

# SUBBASE SPECIFICATION TRENDS

**New survey information shows that in the past five years, free draining subbases have gained in popularity as a reasonable alternative to permeable subbases.**

Surveys of state agencies conducted by ACPA in 2005 and 2010 reveal that while some long-standing subbase specification practices have remained relatively unchanged, a major shift away from permeable subbases is occurring. The number of agency specifications that allow dense-graded asphalt-treated subbases (ATB) and lean concrete subbases has also declined, but not as dramatically. The reason for the shift away from permeable subbases likely stems from performance issues such as cracking and slab displacement from non-uniform support. In 2007, ACPA made a strong case to stop using permeable subbases and replace them with free-draining materials that are more stable, but still provide good drainage. (See ACPA document EB204P for more information.) Twenty eight percent of the current state specifications now include some form of free-draining subbase.



## Background

As part of a larger survey on state practices, the results of which are available in the ACPA's online Database of State DOT Concrete Pavement Practices, data collected by ACPA covered various subbase types specified by each state agency in 2005. At that time, over 60% of agencies specified some form of a permeable subbase.

Permeable subbases, also known as "drainable" or "open-graded" subbases, became a very popular design element for concrete highway pavements in the 1990's. These subbases are generally characterized as having a permeability greater than about 350 ft/day (107 m/day) in laboratory tests. Despite the intuitive advantage of their ability to rapidly remove excess water from the pavement structure, these subbases have been linked to pavement performance problems. A high-degree of deflection

under loads and a loss of stability and uniformity have been found to contribute to cracking and other pavement problems.

Because of their problems, many state agencies have stopped specifying permeable subbases in the past few years. Instead, these agencies have turned to industry-recommended free-draining subbases, which are made from materials that include enough fines to ensure long-term stability but still easily drain water through the pavement structure (e.g., laboratory permeabilities range from about 50 to 150 ft/day [15 to 46 m/day]).

To establish the apparent trend, ACPA conducted a new survey of state agency subbase specifications in 2010. Figure 1 illustrates the results of these data as a percent of responding state agencies that specified each subbase type in 2005 and 2010.

