Recycled Aggregate Products
Recycled Aggregate Products

- Road Base
- Dry Coarse Aggregate
- Pipe Utility Bedding
- Engineered Structural Backfill
- Landscape Dimension Stone
- Vehicle Tracking Rock
- Trail Surfacing
- Ready Mixed Concrete (Green Crete)
- Biota Cap and Cover
- Top Soil Amendment
- Under Slab Bedding
- Drainage Rock
- Stackable Landscape Stone
- Washed Aggregate Products

Recycled aggregate yields more volume by weight, up to 15%
Product Standards & Specifications

• In accordance with ASTM & AASHTO
  – Specifications used by engineers

• Minimal deleterious
  – Contaminates such as wood metal etc…

• Non-reactive
  – Alkali Silica Reactivity (ARS)
  (Not a typical property of recycled aggregates)
Recycled Ready-Mix Concrete
# Interstate Highway Experience

## Recycled Mix Design: I-70 & Peoria Project

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* Department of Transportation’s design specification
75% Recycled Mix Design

I-70 & Peoria Project
Recycling Terminology

• Application Engineering
  – Engineers design project with recycled materials use in mind

• Value Engineering
  – Cost effective engineering solutions

• Re-use planning
  – Owner, Developer, Contractor, Recycler, Engineer all involved from beginning of project design/plan

• Sustainability
  – As part of project goals:
    • Economic, Social, & Environmental
Recycling Equipment
Urban Redevelopment as an Aggregate Resource

- Highway Re-construction
- BRAC
- Shipyards
- Rail & Industrial
- Airports
- Dam & Reservoir
- Large Infrastructure

- Demo with Intent to Recycle:
  - Re-use Planning
  - Sustainability Goals
  - Application Engineering
  - Recycled Aggregate:
    - Base Materials
    - Utility Bedding
    - Drain Rock
    - Trail Cover
    - Concrete Rock
    - Clean Rock Uses
“The Worlds Largest Recycle Project”

#1

Stapleton International Airport
Denver, Colorado
Stapleton Project Overview

• 5,000 Commercial International Airport
• Over 1000 Acres of Paved Hardscape
• Removal of Taxiways, Runways, & Aprons
• Vertical demolition
• 10 year project
• Developer: Forest City
• Municipality: City & County of Denver
Recycling Stapleton

• 6.5 Million Tons of Concrete & Asphalt Removed & Recycled
• Re-use of 1/3 of the recycled aggregates in the re-development of Stapleton
• 6 years continuous removal
• Creation of an “Urban Quarry” for Stapleton and other public construction projects
Re-Use Planning

• Project plan involves re-use
• Stated as a project mission-driven by economies of re-use
• Schedule, Handling, Specialties
• Buy-in of:
  – Owners
  – Engineers
  – Contractors
  – Partnering Concept
Sustainability Goals

- Planning Evolves Goals
- Recycle for Sustainability
- Re-Use of Resources Where Economic
- Mitigate Depletion
- Reduce Impacts:
  - Traffic Rounds
  - Emissions
  - Land Fill Impact 1:1 Concrete vs. 10:1 Trash
Application Engineering

- Utilization of the Recyclable Resource
- Recycle Alternates
- Reduction of Virgin Materials
- Pavement Sections
- Mix Designs
- New Applications
The Urban Quarry

Denver
Stapleton Project Challenges

1. Quantity Survey
2. Material Quality
3. Application Acceptance
4. Volume Relative to Market
5. Cost Revenue Model
“The Worlds Largest Recycle Project”
#2

El Toro MCAS
Irvine, California
El Toro Project Overview

- BRAC Closure
- 5,000 Acre Military Base
- 800 Acres Paved Hardscape
- Removal of Taxiways, Runways, & Aprons
- Vertical demolition
- 8.5 year project
- Developer: Lennar & Great Park
- Municipality: City of Irvine & Orange County
Recycling El Toro

• 4 Million Tons of Concrete & Asphalt to be Removed & Recycled
• Re-use of 100% of demolished recycled aggregates in the re-development of Public and Private sectors
• 4-5 years to remove—additional 2-3 years to utilize
• Creation of an “Urban Quarry” for on-site re-development
El Toro Project Challenges

• Adaptation of material specifications
• Acceptance of materials in engineered applications---structural
• Re-use and sustainable partnering
• Permitting and licensing at local level—restrictive to the general contractor and no exceptions for the re-use applications
Project Comparison
Stapleton vs. El Toro

• Design and construction of materials of runway---commercial aviation vs. military
• Runway layout and site design
• Elimination of approx. 400K truck rounds import & export at El Toro vs. 600K at Stapleton
• 100% material re-use at El Toro vs. 1/3 material re-use at Stapleton due to Partner Planning & Application Engineering
Summary

• Project specific recycling on a major re-development project offers opportunities to utilize a major urban resource, reduce and eliminate disposal waste, reduce project impact on the community and dramatically reduce costs.

• Recycled Aggregates are proven to be of equal quality and in some cases are superior to virgin aggregates.

• Application Engineering, Value Engineering and Re-use planning concepts translate to near zero solid waste stream.

• Uniform acceptance and use should result from continued development of unilateral standards.