

Recycled Aggregate

Introduction

Recycled aggregate is produced by crushing concrete and asphalt according to strict manufacturing standards. These standards comply with Caltrans, the *Standard Specifications for Public Works Construction* (Greenbook), or specific building project specifications. Recycled aggregate has been successfully used by Caltrans as road base and subbase since the 1970s.

Benefits of Recycled Aggregate

The use of recycled aggregate can save money for local governments and other purchasers, create additional business opportunities, save energy when recycling is done on-site, conserve diminishing resources of virgin aggregates, and help local governments meet the diversion goals of the California Integrated Waste Management Act of 1989.

Quantities

According to the Board's 2004 Waste Characterization Study (www.ciwmb.ca.gov/Publications/default.asp?pubid=1097), construction and demolition (C&D) materials made up about 22 percent of California's disposed waste stream, or approximately 8.7 million tons.

More than 977,000 tons of asphalt and concrete currently disposed of in California landfills could be diverted for use as base or subbase material in construction projects.

Materials/Definitions

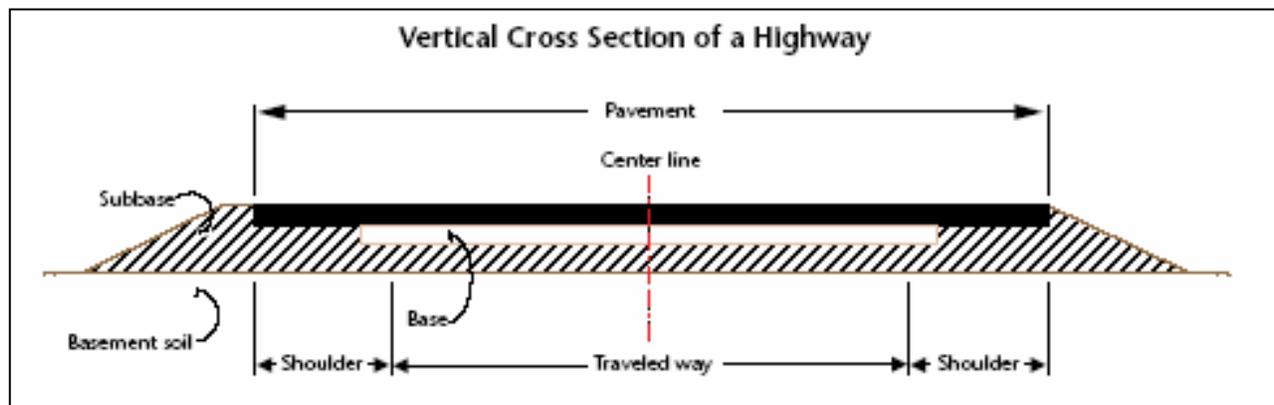
Aggregate consists of hard, graduated fragments of inert mineral materials, including sand, gravel, crushed stone, slag, rock dust, or powder. Aggregate is commonly used as road base and subbase, which supports the pavement.

A roadway is built in several layers: pavement, base, and sometimes subbase. The pavement is the surface layer and is made of asphaltic concrete (AC) or Portland cement concrete (PCC).

The base layer supports the pavement and is made of aggregate base (AB). The subbase layer supports the base and is made of aggregate subbase (ASB). The subbase layer allows more sand, silt, and clay than the AB layer; the subbase layer has less strength but is used because it is more economical when bringing the road up to grade.

Equipment

The AC and PCC generally arrive at the processor in chunks. Heavy crushing equipment is required to break up the chunks into aggregate. Some equipment is portable and can be set up on-site for immediate use of product. A crushing plant may include a hopper to receive the material, a jaw to break it into more manageable pieces, a cone or impact crusher to further reduce its size, a vibrating screen to sort to the required



specification, and a conveyor belt with a rotating magnet to remove metal contamination such as rebar.

Recyclers

According to the California Integrated Waste Management Board (CIWMB), there are approximately 175 producers of recycled aggregate in California. Some receive PCC and/or AC at the plant; others have mobile equipment for in-place recycling. Aggregate recyclers are included in two databases:

Construction/Demolition Recyclers, www.ciwmb.ca.gov/Condemo/Recyclers/, and Recycled-Content Products, www.ciwmb.ca.gov/Condemo/Products/.

