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STATE OF ILLINOIS
Pollution Control Board

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
PROPOSED AMENDMENTS TO	)	
CLEAN CONSTRUCTION OR DEMOLITION	)	R2012-9B
FILL OPERATIONS	)	(Rulemaking-Land)
(35 ILL. ADM. CODE 1100	)	

PC#59

NOTICE OF FILING

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Persons included on the attached

Please take notice that I have today filed electronically with the Office of the Clerk of the Illinois Pollution Control Board the attached comments of James E. Huff, P.E. and the accompanying Attachments, a copy of which is served upon you.

HUFF & HUFF, INC.

By: James E. Huff
Senior Vice President

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PRE-FILED COMMENTS OF JAMES E. HUFF, P.E.

Introduction

My name is James E. Huff, and I was an active participant throughout the CCDD proceedings. I testified previously on whether monitoring wells are necessary. My comments today are directed toward **if** monitoring wells are determined to be necessary by the Illinois Pollution Control Board (Board), the specific requirements that should be imposed and not imposed. In addition, there are two areas under the current regulations that I would recommend be re-visited; first the maximum soil pH, and second, the decision to not incorporate the Maximum Allowable Concentrations (MACs) under the Board's regulations. As I will explain herein, there are serious problems with both of these issues, and this supplemental docket would be the appropriate time to address these areas.

I would also like to thank the Board for the work it did on the final CCDD regulations adopted this past summer. After participating throughout the process, it was clear to me that the Board carefully listened to the information presented and adopted regulations based on the record that are both protective of human health and the environment as well as reasonable from an implementation perspective.

Monitoring Wells at CCDD and Uncontaminated Soil Fill Operations

The Board previously determined that monitoring wells were not necessary to protect groundwater, which was clearly based on the record in R2012-009. The Illinois Environmental

Protection Agency had other opinions on this, and hopefully they will provide actual data to support its position in this docket. Protecting groundwater is important to all stakeholders; however, there are various methods to assure groundwater quality. Monitoring wells are one mechanism, but regulating the quality of CCDD material also provides that assurance that groundwater will be protected. Assessing the data from monitoring wells and using that data to determine when remedial efforts are needed are important elements of this discussion. A key area in the previous docket that hopefully can be vetted in this docket is the economic implications of requiring monitoring wells; not just the cost of monitoring, but more importantly, whether the fill operations will proceed with even putting in the monitoring wells. I am very concerned that the vast majority of the fill operations will elect to exit the CCDD and uncontaminated soil markets, forcing clean materials to landfills at a huge economic burden on the citizens of Illinois.

While the record is clear that no groundwater impacts have been found from these fill operations, including extensive data in the undersigned's testimony on a CCDD site in Kane County thoroughly tested,[1] the Agency and Attorney General's Office are in support of groundwater monitoring at the fill operations. There are two costs associated with groundwater monitoring; 1) the capital and operating costs for monitoring, and 2) the unknown costs should some contaminant be found above the regulatory threshold. While the costs of the first item are significant, they are known and fill operations can make a business decision as to whether the costs incurred would justify continuing in the fill business. The second cost, however, is totally unknown and uncontrollable and clearly the largest concern to the industry. Not only would groundwater monitoring detect future fill operation impacts, but would also detect historic impacts. <u>If</u> impacts are found, remediation approaches would be to either; start a pump and treat system that would literally go on indefinitely, or, attempt to secure a groundwater management zone for the area.

The Agency originally proposed a non-degradation requirement for offsite contamination, which is particularly unsettling to the regulated community. The "background" requirement is much more stringent than the groundwater standards used to assess the need for completion of

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[1] Pre-filed Testimony of James E. Huff, October 2011, Exhibit 10, pages 4-7.

remediation in other Illinois programs.[2] The Agency has interpreted Section 620.301 as meaning achieving background concentrations, as opposed to creating *an existing or potential use* impairment, which is what Section 620.301(a)(2) states. This subtle wording change can result in groundwater objectives far below the Class I standards. In addition, there is no recognition of risk assessment, receptors, or other concepts, in the CCDD Proposal, as presently available to LUST sites, Site Remediation Program sites, or hazardous waste sites under Part 742. Thus, this industry would be faced with a more stringent remedial standard than LUST, RCRA, and voluntary (Site Remediation) programs. All of these programs manage chemicals with the same or greater potential hazards than the CCDD material under consideration. If a contaminant is going offsite above background, immediate remediation would be required under the Agency's original proposal. As the Agency indicated, they have their own interpretation of non-degradation and couldn't give "blanket answers" to questions regarding non-degradation.[3] The Agency talked about going through an adjusted standard process,[4] for which there is a significant cost associated relative to the revenue generated from these operations.

