



Open-Graded Friction Courses

Course Number: CE-02-901

PDH: 2

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This document is the course text. You may review this material at your leisure before or after you purchase the course.

After the course has been purchased, review the technical material and then complete the quiz at your convenience.

A Certificate of Completion is available once you pass the exam (70% or greater).

If a passing grade is not obtained, you may take the quiz as many times as necessary until a passing grade is obtained).

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COURSE OBJECTIVES

This course is an introduction to the subject of open-graded friction courses (OGFC) for roadway paving. The contents of this document are intended to serve as guidance and not as an absolute standard or rule.

The objectives of this course are to:

- **Provide technical information on open-graded friction courses (OGFC)**
- **Present their advantages and limitations**
- **Recommend factors to be considered when choosing an OGFC.**

Some of the topics for consideration include: *the benefits of using open-graded courses; safety advantages; noise reduction features; economic issues; service life; limitations or past problems; current OGFC mix designs usage; and real world examples.* The course research data will be used to provide material for generating any conclusions and recommendations for open-graded friction courses.

Upon course completion, the participant should be familiar with the fundamentals of open-graded friction courses. The course will present various aspects to be considered when selecting and designing OGFCs.

INTRODUCTION

An “**open-graded friction course**” is defined as a thin, permeable layer of asphalt that consists of uniform aggregate grading with a minimum of fines. The percentage of fine aggregate produces a large number of air voids in the compacted mix. The pavement consists primarily of single size coarse aggregate with a high asphalt content. The aggregate skeleton is responsible for the pavement's ability to carry traffic loads without undergoing permanent deformation. The load is carried by the stone while the asphalt keeps everything in place.

Open-Graded Friction Course

(Steve Muench; hawaiiiasphalt.org)



The development of open graded hot mixes was a possible solution to the problems associated with chip seal construction. These pavements have been shown to reduce hydroplaning and poor visibility from splash and spray.

HISTORY

Oregon began experimenting with open-graded friction courses (OGFC) in the 1930's to improve the surface frictional resistance of asphalt pavements. In 1974, the Federal Highway Administration (FHWA) developed an OGFC mix design procedure to be used by state departments of transportation (DOTs). At first, many DOTs reported good performance using OGFC but others stopped using these mixes due to unacceptable performance. Since then, many significant improvements have been made in the areas of OGFC gradation and binder type.



Although DOTs experiences with open graded mixes has been varied, half of the states surveyed in a recent National Center for Asphalt Technology (NCAT) study indicated good performances with OGFC. Over 70 percent of the states reported an OGFC service life of eight or more years - plus approximately 80% of the states have standard specifications for open-graded mix design and construction.

MATERIALS

Recent open-graded friction-course pavements built in the U.S. and Europe have considerably higher air void contents than before (17 to 22%). The void content for hot mix asphalt (HMA) paving used in Tennessee is normally 4 to 7 percent. Newer OGFC mixes are much more open with more voids.

Job Mix Formulas and Design Limits for Open-Graded Friction Course (OGFC) and Porous European Mix (PEM)

Mix Control	Asphaltic	FHWA	Georgia	12.5 mm
Typical	Concrete	Guidelines	OGFC	PEM
Tolerance	Concrete	Guidelines	OGFC	PEM
	Concrete	Guidelines	OGFC	PEM

Gradation Requirements

±0.0 % Passing 19 mm Sieve	-	100	100	100
±6.1 % Passing 12.5 mm Sieve	100	85-100	90-100	95-100
±5.6 % Passing 9.5 mm Sieve	95-100	55-75	35-60	80-93
±5.7 % Passing 4.75 mm Sieve	30-50	15-25	10-25	54-76
±4.6 % Passing 2.36 mm Sieve	5-15	5-10	5-10	35-57
±2.0 % Passing 75 µm Sieve	2-5	2-4	1-4	0-7

