

Techniques of Recycling Demolished Concrete into Specification Aggregates for Re-use



Rick C. Givan, President
Recycled Materials Company, Inc.

Company Overview

- Founded in 1987
- Offices in Colorado & California
- Have Recycled over 25 Million Tons of Concrete and Asphalt to date
- Domestic & International Market Presence



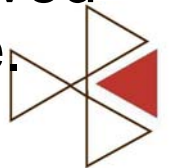
Our Services

- Demolition
- Civil Construction
- On-Site Recycling
- Consulting
- Recycled Aggregate Supplier
- Recycled Ready Mix Supplier



Our Goal: Recycling for Sustainability

- Sustainable Projects use Recycled Aggregate
 - Environmental
 - Application Engineering: Architects & Engineers design project with recycled aggregates usage in mind.
 - Recycled aggregates are “Environmentally Free” products according to Life Cycle Analysis studies.
 - Economical
 - Value Engineering= Cost effective engineering solutions
 - Avoid landfill disposal costs and reduce transport costs
 - Social
 - Re-use Planning: Owner, Developer, Contractor, Recycler, Architect, Engineer & Community all involved from beginning of project design and planning stage.



Our Products



Recycled Aggregate Products

- Road Base
- Coarse Aggregate
- Pipe Bedding
- Structural Backfill
- Landscape Stone
- Vehicle Tracking Rock
- Biota Cap
- Soil Amendment
- Under Slab Bedding
- Drainage Rock
- Washed Aggregate
- Trail Surfacing

Recycled aggregate yields up to 15% more volume by weight!



Product Standards & Specifications

- Produced to ASTM & AASHTO Specs
 - Engineering Specifications
- Non-Reactive
 - Alkali Silica Reactivity (ARS)
 - Not a typical property of recycled aggregates
- Minimal Deleterious Materials
 - Contaminates such as wood, metals & trash
 - Quality Control



Recycled Ready-Mix Concrete



Recycling Equipment



Urban Re-development as an Aggregate Resource

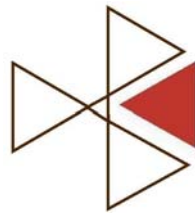
- Demolition with intent to Recycle produces aggregate resources
 - Highway Re-construction
 - BRAC
 - Rail & Industrial
 - Airports
 - Dam, Reservoir, Ports
 - Large Infrastructure



The “Urban Quarry”



Recycling Case Studies



I-70 & Peoria Project



DOT uses 75% Recycled Mix Design!

RMCI's RECYCLED MIX DESIGNS:

Design:	C/A Ratio:	7 Day	14 Day	28 Day
1. Flexural Strength	25% RC 75% NAT	710 PSI 4600 PSI	760 PSI NO DATA	760 PSI 5730 PSI
2. Flexural Strength	50% RC 50% NAT	640 PSI 4560 PSI	690 PSI NO DATA	700 PSI 5530 PSI
3. Flexural Strength	75% RC 25% NAT	665 PSI 4700 PSI	690 PSI NO DATA	800 PSI 6230 PSI
				Project Average 697.55 PSI

Original Department of Transportation Mix Design only at 650 PSI--without using Recycled Course Aggregate



“The Worlds Largest Recycle Project”



Stapleton International Airport
Denver, Colorado

Project Overview

- 5,000 acre Commercial International Airport
- Over 1000 Acres of Paved Hardscape
- Horizontal & Vertical demolition
 - Removal of Taxiways, Runways, Aprons, Hangers, Towers
- 10 year project
- Developer: Forest City
- Municipality: City & County of Denver



Recycling Stapleton

- Recycled 6.5 Million Tons of Concrete & Asphalt
- 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



Application Engineering

- Projects designed with re-use in mind
- Recycled Aggregates are used in infrastructure re-development
- New applications are developed to fit project needs



“Staple Stone”

Stapleton, Colorado



Stapleton Project Challenges

- Quantity Survey
- Material Quality
- Application Acceptance
- Volume Relative to Market
- Cost Revenue Model



The NEXT World's Largest Recycle Project!



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 & Horizontal demolition
- 8.5 year project
- Developer: Lennar & Great Park
- Municipalities: City of Irvine & Orange County



Recycling El Toro

- 4 Million Tons of Concrete & Asphalt will be Removed & Recycled
- 100% re-use of recycled aggregates in re-development phase
- 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 structural engineering applications
- 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 truck trips
 - El Toro: saves 400K truck trips
 - Saved 16,000,000 miles (assuming 40 mile RT)
 - Saved 80,000 tons GHG (CO₂e) emissions (note 1)
 - Stapleton: saves 600K truck trips
 - Will save 24,000,000 miles (assuming 40 mile RT)
 - Will save 120,000 tons GHG (CO₂e) emissions (note 1)

Note 1: Assumes half distance full-load and half distance empty



Summary

- Project specific recycling on a major re-development project offers opportunities to utilize urban resources, reduce and eliminate disposal waste, reduce community impact and 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 waste”
- Uniform acceptance and use should result from continued development of unilateral standards.



Questions??



Thank You!