If the Board elects to require groundwater monitoring, I would suggest the following considerations be made:

1. *Limit the groundwater monitoring to volatile organic compounds and dissolved RCRA metals.*
   This would eliminate much of the monitoring cost burden while focusing on the contaminants of real concern from a groundwater perspective. Dissolved metals as opposed to total metals are critical to avoid false readings, such as Mr. Sylvester reported, which was obviously due to excessive sediment collected in the groundwater samples. To the extent metals migrate in the groundwater, they are in the **dissolved** form, as the particulate form is filtered out. Volatile organics are the most mobile contaminants and the most commonly found contaminants in groundwater. It would be appropriate to monitor for only volatile organic compounds and dissolved metals.

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[2] The Agency's non-degradation interpretation is described in Mr. Richard Cobb's testimony in R08-18 in the matter of Groundwater Quality Standards Amendments. Section 620.301 is entitled *General Prohibition Against Use **Impairment** of Resource Groundwater*. Section 620.301(b) would also allow a CCDD to establish a groundwater management zone, presumably where groundwater standards were exceeded, as opposed to where levels were above background concentrations.

[3] October 26, 2011 transcript, pages 35 and 36.

[4] October 26, 2011 transcript, page 38.

2. *Eliminate any reference to non-degradation requirement and specifically allow the use of groundwater use restrictions as provided for in 35 Ill Adm Code 742.* The CCDD proposed regulations have borrowed heavily from the TACO regulations, a very functional program. There is no reason that the fill operations could not be afforded the same ability to secure a groundwater use restriction. The Agency's primary reluctance with using TACO for landfills was the presence of solid waste that could not be characterized. As has been repeatedly stated in these proceedings, CCDD and uncontaminated soil are NOT wastes, and therefore allowing the same opportunity as found in other Illinois programs where impacts are discovered would go a long way to controlling costs while protecting the environment. In fact, there is no reason that these fill operations should not be allowed to enroll in the Illinois Site Remediation Program under this same argument, assuring these properties are treated like all other properties in Illinois.

To the extent the quarries have been receiving CCDD and soil fill material for many years; groundwater monitoring will detect not only contaminants from on-going operations, but from past practices. Without some cost effective approach to address any impacts from past practices, each quarry runs the risk of addressing past concerns **if** it elects to continue to accept CCDD and uncontaminated soil fill. This is a major disincentive to continue to accept CCDD and uncontaminated soil. Thus, without some cost effective way to address groundwater impacts, such as what is proposed above, there would need to be a baseline (preexisting condition) monitoring period. The fill operators would only then be required to remediate if the groundwater quality changes in a statistically significant manner above the quality present after the first year from when the regulations go into effect. This would reduce the economic implications associated with groundwater compliance going forward.

Maximum pH on Uncontaminated Soil

When the Board adopted the higher minimum pH of 6.25, it also imposed, unexpectedly to all participants, a maximum pH of 9.0. This has created a number of problems, as the aggregate limestone used beneath both roadways and buildings can have a pH as high as 12.45. (See Attachment 1). Recall that pH is a logarithmic scale, so a small amount of limestone fines in a soil sample will raise the pH above 9.0. The soil pH limit does not apply to the CCDD material, although where CCDD material and uncontaminated soil are co-mingled, then the pH limit would apply. I have experienced rejected loads of aggregate with minimal uncontaminated soil due to elevated pH. As many of the quarries are limestone quarries, where pH values are higher than 9.0, this limit does not make technical sense. When sampling beneath roadways, it is very difficult to get a sample that does not have limestone fines in the sample, and, when removing the soil immediately beneath the limestone base course, it is also not possible to remove the limestone fines sufficiently to achieve a pH of 9.0. In addition, much of the native soil in northeastern Illinois is derived from glacial deposits, which are comprised of material scoured from limestone and dolomitic bedrock. It is not uncommon to have naturally occurring soils derived from these parent materials to exceed a pH of 9.0. There is really no technical basis for the upper pH limit for uncontaminated soil, as metal mobility is not affected by higher pH levels.