Markets

Uses: Recycled aggregate can be used:

- In paved roads as aggregate base, aggregate subbase, and shoulders.
- In gravel roads as surfacing.
- As base for building foundations.
- As fill for utility trenches.
- Non-structural concrete, curbs, gutters, sidewalks.

At this time, the primary market is aggregate base and subbase in road projects.

Specifications

Road projects in California typically either follow the Caltrans specifications or the Greenbook specifications. In Southern California, the Greenbook is commonly used. Both the Caltrans and Greenbook specifications allow the use of recycled aggregate provided it meets the same grading and quality specifications as virgin aggregate.

Caltrans Specifications—Procedures

Caltrans takes a new specification through three stages:

1. Special Provision (SP). Trial period where an SP is used initially on a number of projects.
2. Standard Special Provision (SSP). After the SP has been used successfully for a period of time it usually becomes an SSP, which means that it is a method approved by Caltrans.
3. Standard Specification. After the SSP has been used successfully for a period of time, then it usually becomes a Standard Specification and is included in Caltrans Standard Specifications, which is published every four years.

Caltrans Specifications—Existing

The Caltrans Standard Specifications, May 2006, covers aggregate base and aggregate subbase in Sections 25 and 26. These sections allow up to 50 percent recycled aggregate. The Caltrans SSPs do allow up to 100 percent "reclaimed asphalt concrete, portland cement concrete, lean concrete base, cement treated base," or "glass" in Class 2 and 3 aggregate base, and also in Class 1, 2, and 3 aggregate subbases.

Greenbook Specifications

The city and county of Los Angeles and 200 other local governments and agencies in the Los Angeles area use the Greenbook.

The Greenbook is published by the Joint Cooperative Committee of the Southern California Chapter of the American Public Works Association and the Southern California Districts of the Associated General Contractors of California. It is updated and republished every three years. Supplements are published yearly. The Greenbook includes both English and metric units and is available through:

BNI Building News
1612 S. Clementine St.
Anaheim, CA 92802
(714) 517-0970
<http://bni-books.com/>

Aggregate Base Specifications. In Section 200-2, "Untreated Base Materials," the *Greenbook* includes four categories of aggregate base that are of interest here:

1. Crushed Aggregate Base (CAB) does NOT include recycled aggregate. CAB may sometimes be specified where recycled base (CMB or PMB) would also meet requirements.
2. Crushed Miscellaneous Base (CMB) allows recycled aggregate. The *Greenbook* states that CMB "shall consist of broken and crushed AC or PCC and may contain crushed aggregate base or other rock."
3. Processed Miscellaneous Base (PMB) also allows recycled aggregate. The *Greenbook* states that PMB "shall consist of broken or crushed AC, PCC, railroad ballast, glass, crushed rock, rock dust, or natural material."
4. Select Subbase is the *Greenbook's* only aggregate subbase category. It allows recycled aggregate.

Section 200-2.4 spells out the performance standards for CMB.

Solid Waste Permits

Regulations affecting C&D and inert debris transfer/processing facilities became effective on August 9, 2003. Processors that accept segregated C&D debris may be required to have a solid waste facilities permit. Contact your local enforcement agency (LEA) for information.

To find out who the LEA is for the project area, check the LEA Directory, www.ciwmb.ca.gov/LEACentral/LEADirectory/, on the Board's website or call the LEA/EA Branch at (916) 341-6314. More information is available at the CIWMB Construction/ Demolition and Inert Debris website, www.ciwmb.ca.gov/LEATraining/Resources/CDI/default.htm.

Resources

See the CIWMB online Publications Catalog at www.ciwmb.ca.gov/Publications/default.asp?cat=3 for a complete list of C&D publications, including downloadable versions.

Specifications

For more information regarding specifications for CMB, please visit the CIWMB's construction and demolition specifications web page at www.ciwmb.ca.gov/Condemo/Specs/.

Construction/Demolition Recyclers—A searchable database of sites in California that receive construction and/or demolition materials for recycling or reuse, including concrete, asphalt, and brick, is available at www.ciwmb.ca.gov/Condemo/Recyclers/.

Recycled-Content Products—A searchable database of manufacturers of recycled construction products sold in California, including aggregate, is available at www.ciwmb.ca.gov/Condemo/Products/.

CIWMB Contact

For more information about recycled aggregate, contact CIWMB at (916) 341-6500 or by e-mail at condemo@ciwmb.ca.gov.