

AASHTO Concerns with Fly Ash

Overview:

Below are a handful of state responses to a short survey pertaining to the Fly Ash issue. The state Materials Engineer is listed after the state's response.

Texas

1. How much Fly Ash does your agency use (a rough estimate is okay)?

Approximately 2.7 million tons (or 40% of annual production) is used in the state each year. TxDOT used 200,000 tons in 2009 (I believe this number to be under-reported).

2. Would your state use Fly Ash if it is listed as a hazardous waste with an exemption for beneficial use? If no, why not? Liability issues? Public perception?

Yes.

3. Would there be an increase in cost in concrete if Fly Ash was not allowed to be used? If so, about how much (cost per mile or cost per sq. ft.)?

There would be approximately a 10-15% increase in areas with good distribution lines, just to account for the difference between FOB prices of cement versus fly ash.

When ASR mitigation efforts would require the use of testing (our ASR mitigation Option 8), prices per mix design would increase about \$5,000. Where the use of lithium would be required (our ASR mitigation Option 6), prices would increase approximately \$25 per cubic yard (30%).

4. Are there disadvantages to replacing Fly Ash in terms of structural stability and durability? If so, can you quantify it?

There are large improvements in long term durability, especially with the use of Class F fly ash. ASR mitigation, permeability improvements, and resistance to external sulfate attack all contribute to a longer lasting concrete element. It is difficult to quantify the long-term maintenance costs associated with durability problems that fly ash could mitigate significantly, but it would be in the hundreds of millions of dollars, as the life of concrete structures spans over 70 years and the life of concrete pavements over 35.

5. Do you have a state standard that would preclude using Fly Ash if it is listed hazardous with an exemption for beneficial use? (Some State regulations prohibit beneficial use of hazardous waste).

No.

6. If you'd like, please provide any general comments/statements:

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TxDOT has severe ASR problems with concrete aggregate (essentially all of our concrete sands are reactive to various degrees, and most of the coarse aggregates are reactive or potentially reactive). The use of Class F ash has been our primary means of mitigating the ASR problem. Should the ash become classified as hazardous, even with the beneficial use caveat, we have been told that our already dwindling access to quality Class F ash will get even worse. If this happens, we are left only with the use of lithium as a means to mitigate reactive materials, a move that will be expensive and whose long-term efficacy is still unknown.

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Maine

1. How much Fly Ash does your agency use (a rough estimate is okay)?

Currently only one Redimix concrete supplier is using Fly Ash on MeDOT projects. One of the suppliers who was using Fly Ash is in the process of switching back to using Blast Furnace Slag. On the precast side of things I believe only 3 or 4 are currently using Fly Ash. It's hard to determine an annual tonnage used but on a percentage basis I would estimate less than 5% of Redimix is produced using Fly Ash while maybe 15% of precast concrete is produced using Fly Ash. Slag is currently our primary method of ASR mitigation and used in most of our concrete mixes.

2. Would your state use Fly Ash if it is listed as a hazardous waste with an exemption for beneficial use? If no, why not? Liability issues? Public perception?

If one were to incorporate a material classified as hazardous into a bridge or highway, there would likely be implications for monitoring for potential leachate, future handling of recycled material post-use, etc. which would create problems that could drastically decrease our use of fly ash.

3. Would there be an increase in cost in concrete if Fly Ash was not allowed to be used? If so, about how much (cost per mile or cost per sq. ft.)?

Maine DOT would probably see a small increase immediately in the cost of concrete if Fly Ash were no longer available. Discussions with suppliers who use Fly Ash have indicated that Fly Ash is still slightly less in cost than Portland cement and is also lower in cost than using Blast Furnace Slag. However, there could be a larger increase in the future due to reduced ASR mitigation options and increased

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demand for GGBFS. We are not able to quantify this increase but it could be substantial if other sources of mitigation are not available.

4. Are there disadvantages to replacing Fly Ash in terms of structural stability and durability ? If so, can you quantify it?

Maine has allowed GGBFS as an equal option to Fly Ash and we believe that GGBFS will still provide stability and durability to our concrete structures.

5. Do you have a state standard that would preclude using Fly Ash if it is listed hazardous with an exemption for beneficial use? (Some State regulations prohibit beneficial use of hazardous waste).

We are not aware of a state standard that would preclude use of Fly Ash.