Recommendation: *Eliminate from the restriction on uncontaminated soil with pH values above 9.0.*

Codify the Maximum Allowable Concentrations in the Regulations

During the proceedings, only items like the minimum pH were vetted, relying on the Agency to then establish the MACs based on TACO and the criteria. The record included some discussion on the five percent of naturally occurring samples that will exceed the arsenic MAC, and whether the Agency believed this five percent would be a waste in its view. No other constituent was discussed. The Agency has set MAC limits for iron and manganese at the median concentration in the State of Illinois. This is clearly a problem. Running the alternative SPLP test routinely also fails the MAC limits.

Chromium exists in two oxidation states, trivalent and hexavalent. In nearly all soils, chromium will be present predominantly in the trivalent state.[5] In my experience, I do not recall ever detecting hexavalent chromium in uncontaminated soils in Illinois, but perhaps the Agency has some more extensive database they could submit into the record. The Agency, without any discussion outside the Agency, elected to establish a **total** chromium MAC based on the **hexavalent** chromium value in Table C, the pH specific table in TACO. At pH 8.75 to 9.0, this value is 21 mg/kg **hexavalent** chromium. The current MAC set by the Agency is 21 mg/kg **total** chromium. In the Agency's 1984 *A Summary of Selected Background Conditions for Inorganics in Soil,* the **mean** total chromium concentration within metropolitan areas is 21.2 mg/kg and the **median** is 16.2 mg/kg. So we know that somewhere less than half [6] of all soil in the metropolitan areas of Illinois will fail the total chromium MAC based on these results.

If one assumes that the iron, manganese, total chromium, and arsenic concentrations are independent of each other in uncontaminated soils in Illinois and that say 40 percent of the naturally occurring chromium will exceed 21 mg/kg, then if just these four metals are tested for, the probability of passing the MAC is as follows:

Probability of **passing**$=(P_{iron})(P_{Mn})(P_{Cr})(P_{As})$

$=(0.5)(0.5)(0.6)(0.95)$

$=0.14$, or **14 %**

Clearly there is something very wrong when the MAC values have determined **86% of what is naturally occurring metals in the soil in Illinois is classified as *contaminated* soil!**

The Agency is aware of the above concerns, and has provided the following responses:

1) Why are you testing for these metals?
2) You can always run SPLP or TCLP.

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[5] ATSDR, 2008. *Toxicological Profile for Chromium.* Agency for Toxic Substances and Disease Registry, Division of Toxicology/Toxicology Information Branch, Atlanta Georgia

[6] The Agency must have data on what this exact percentage of uncontaminated soil is above 21 mg/kg from when the TACO regulations were being developed that they could share in this proceedings.

3) Chromium could theoretically exist in uncontaminated soil in the hexavalent oxidation state.

I would welcome a discussion on these limits so that we can establish MAC limits that are protective of groundwater but also representative of the existing environment. The economic impact of the proposed CCDD regulations I provided in previous testimony and comments remain valid due to the above MAC concerns. Clearly the economic implication of the Agency's MAC values on these four metals is sufficient justification to request that the MACs be established within the framework of the Board's regulations, so that these issues are properly vetted.

Recommendation: *Expand the current docket to vet the MACs and bring these limits under the Part 1100 regulations.*

Thank you, this concludes my comments. I look forward to the hearings that are necessary to vet these issues.

James E. Huff, November 30, 2012

CERTIFICATE OF SERVICE

I, the undersigned, certify that on this 30th day of November, 2012, I have served electronically the attached Pre-Filed comments of James E. Huff, P.E., accompanying Attachments, and Notice of Filing upon the following person(s):

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James E. Huff

James E. Huff, P.E.

ATTACHMENT 1

APPENDIX 3. Sample Aggregates Specifications

Following are sample specifications for gravel road aggregate surface courses from several different states. Road personnel should check with their State Department of Transportation or their Local Technical Assistance Program / Technology Transfer (T2) Center for specifications being used in their own state. Many state DOTs have their specifications readily available via their Web sites.