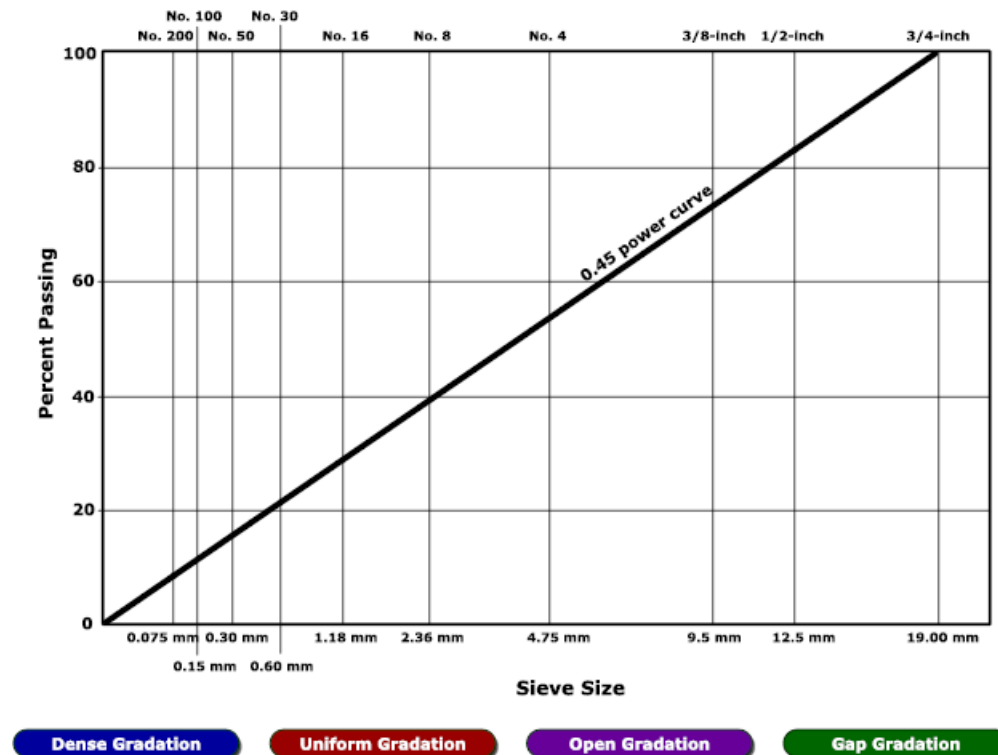
Design Requirements

±0.4 Range for % AC	-	-	5.5-7.0	5.3-7.0
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(FHWA, Georgia DOT & Tennessee DOT)

Today's OGFCs are polymer-modified and include spun mineral or cellulose fibers. Polymer modifiers and fibers complement each other in the liquid asphalt. The polymer stiffens the asphalt binder and adds flexibility in order to resist raveling. The fibers disperse, overlap and form a mat, which keeps the liquid asphalt from draining to the bottom of the layer before cooling.

Typical Gradations



Open graded. Refers to a gradation that contains only a small percentage of aggregate particles in the small range. This results in more air voids because there are not enough small particles to fill in the voids between the larger particles. The curve is near-horizontal and near-zero in the small-size range.

(Steve Muench; hawaiiiasphalt.org)



OVERVIEW

POSSIBLE APPLICATIONS

Open-graded courses are suitable for use in new construction, major rehabilitation, and overlay projects. OGFCs are best utilized when tailored to specific project areas with any of the following characteristics:

Hydroplaning

Locations with a high level of wet crashes

Good tire-pavement contact can be maintained in the presence of water

Wet/Nighttime Visibility

Sites with high number of wet/nighttime accidents

OGFC channels will minimize splash and spray due to rain

Skid Resistance

Locations needing higher friction for high speed wet weather driving

OGFC structure allows slower decrease in friction values

Location

OGFC should be used if adjacent to an existing OGFC project

Allows for continuity of pavement cross section and slope

Cross Slope

Sites with cross slopes less than 2% with 2 or more lanes in one direction

Effectively removes water from roadway surface



Purchase this course to
see the remainder of
the technical materials.