

# Fly Ash FOR CONTROLLED DENSITY FILL

Controlled Density Fill (CDF), also known as “flowable fill”, is an engineered, controlled fill material which is self-placing, self-leveling, self-compacting and non-settling. It is easily proportioned to suit almost any application and uses conventional materials found in almost every concrete production facility.

## Reasons to Use CDF

CDF was developed to answer the need to be able to do a difficult job well. Since that time, the list of reasons for its use has continued to grow. A few of the reasons to use CDF are:

1. CDF perfectly encapsulates whatever has been installed in the trench and protects it against damage.
2. There is no damage to installed utilities, since no mechanical force is needed to place or compact CDF.
3. CDF does not settle after consolidation, so there is complete long-term protection for encapsulated utilities.
4. The job can be done once and forgotten because CDF eliminates costly repairs due to settlement.
5. CDF consolidates rapidly to allow placement of a permanent pavement patch. Usually allowed to harden overnight, the filled trench can be plated until the following day and then paved.
6. Placing CDF fills requires fewer personnel and reduced equipment.
7. Future access to the fill is assured by designing in excavatability of the CDF.
8. CDF protects utilities in fills against loss of support during adjacent excavation operations. Loose pea gravel fill can flow out if exposed by excavation, causing a loss of support. Should this occur, however, refilling is made easy with CDF.
9. Traffic accidents (and accompanying litigation) resulting from settled fills are eliminated. Public safety is maintained with non-settling CDF.

**The materials and methodology used for void filling have remained virtually unchanged for centuries. The filling process has involved compacting granular materials into voids to provide stabilized fill. Evolving technology replaced manual labor with mechanized compaction. Now there is an engineered product designed to eliminate failures inherent in the traditional method. This product is called Controlled Density Fill (CDF).**

**For more information or answers to questions about the use of fly ash in specific applications, contact your nearest Boral Resources Technical Sales Representative or call 1-770-684-0102**

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10. CDF improves worker safety, since no one needs to enter the excavation for placing or consolidation.
11. Field inspection is eliminated, because CDF can be depended upon to perform. Conventional fill materials must be tested for density in each lift.
12. Excavation costs are reduced because excavations can be made narrower, reducing the volume of spoils and fills needed.
13. CDF can be placed in any weather at any time. It will even displace standing water, which reduces dewatering costs.
14. The speed of construction with CDF minimizes pavement downtime and helps keep traffic moving.
15. CDF requires no storage or dumping area as it is delivered fresh from the ready-mix concrete truck directly into the void.
16. CDF is the perfect fill material for remote locations where access is difficult. Simply pump CDF in place with a concrete pump. Proportioning for pumpability is simple.
17. CDF is the most versatile of materials. It can be easily adjusted to meet requirements for greater flowability, lower unit weight and higher strength.

## Materials for CDF Production

The materials used in the production of CDF are the very same utilized in the production of portland cement concrete. These materials include:

**Portland Cement** – used to provide a light degree of cementing action to the mixture. Control of the degree of cementing action is necessary to provide excavatability for future work. Cement contents typically range for 30#/cy for normal excavatable fill up to 200#/cy where structural, non-excavatable fill is required. Cement type is not important.

**Fly Ash** – used as a workability agent to provide mixes that can flow great distances without segregation. It also provides a slight cementing action. Fly ash contents typically range from 200#/cy where limited flowability is necessary up to 1,000#/cy where long-range flowability/pumpability is necessary.

**Aggregate** – the same types currently used in concrete, or other forms not of concrete quality. Almost any aggregate can be used, provided it is free of plastic fines.

**Admixtures** – usually restricted to air-entraining agents but can include the use of water-reducers.

## Physical Properties

A typical CDF mixture will have the following approximate characteristics:

- 1 day strength: 10-20 psi
- 28 day strength: 50-100+ psi
- Angle of internal friction: 30-55 degrees
- Permeability: 10-5 to 10-7 cm/sec