A3.1 Pennsylvania's Driving Surface Aggregate

Material Specifications: All Driving Surface Aggregate (DSA) is to be derived from natural stone formations. Stone is defined as rock that has been crushed; rock is defined as consolidated mineral matter. For use in this program, both are restricted to that which has been mined or quarried from existing geologic bedrock formations.

All components of the aggregate mix are to be derived from crushed parent rock material that meets program specifications for abrasion resistance, pH and freedom from contaminants. Ninety-eight percent (98%) of fines passing the #200 sieve must be parent rock material. No clay or silt soil may be added. The amount of particles passing the #200 sieve shall be determined using the washing procedures specified in PTM No. 100.

Size: The required amounts and allowed ranges, determined by percent weight, for various size particles are shown in Table 1.
LA Abrasion: The acceptable limit as measured by weight loss is "less than 40% loss." Los Angeles Abrasion test, AASHTO T-96 [ASTM C 131] shall be used to determine this property. Existing data obtained from tests made for and approved by PENNDOT will be accepted.

Passing sieve	*Lower %*	*High%*
1 ½ inches	**100**	
¾ inches	**65**	**90**
#4	**30**	**65**
#16	**15**	**30**
#200	**10**	**20**

Table 1. DSA Gradation

Sulfate Test: Soundness or resistance to freeze/thaw [*i.e., sulfate test*] is not specified for this application because a gravel road driving surface aggregate is not bound within a concrete or asphalt mix.
pH: Aggregate must be in the range of pH 6 to pH 12.45 as measured by EPA 9045C.
Optimum Moisture: Material is to be delivered and placed at optimum moisture content as determined for that particular source. The optimum percentage moisture is to be identified by the supplier in the bid/purchasing documents.
Transport: Tarps are to be used to cover 100% of the load's exposed surface from the time of loading until immediately before dumping. This requirement includes standing time waiting to dump.

Aggregate producers are required by the program to certify that the aggregate they deliver conforms to the program specifications.

Road Surface Preparation: Driving Surface Aggregate will reflect the shape of the surface to which it is applied; therefore, all road surface preparation work is to be completed before delivery and placement of the aggregate.

1. Prepare underdrainage, including drain tile, French drains (porous fill) and crosspipes.
2. Address surface drainage features such as broad-based dips, grade breaks, crown, and side-slope.
3. Establish proper cross-slope in existing base (Fig. 1). Recommended crown or slope is ½ to ¾ inch rise per horizontal foot. Proper shape may be a flat "A" crown profile, an in-slope or out-slope. If exposed bedrock or insufficient material prevents proper shaping of the road base, additional base material may be needed.
4. To bind aggregate with the road base, scarify impermeable smooth surfaces such as oil and chip, exposed bedrock or smooth tight aggregate. Do not loosen coarse aggregate or chinked stone roadbeds rough enough to permit binding with Driving Surface Aggregate.
5. If required, separation fabric should be placed according to manufacturer's recommendations.

Placement: An un-compacted uniform depth of 8 inches of DSA is to be used to establish the driving surface. Placement is to be in a single 8-inch lift. The preferred method of application is through a paver. Set the paver adjustments on application thickness and width so it is unnecessary to use a grader. The required crown or side slope is to range from ½ to ¾ inch rise per horizontal foot. This slope is to be achieved by properly preparing base and placing aggregate in a uniform lift. When the paver is applying aggregate, care should be taken to keep the paver at or near capacity at all times.

To fill driving surface areas outside the specified width (e.g., driveway entrances, pull-offs, and passing lanes), additional DSA is to be added and tapered to grade or butted against a precut channel of the same depth. If berm or bank edges don't exist to hold the new DSA surface, then sufficient material is to be placed, tapered and compacted to form protective edge berms. Material shall be compacted to a final thickness of approximately 6 inches.

DSA CALCULATION FORMULA

$$\text{DSA Needed (tons)} = \text{Road Width (ft)} \times \text{Road Length (ft)} \times 0.042$$

Applies to standard 8" lift, compacted to 6"

Compaction Sequence: Verify that moisture is optimum for compaction. If the material has dried out, re-wet the DSA surface with a water truck. If clumps of aggregate adhere to the roller drum, the aggregate may be too moist. Allow drying time before rolling. Do not use the vibratory rolling mode if that action brings water to the surface of the aggregate.

