




**YAGGY
COLBY**
ASSOCIATES

2013 MUNICIPAL STREETS SEMINAR

NOVEMBER 13, 2013
AMES, IOWA

RECYCLED CONCRETE
VALUE TO CITY

- 
- Recycled Portland Cement Concrete (RPCC)
 - Recycling Process
 - Recycled Concrete Aggregates (RCA)
 - Value to City

RECYCLED PORTLAND CEMENT CONCRETE (RPCC)

- What is RPCC
 - Roadways
 - Driveways & Sidewalk
 - Parking Lots
 - Structures





RECYCLING PROCESS

- Evaluation of Source Concrete
- Pavement Preparation
- Pavement Breaking and Removal
- Removal of Steel
- Stockpiling
- Crushing and Sizing
- Beneficiation
- Testing and Delivery

RECYCLING PROCESS



RECYCLED CONCRETE AGGREGATES (RCA)

- Characteristics of RCA
 - Physical Properties
 - Particle Composition
 - Shape and Texture
 - Absorption Capacity
 - Specific Gravity
 - Gradation
 - Stability





RECYCLED CONCRETE AGGREGATES (RCA)

- Characteristics of RCA
 - Mechanical Properties
 - Los Angeles Abrasion Loss
 - Sulfate Soundness Mass Loss
 - Magnesium Sulfate Soundness Mass Loss
 - CBR
 - Durability
 - Chemical Properties
 - Alkalinity
 - Chloride Content
 - Precipitate Potential



RECYCLED CONCRETE AGGREGATES (RCA)

- Characteristics of RCA
 - Comparisons of Some Typical Virgin Aggregate and RCA Properties

Property	Virgin Aggregate	RCA
Shape and Texture	Well-rounded & smooth to angular & rough	Angular with rough surface
Absorption Capacity	0.8% - 3.7%	3.7% - 8.7%
Specific Gravity	2.4 - 2.9	2.1 - 2.4
LA Abrasion Loss	15% - 30%	20% - 45%
Sodium Sulfate Soundness Mass Loss	7% - 21%	18% - 59%
Magnesium Sulfate Soundness Mass Loss	4% - 7%	1% - 9%
Chloride Content	0 - 2 lb/yd ³	1 - 12 lb/yd ³



RECYCLED CONCRETE AGGREGATES (RCA)

- Uses of RCA
 - Unstabilized Subbase
 - Granular Subbase
 - Modified Subbase
 - General Fill and Embankment
 - Special Backfill
 - Pipe Bedding and Trench Backfill



RECYCLED CONCRETE AGGREGATES (RCA)

- Uses of RCA
 - Granular Surfacing & Granular Shoulders
 - Erosion Control (Rip-Rap)
 - Stabilized Subbase
 - Cement Treated
 - Lean Concrete
 - Asphalt
 - New Pavement Mixtures

RECYCLED CONCRETE AGGREGATES (RCA)

- Specifications in Iowa
 - Iowa Department of Transportation (IDOT)
 - Iowa Statewide Urban Design and Specifications (SUDAS)
 - Municipalities (Local)



RECYCLED CONCRETE AGGREGATES (RCA)

- Granular Subbase
 - IDOT 4121 ; SUDAS 2010 (IDOT Materials I.M. 210)
 - Gradation No. 12a
- Modified Subbase
 - IDOT 4123 ; SUDAS 2010 (IDOT Materials I.M. 210)
 - Gradation No. 14





RECYCLED CONCRETE AGGREGATES (RCA)

- Special Backfill
 - IDOT 4132 ; SUDAS 2010
 - Gradation No. 30
- Pipe Bedding and Backfill
 - IDOT 4118 ; SUDAS 3010
 - Gradation No. 3 (No. 200 restrictions do not apply)
- Granular Surfacing and Granular Shoulder
 - IDOT 4120 ; SUDAS 2010 & 7030
 - Gradation No. 11

RECYCLED CONCRETE AGGREGATES (RCA)

- Effects on Subsurface Drainage
 - Tufa
 - Rodent Guard
 - Filter Fabric
 - Waste Material (#4 Minus)





RECYCLED CONCRETE AGGREGATES (RCA)

- New Pavement Mixtures
 - Currently not allowed by Specification (IDOT & SUDAS)
 - In general, RCA products should meet same quality requirements as virgin aggregate
 - Workability and Finishing Issues
 - Iowa Projects – Research & Development
 - Future – Private (LEED)



VALUE TO CITY

- Performance
 - Comparable to Virgin Aggregates
- Economics
 - Construction Costs
- Waste Reduction
 - Land Availability



VALUE TO CITY

- Resource Conservation
 - Virgin Aggregates
- Fuel / Energy Conservation
 - Virgin Aggregate Production
 - Delivery System
- Virgin Aggregate Availability
 - Urban Locations
 - Depleted Sources



VALUE TO CITY

“SUSTAINABILITY”



REFERENCES

- Center for Transportation Research and Education (CTRE) / Iowa State University
 - *Performance Evaluation of Concrete Pavement Granular Subbase – Pavement Surface Condition Evaluation*, July 2008.
- Institute for Transportation / Iowa State University
 - *Evaluating Roadway Subsurface Drainage Practices*, May 2013.
- American Concrete Pavement Association (ACPA)
 - Engineering Bulletin (EB043P) - *Recycling Concrete Pavements*.



Discussion???