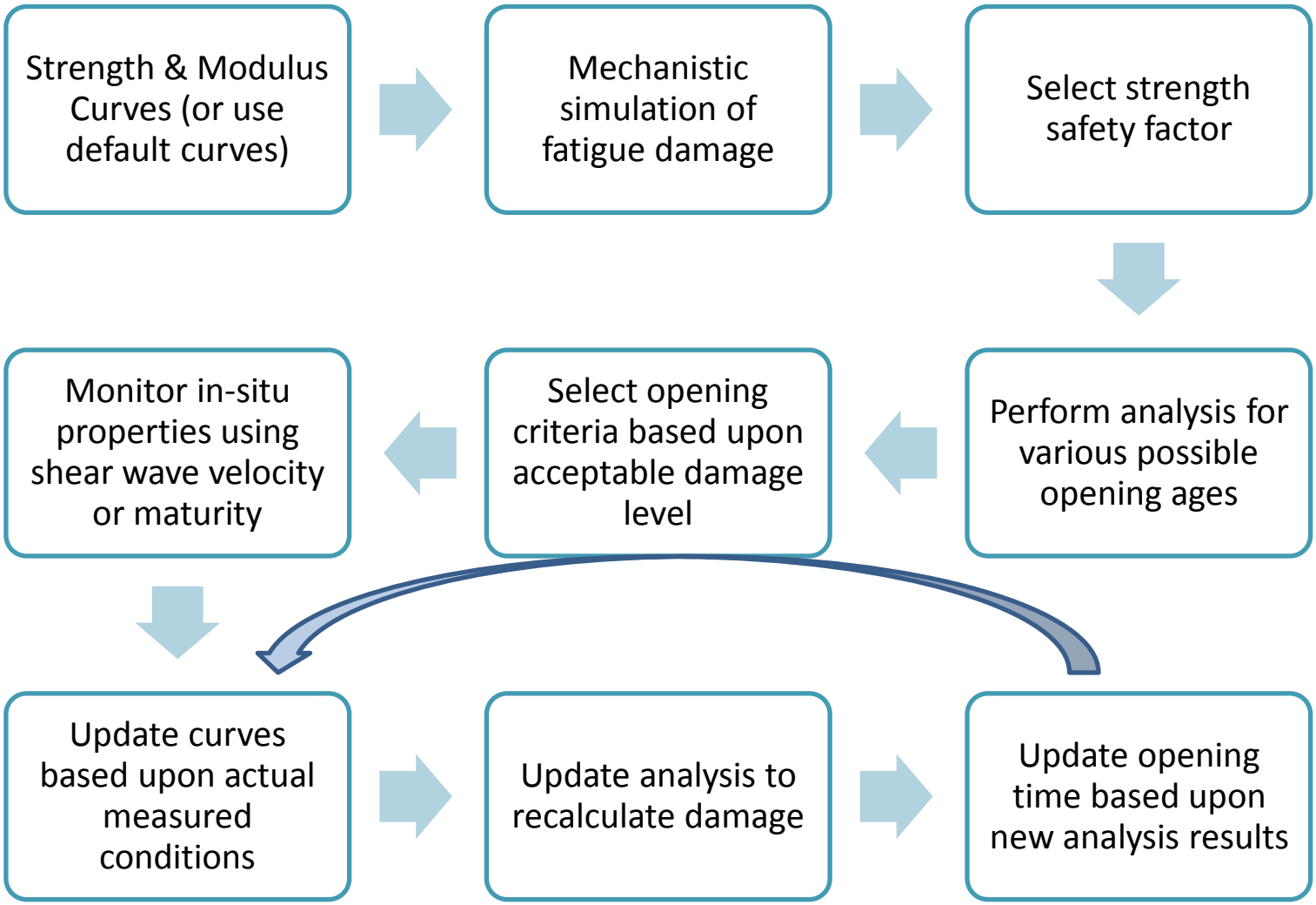
# Laboratory and Field Testing
# Ultrasound Tomography Testing



Shear wave velocity -> Concrete Modulus of Elasticity -> Strength

# Mechanistic-Empirical Model



# Application of Research Results

- Reduction of construction time and cost
- Reduction of traffic congestion and user cost