Only self-powered machines designed specifically for compaction shall be used. Compaction with truck tires is not acceptable.

1A. Supported Edge: *If edge of placed aggregate is supported by an existing bank*

or berm: First pass: Roll slowly in static mode on the outside edge of placed aggregate.
1B. Unsupported Edge: *If the edge of the placed aggregate is not supported*: First Pass: Roll slowly in static mode near but not over unsupported outside edges. Once that path is firm, move progressively closer to the outside edge with static passes until unsupported edge is firm.
2. Sequence: As in all rolling operations, compaction is achieved making overlapping lengthwise passes beginning at the ditch or berm-side and working toward the crown or the top edge (if it is a side-sloped or super-elevated section of road). In no case should the roller be run lengthwise on the top of the road crown.
3A. Static Roller: The minimum acceptable weight of a static roller is 10 tons. Repeat the sequence of overlapping passes until desired compaction is achieved.
3B. Vibratory Roller: The minimum striking force of vibratory rollers is 20,000 lbs. When using a vibratory roller, the initial pass over un-compacted aggregate should be completed in static mode. All successive passes should be made using the vibratory mode until the desired level of compaction is achieved. The final pass over each area should be made in static mode to remove all roller edge marks. The vibratory roller should be set to deliver between 6 and 17 impacts per linear foot with the roller moving at the speed at which a person walks on each pass upgrade. **Vibration must be turned off during downgrade passes**. Vibrating the drum when rolling downgrade will cause aggregate to flow in "waves" in front of the roller, resulting in an uneven surface.
4. Desired Compaction: Unless more refined testing equipment is available, adequate compaction is indicated when no further depressions are created with a roller or loaded dump tuck. Cracking of larger stones or rocks in the road surface is another reliable indication of adequate compaction.

A3.2 Illinois DOT Specifications. (excerpts)(www.dot.il.gov)
Section 402. Aggregate Surface Course
402.01 Description. This work shall consist of furnishing and placing one or more course of aggregate upon a prepared subgrade.
402.02 Materials. Materials shall meet the requirements of Section 1000, Article 1004.04

1004.04 Coarse Aggregate for Aggregate Surface Course.

a. Description. The coarse aggregate shall be pit run gravel, gravel, crushed gravel, novaculite, crushed stone, crushed concrete, crushed slag or crushed sandstone.

a. Quality. The coarse aggregate shall be Class D Quality or better.

Quality Test	Class D
Sodium Sulfate Soundness[2] 5 cycle, AASHTO T104[1,2], Max % loss	25[3]
Los Angeles Abrasion AASHTO T96, Max % loss	45

[1]As modified by the Department
[2]Does not apply to crushed concrete.
[3]For aggregate surface course, the maximum percent loss shall be 30.

b. Gradation.
   1. For aggregate surface course Type B, Gradation CA6, CA9, or CA10 may be used. If approved by the Engineer, Gradation CA4 or CA12 may be used.
   2. For aggregate subbase Type B, Gradation CA6, CA10, CA12, , or CA19 shall be used. If approved by the Engineer, Gradation CA2 or CA4 may be used.
   3. For aggregate Subbase Type C, Gradation CA7 or combined size CA5 and CA7 shall be used.
   4. For granular aggregate courses (base, subbase, and shoulder except subbase Types B and C), Gradation CA6, or CA10 shall be used. If specified, Gradation CA2 or CA4 For aggregate surface course Type B, Gradation CA6, CA9, or CA10 may be used. If approved by the Engineer, Gradation CA4 or CA12 may be used.
   5. Stabilized aggregate courses (base, subbase, and shoulder), Gradation CA6 or CA10 shall be used. If approved by the Engineer, Gradation CA2, CA4, or CA12 may be used.
   6. For aggregate surface course Type A, Gradation CA6, or CA10 shall be used. If approved by the Engineer, Gradation CA2, CA4, CA9, or CA12 may be used.

c. Plasticity. All material shall comply with the plasticity index requirements listed below.