6. If you'd like, please provide any general comments/statements:

Maine has been using Class F Fly Ash since the late 1990's, and with the exception of some problems associated with Class C Fly Ash, our experiences have been mostly positive. Maine's limited use of Fly Ash can be mostly contributed to availability and market demands. During the time when Maine began to utilize pozzolans in concrete for the beneficial properties associated with their use, the "Big Dig" project in Boston was placing a high demand on Class F Fly Ash, and subsequently, not much Fly Ash was available for use in Maine. Ground Granulated Blast Furnace Slag was readily available and became the pozzolans of choice for most local concrete suppliers.

Maine has always recognized that Class F Fly Ash is an effective pozzolan for use in structural concrete and will continue to allow its use if permitted. Our internal testing over the years has proven that it is the most cost effective pozzolan available for mitigation of Alkali Silica Reactive aggregates (ASR) and also provides low permeability concrete which is also very important for long term durability of structures in our bridge and highway programs.

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Washington

1. How much Fly Ash does your agency use (a rough estimate is okay)?

20% of our cement use is flyash. It is our primary source of mitigation to prevent ASR.

2. Would your state use Fly Ash if it is listed as a hazardous waste with an exemption for beneficial use? If no, why not? Liability issues? Public perception?

It would make use more expensive, difficult and problematic, so we would probably back away from its use. Public perception becomes reality and the same is true for regulatory agencies; they would make use impossible.

3. Would there be an increase in cost in concrete if Fly Ash was not allowed to be used? If so, about how much (cost per mile or cost per sq. ft.)?

Expect an increase of 50% of the cost of concrete. Fly ash is one of the best mitigations for ASR; other mitigations will be much more expensive.

4. Are there disadvantages to replacing Fly Ash in terms of structural stability and durability? If so, can you quantify it?

Yes: ASR mitigation and slow strength gain are benefits of fly ash (Type F). We could move to non-reactive aggregates, thereby eliminating about 90% of the aggregate sources in the state. Fly ash is the main mitigation from ASR.

5. Do you have a state standard that would preclude using Fly Ash if it is listed hazardous with an exemption for beneficial use? (Some State regulations prohibit beneficial use of hazardous waste).

We would have extensive work to do if it was listed as hazardous, but the reality of it is that we would just not use it. Perception in particular is huge. If they do this to flyash, can slag (ground granulated blast furnace slag) be far behind?

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Nebraska

1. How much Fly Ash does your agency use (a rough estimate is okay)?

Based on the Average Unit Quantities for July 2008-June 2009, NDOR used the following approximate quantity of fly ash:

Class C Fly Ash – **38,281 tons** for soil and bituminous stabilization

Class F Fly Ash – For 1,137,778 yd² of concrete pavement with 25% ash in the cement, we used **22,281 tons**

2. Would your state use Fly Ash if it is listed as a hazardous waste with an exemption for beneficial use?

We would want to use it, but it will be very difficult.

If no, why not?

If it is hazardous, worker protection will be big issue. What happens when we place it on grade to stabilize soil? How do we handle the material? Also, concrete plants may not be willing to allow hazardous materials on their plants. **Liability issues?** This will be big issue. We don't really know how fly ash impacts human health. So working around it may create liability issue for the industry. **Public perception?** There is question that public may feel we are doing something wrong when specifying fly ash.

3. Would there be an increase in cost in concrete if Fly Ash was not allowed to be used? If so, about how much (cost per mile or cost per sq. ft.)?

The cost will definitely be higher. Shipping and handling will be much more expensive. Most producers may not take the chance, and stop producing concrete with fly ash. This will reduce supply, and increase cost.

4. Are there disadvantages to replacing Fly Ash in terms of structural stability and durability ?

In Nebraska, concrete pavement without fly ash will last half as long as concrete with 25% fly ash. If so, can you quantify it? We already know what will happen when ASR is not prevented by using fly ash in concrete. The structure will crack, and have reduce the useful life of structures.

5. Do you have a state standard that would preclude using Fly Ash if it is listed hazardous with an exemption for beneficial use? (Some State regulations prohibit beneficial use of hazardous waste).

We are in the process of researching this.

6. If you'd like, please provide any general comments/statements:

If fly ash is classified as hazardous, the concrete industries in Nebraska will be adversely impacted. This could result in loss of jobs. Using fly ash in concrete, and soil stabilization projects is the best way of recycling this material that is otherwise wasted in landfills.