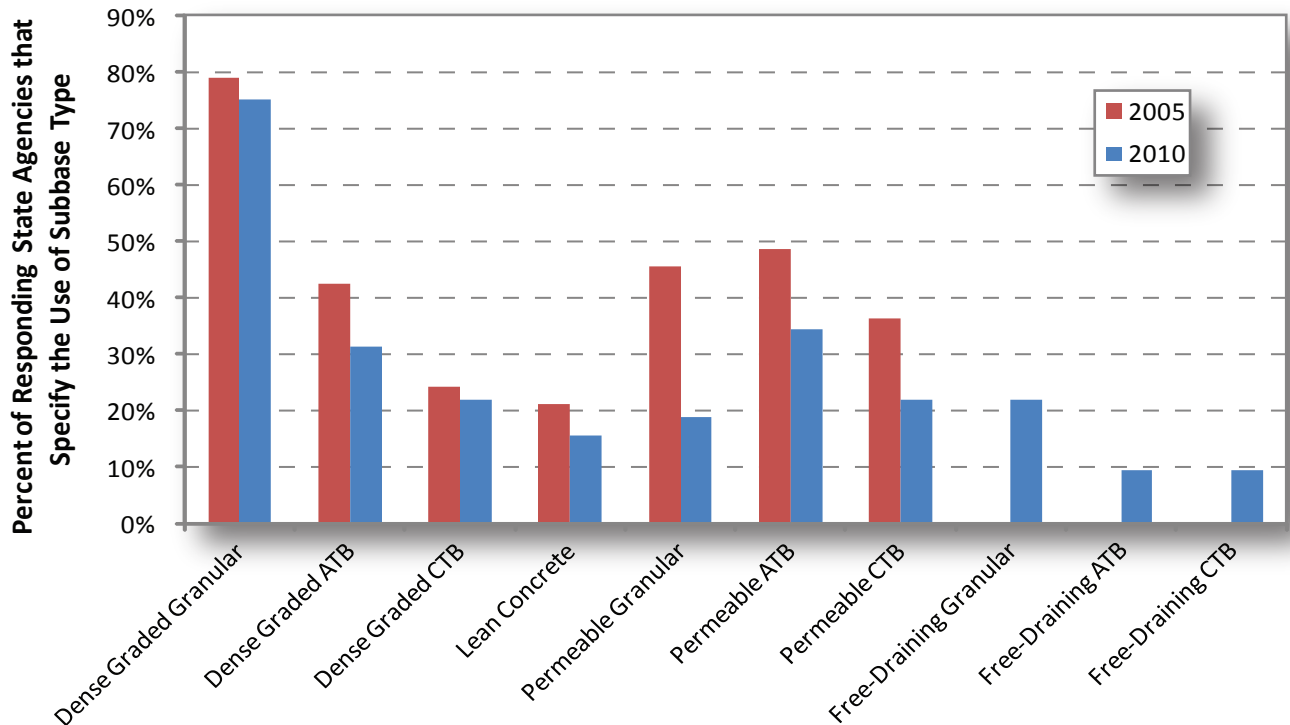


Figure 1. Percent of State Agencies that Specified the Use of each Subbase Type in 2005 and 2010.

## Trends in State Subbase Specifications (See Table 1)

**Dense-graded granular subbases** are the most widely specified subbase type. Almost 80% of agencies allowed dense-graded granular subbases in 2005, while 75% still do so in 2010, a decrease of less than 5% in 5 years.

**Dense-graded asphalt-treated subbase (ATB)** had a much more drastic change, being specified 26% less in 2010 than in 2005.

**Dense-graded cement-treated subbase (CTB)** is being specified about 10% less in 2010 than in 2005.

**Lean concrete subbase** specifications decreased 26% (similar to the decrease in the specification of ATB); just 16% of agency specifications included them in 2010, while about 21% did so in 2005.

**Permeable granular subbases saw the largest change in the 5 years with a decrease of 59%. While more than 45% of agencies specified their use in 2005, fewer than 19% of agencies do so in 2010.**

**Permeable ATB** specifications have been eliminated from many state standard specifications. Their use dropped from 49% of the agency specifications to less than 35% between 2005 and 2010, a decrease of 29%.

**Permeable CTB** had the second largest change in five years, changing from more than 36% of agencies allowing their use to less than 22%, a decrease of 40%.

## Emergence of Free-Draining Subbases

The data collected suggests that industry's recommendations to avoid permeable subbases (based on performance problems experienced in many areas) have impacted practice. Many states now realize that rather than simply specifying materials with high permeability (as was done with permeable subbases), long-term stability must also be considered (as is done with free-draining subbases). Most states that abandoned the use of permeable subbases instead now specify free-draining subbases. For example, the number of agencies now specifying free-draining subbases corresponds almost exactly to the number abandoning specifying each permeable subbase type.

**Free-draining granular subbases are now specified by 22% of agencies, making it a more commonly specified subbase type than permeable granular subbases.**

**Free-draining ATB** and **free-draining CTB** are both now specified by almost 10% of agencies.

*Table 1. Percent Change in Agency Specification of each Subbase Type from 2005 to 2010*

Subbase Types	% Change
Dense Graded Granular	-5%
Dense Graded ATB	-26%
Dense Graded CTB	-10%
Lean Concrete	-26%
Permeable Granular	-59%
Permeable ATB	-29%
Permeable CTB	-40%

## Overall Reduction in Subbase Options within Each State

Also evident from the data is that agencies are decreasing the number of allowable subbase options. This is likely a result of streamlining as agencies review their practices with the latest information.

**In 2005, there was, on average, 3.0 subbase types specified by each agency. By 2010, this decreased to just 2.6 subbase types per agency, on average.** This is significant because there are now more subbase options available (e.g., the free-draining subbase types).

Because many of the states previously specifying permeable subbases are now specifying comparable free-draining subbases, the elimination of dense graded ATB and lean concrete subbases by many agencies has had the most impact on the overall reduction in average number of subbase types allowed by each state.

