



American Concrete Institute

Electric Arc Furnace Slag as Concrete Coarse Aggregate

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Overview

- Motivation
- Background
- Expansion (ASTM D4792)
- Mechanical Strength
- Implications



Motivation

- Electric arc furnace (EAF) slag is a product of steel recycling
- >10 million tons per year in USA
- Often landfilled at \$60-80/ton
- Beneficial use as concrete aggregate:
 - Reduces landfill burdens & disposal costs
 - May improve concrete properties



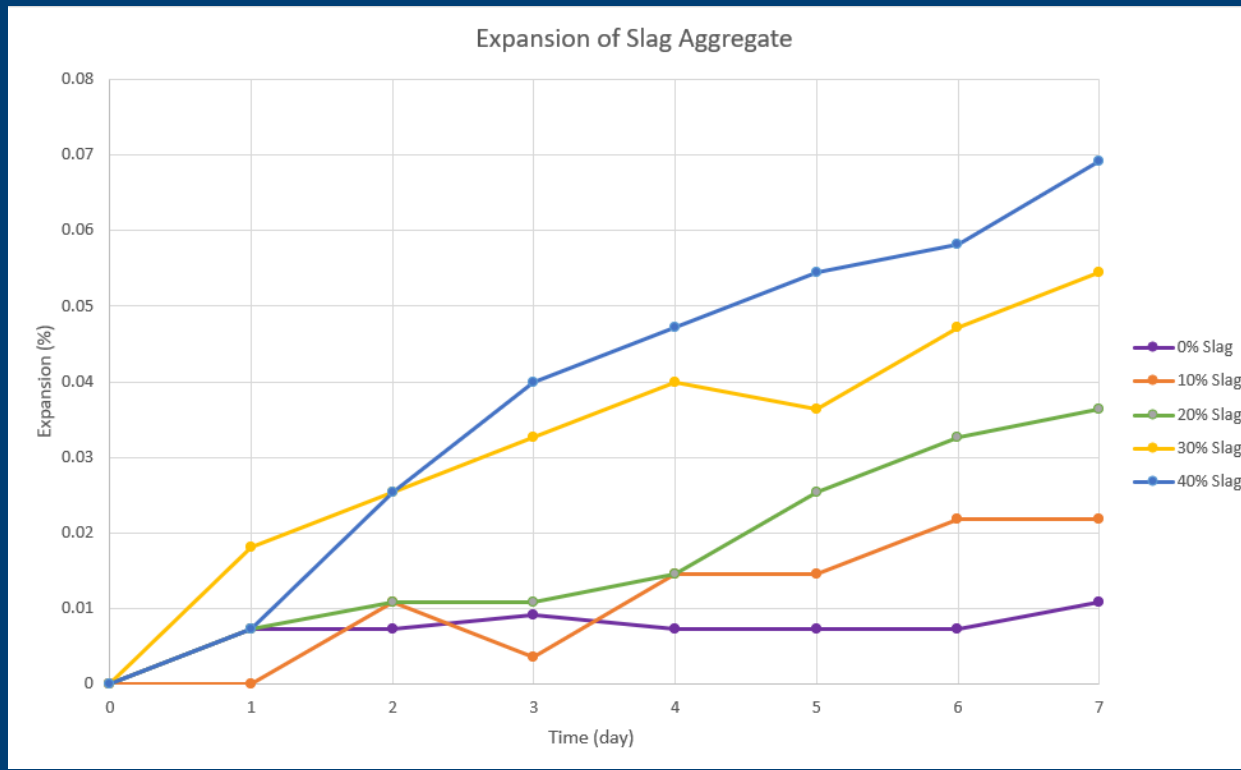
Background

- Potential for expansion due to hydration of free CaO and MgO
- Maximum coarse aggregate replacement level is limited by expansion & unit weight

Chemical Composition	Average Range (%)
SiO ₂	5–40
FeO	1.2–50
CaO	15–54
MgO	1–21.4
Al ₂ O ₃	1–15
Others	0.05–5

Expansion (ASTM D4792)

- The samples did not show levels of expansion that would be detrimental to the performance of concrete.



Mechanical Strength

Slag fraction (wt% of coarse aggregate)	Compressive strength (psi)	Modulus of elasticity (10^6 psi)	Flexural strength (psi)
0	7340	5.109	941.67
30	6890	4.314	1041.67
40	6600	4.604	1037.50

- EAF slag aggregate provides:
 - Small changes in compressive strength
 - Reduction in modulus of elasticity
 - Moderate increase in flexural strength.

Implications

- Cost
 - EAF slag - \$5-10 per ton
 - Limestone - \$10-50 per ton
- Potential Uses
 - Flexible concrete pavements (lower MOE)
- “Use constituting disposal” → “Beneficial use determination”
- Use of EAF slag aggregates can have both economic and engineering benefits



Thank You