This ruling can end the way fly ash is being recycled, and that is not good for environment.

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Kansas

KDOT has incorporated over 850,000 tons of fly ash in construction work over the last 17 years and now considers fly ash as a critical component of KDOT's construction effort. It has been integrated into virtually every aspect of the process: soil modification/stabilization, treated bases, concrete pipes, concrete structures, concrete pavements and pavement preservation. Also, KDOT now has a permeability specification for concrete. We are attempting to tighten up the cement paste so less water/chlorides can infiltrate into the concrete. Fly ash is certainly one of the materials that can reduce the permeability.

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New Hampshire

- 1. How much Fly Ash does your agency use (a rough estimate is okay)?**
10% of our total cementitious material is fly ash (20% requirement is used in half of our mixes), an estimated 2,160 CY.
- 2. Would your state use Fly Ash if it is listed as a hazardous waste with an exemption for beneficial use? If no, why not? Liability issues? Public perception?**
Materials & Research Bureau would be in support of continued use, subject to direction of our policy makers.
- 3. Would there be an increase in cost in concrete if Fly Ash was not allowed to be used? If so, about how much (cost per mile or cost per sq. ft.)?**
NH once primarily used slag. We expect that there would be a cost increase due to the lack of competition and difficulties of meeting the demand on these materials for ASR mitigation.
- 4. Are there disadvantages to replacing Fly Ash in terms of structural stability and durability? If so, can you quantify it?**
No, but slag, as the likely substitute, is less efficient in achieving our ASR mitigation and permeability requirements.
- 5. Do you have a state standard that would preclude using Fly Ash if it is listed hazardous with an exemption for beneficial use? (Some State regulations prohibit beneficial use of hazardous waste).**
No

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Missouri

1. How much fly ash does your agency use (a rough estimate is okay)?

MoDOT uses approximately 49,000 tons of fly ash a year. The bulk of this is used in concrete.

2. Would your state use fly ash if it is listed as a hazardous waste with an exemption for beneficial use? If no, why not? Liability issues? Public perception?

At this time, MoDOT would continue to allow the use of fly ash. However, we don't believe the concrete industry will want to handle a hazardous material due to liability issues and public perception.

3. Would there be an increase in cost in concrete if fly ash was not allowed to be used? If so, about how much (cost per mile or cost per sq ft.)?

Yes, the price of concrete will increase if fly ash is not utilized. We estimate the cost to be \$28,000 per mile.

4. Are there disadvantages to replacing fly ash in terms of structural stability and durability? If so, can you quantify it?

Other supplementary cementitious materials (slag, metakaolin and silica fume) can be used to enhance concrete properties. However, these materials cost more than fly ash.

5. Do you have a state standard that would preclude using fly ash if it is listed hazardous with an exemption for beneficial use? (Some State regulation [prohibit beneficial use of hazardous waste.]

We are not aware of any at this time.

6. If you'd like, please provide any general comments/statements:

If fly ash is designated as a hazardous material how will this impact concrete sawing operations, diamond grinding and pavement repair construction? Also, how will this impact the use of old concrete pavement for granular base under a new pavement?

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North Dakota

1. How much Fly Ash does your agency use (a rough estimate is okay)?

Approximately 2000 tons per year.

2. Would your state use Fly Ash if it is listed as a hazardous waste with an exemption for beneficial use? If no, why not? Liability issues? Public perception?

Yes if restriction were minimal otherwise no because of liability and public perception.

3. Would there be an increase in cost in concrete if Fly Ash was not allowed to be used? If so, about how much (cost per mile or cost per sq. ft.)?

Yes, we allow 29 percent fly ash replacement. Our costs would increase approximately 0.25 cents per square foot of concrete.

4. Are there disadvantages to replacing Fly Ash in terms of structural stability and durability? If so, can you quantify it?

The fly ash that is used in North Dakota improves our concrete properties. Permeability is reduced in concrete which improves durability. During construction fly ash also improves workability and allows easier placement.

5. Do you have a state standard that would preclude using Fly Ash if it is listed hazardous with an exemption for beneficial use? (Some State regulations prohibit beneficial use of hazardous waste).

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6. If you'd like, please provide any general comments/statements:

We see fly ash as a beneficial replacement for concrete and not as a hazardous waste. By allowing the use we are using a waste by product and reducing the carbon footprint for concrete.

North Dakota DOT

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