Type of construction	Plasticity Index – Percent[1]	
	Gravel	Crushed Gravel, Stone, Slag
Aggregate Subbase Type A or B	0 to 9	-
Aggregate Base Course Type A or B	0 to 6	0 to 4
Aggregate Surface Course Type A or B[2]	2 to 9	-
Stabilized Aggregate Material	0 to 9	0 to 9

[1]Plasticity index shall be determined by the method given in AASHTO T90. Where shale in any form exists in the producing ledges, crushed stone samples shall be soaked a minimum of 18 hours before processing for plasticity index or minus #40 material. When clay material is added to adjust plasticity index, the clay material shall be a minus #4 sieve size.
[2]When Gradation CA9 is used, the plasticity index requirement will not apply.

402.03 Equipment shall meet the requirements of the following Articles of Section 1100:

a. Tamping Roller....................1101.01
d. Pneumatic-Tired Roller..........1101.01
e. Three-Wheel Roller (Note 1)....1101.01
f. Tandem Roller (Note 1)..........1101.01
g. Spreader............................1101.01
h. Vibratory Machine (Note 2).....1101.04

Note 1. Three-wheel or tandem rollers shall weigh 6 to 10 tons and shall weigh not less than 200lb/in nor more than325 lb/in of width of the roller.

Note 2. The vibratory machine shall meet the approval of the Engineer.

Construction Requirements

402.04 Subgrade. The subgrade shall be prepared according to Section 301 except that Article 301.06 will not apply.

402.05 Type A Requirements. Aggregate surface course, Type A shall be constructed according to Article 351.05(a) and (b) except the bearing ratio requirements shall not apply.

402.07 Type B Requirements. Any one or two gradations of the material specified in Article 1004.04 shall be used except where two gradations of material are used, the change shall not be made at more than one location on the section.

The surfacing material shall be deposited on the subgrade by means of a spreader.

The equipment used shall be such that the required amount of material will be deposited uniformly along the central portion of the roadbed.

The material which has been deposited shall be spread immediately to the plan cross section. Hauling shall be routed over the spread material so it will cover the entire width of surface. If the equipment used in hauling operations causes ruts extending through the spread material and into the subgrade, and the subgrade material is being mixed with the surface material, the equipment shall be removed from the work or the rutting otherwise prevented as directed by the Engineer.

The Contractor shall keep the surface smooth by dragging or blading as many times each day as the engineer may direct.

Holes, waves, and undulations which develop and which are not filled by blading shall be filled by adding more material.

A3.3 Michigan DOT Specifications (excerpts) (www.mdot.state.mi.us)

Section 306. Aggregate Surface Course

306.01 Description. Construct an aggregate surface course on a prepared subgrade or an existing aggregate surface.

306.02 Materials. Use materials meeting the following:

Dense-graded Aggregate 21AA, 21A, 23A..........902

Use aggregate 21AA or 21A if the aggregate surface course will later receive a hot mix asphalt (HMA) surface. Use aggregate 23A if the aggregate surface course is to be constructed without an HMA surface. Use dense-graded aggregate 22A, 23A for temporary maintenance gravel.

902.06 Dense-Graded Aggregates for Base Course, Surface Course, Shoulders, Approaches and Patching. Michigan Class 21AA, 21A, 22A and 23A dense-graded aggregates will consist of natural aggregate, iron blast furnace slag, reverberatory furnace slag, or crushed concrete, in combination with fine aggregate as necessary to meet the gradation requirements in Table 902-1, the physical requirements in Table 902-2, and the following:

A. Dense-graded aggregates produced by crushing Portland cement concrete will not contain building rubble as evidenced by the presence of more than 5.0%, by particle count, building brick, wood, plaster, or similar materials. Sporadic pieces of steel reinforcement may be present provided they pass the maximum grading sieve size without hand manipulation.

B. Class 21AA, 21A, and 22A dense-graded aggregates produced from Portland cement concrete will not be used to construct either an aggregate base or aggregate separation layer when either of the following conditions apply:

1. When there is a geotextile liner or membrane present with permeability requirements.
2. In a pavement structure with an underdrain, unless there is a filter material between crushed concrete and the underdrain. The filter material will be either a minimum of 12 inches of granular material or a geotextile liner or blocking membrane that will be a barrier to leachate.

C. Class 23A dense-graded aggregate may be produced from steel furnace slag, but only for use as an unbound aggregate surface course or as an unbound aggregate shoulder.

Table 902-1 Grading Requirements for Dense-Graded Aggregates

Class	Sieve Analysis (MTM 109) Total Percent Passing (b)						Loss by Washing (MTM 108) % Passing #200
	1.5 in.	1 in.	¾ in	½ in	3/8 in	# 8	
21AA, 21A	100	85-100		50-75		20-45	4-8 (e)(f)
22A		100	90-100		65-85	30-50	4-8(e)(f)
23A		100			60-85	25-60	9-16(f)

(b) Based on dry weights
(e) When used for aggregate base courses, surface courses, shoulders and approaches and the material is produced entirely by crushing rock, boulders, cobbles, slag, or concrete, the maximum limit for Loss by Washing will not exceed 10%.
(f) The limits for Loss by Washing of dense-graded aggregates are significant to the nearest whole percent.

Table 902-2 Physical Requirements for Dense-Graded Aggregates

Class (j)	Crushed Material, % min. (MTM 110,117)	Loss, % max, Los Angeles Abrasion (MTM 102)
21AA	95	50
21A	25	50
22A	25	50
23A	25	50

(j) Quarried carbonate (limestone or dolomite) aggregate will not contain over 10% insoluble residue finer than Number 200 sieve when tested in accordance with MTM 103.

306.03 Construction.

A. Preparation of Base. When required, blade, or scarify and blade, the existing aggregate surface to remove irregularities in the grade.

B. Placing and Compacting. Provide a uniform aggregate mixture compacted in place with uniform density full depth. Provide a completed surface course conforming to the line, grade or plan cross section.
Place maintenance gravel to provide a flush transition between shoulders, driveways and other areas where traffic is maintained. Maintenance gravel may remain permanently as part of the work, if approved by the Engineer.
Do not place aggregate when the base is unstable. Maintain the aggregate in a smooth, stable condition and provide dust control until removed or surfaced.

C. Use of additives. Use of additives to facilitate compaction and for dust control of the aggregate is acceptable.

A3.4 New York DOT Specifications (excerpts) (www.dot.state.ny.us)
Section 667 – Local Road Gravel Surface, Base, and Subbase Courses
667-1.02 Material Types. Provide materials as specified by the following options.

Type A. Surface quality material with a maximum particle size of 25mm.

Type B. Base quality material with a maximum particle size of 50 mm.

Type C. Subbase quality material with a maximum particle size of 75mm.
667-2.02 Material Requirements. Provide materials for road gravel surface, base and subbase courses that consist of Sand and Gravel, approved Blast Furnace Slag or Stone that meet the requirements contained herein. Provide materials well graded from coarse to fine, and free from organic or other deleterious materials. Any gravel material will be rejected if it is determined to contain any unsound or deleterious materials.

B. Gradation, Perform sieve analysis in accordance with AASHTO procedures T27, T88 or T311. Provide materials meeting the gradation limits from Table 667-1.
C. Soundness. Material will be accepted on the basis of Magnesium sulfate. Soundness Loss after four cycles performed according to NYSDOT procedures and Table 667-2.
D. Plasticity. Determine plasticity using either of the following methods:
    1. Plasticity Index. The Plasticity Index of the material passing the #40 mesh sieve shall meet the values in Table 667-2. Determine plasticity using AASHTO tests T89 and T90.
    2. Sand Equivalent. The sand equivalence of the granular material shall meet the values in Table 667-2. Determine sand equivalence using AASHTO test T176.

Table 667-1: Percent passing by Weight of Gravel Materials

Sieve (US Sieve)	A (Surface)	B (Base)	C (subbase)
3"			100
2"		100	-
1.5"		85-100	70-100
1"	100	-	-
¾"	85-100	-	-
¼"	50-75	30-50	30-55
#40	15-35	5-20	5-25
#200	8-15	0-5	0-8

Table 667-2: Test and control Limits of Gravel Materials

Material Properties	A (Surface)	B (Base)	C (subbase)
Maximum Soundness loss (%)	20	20	25
Plasticity Index	2-9	0-5	0-8
Sand Equivalent	>25	>40	>35

E. Elongated Particles Not more than 30%, by weight, of the particles retained on a ½" sieve shall consist of flat or elongated particles. A flat or elongated particle is defined herein as one which has its greatest dimension more than 3 times its least dimension. Acceptance for this requirement will normally be