

## **APPENDIX C**

# **COMPILATION OF SURVEY RESPONSES PROVIDED BY AGENCY RESPONDENTS NCHRP PROJECT 20-05 TOPIC 48-10**

### **AGGREGATE QUALITY REQUIREMENTS FOR PAVEMENTS**

#### **Background and Purpose**

The Transportation Research Board (TRB) is preparing a synthesis on Aggregate Quality Requirements for Pavements. This is being done for the National Cooperative Highway Research Program (NCHRP), under the sponsorship of the American Association of State Highway and Transportation Officials (AASHTO), in cooperation with the Federal Highway Administration (FHWA). The goal of this questionnaire is to document quality requirements for utilization of different types, sources, and quality classes of aggregates used in flexible and rigid pavements.

Your expertise and experience is critical to the success of this important project. Your individual privacy will be maintained in all published and written data resulting from this study. We thank you in advance for your time and thoughtful consideration. The final report of this project will be provided to your agency. If you are not the appropriate person at the agency to complete this questionnaire, please forward it to the correct person.

Please complete and submit this survey by March 13, 2017. We estimate that it should take approximately 30 minutes to complete.

**Note:** The information included in this Appendix is presented exactly as received by agencies. Some respondents may not have circulated the survey within their agency to receive complete responses.

## General: Aggregate Quality Requirements for Pavements

1. Which of the following pavement layers are constructed with specific aggregate quality requirements by your agency depending on the applications? (Please check all that apply)

- [53] Asphalt Concrete (AC) including surface and base course – **100%**
- [46] Portland Cement Concrete (PCC) – **87%**
- [50] Surface Treatment (ST) – **94%**
- [50] Unbound aggregate base course – **94%**
- [36] Stabilized (admixture treated) base course – **68%**
- [40] Unbound aggregate subbase course – **76%**
- [31] Stabilized subbase course – **59%**
- [30] Open graded drainage layer – **57%**
- [19] Separator/filter layer – **36%**
- [14] Pavement working platforms for subgrade stability applications – **26%**
- [3] Other (please specify) – **6%**

### 53 Respondents

#### Other (please specify) responses

- Drainable Stable Base (DSB) for concrete pavements
- Streambed Aggregates
- Subbase with clean sand is sometimes stabilized by using a granular base course layer on top. Emulsions have also been used for stabilization purpose.

2. Is there any pavement layer constructed with aggregate materials without checking aggregate quality requirements?

- [5] Yes – **9%**
- [48] No – **91%**

If you marked 'Yes', (please briefly explain)

### 53 Respondents

#### If you marked 'Yes', (please briefly explain) responses

- For our recycled foundation course applications (crushed concrete, bituminous millings) we do not require quality testing, just gradation requirements.
- Minor asphalt and aggregate may be accepted visually at Engineer's discretion, or tested.
- Pavements placed on small or temporary pavement jobs for municipalities to keep costs down.
- Subbase meeting A-1-a (o) classification.
- Special backfill

3. Do you construct pavement layers utilizing any of the following aggregate sources? (Please check all that apply)

- [50] Recycled aggregates – Recycled Asphalt Pavement (RAP) – **94%**
- [29] Recycled aggregates – Recycled Concrete Aggregate (RCA) – **55%**

- [24] Artificial/By-product aggregates such as Steel Furnace Slag (SFS), Blast Furnace Slag (BFS), and Light Weight Aggregate (LWA) – **45%**
- [8] Marginal aggregates (out of spec.) – **15%**
- [11] Nontraditional aggregate (e.g., large size aggregates, primary crusher run) – **21%**
- [37] Blended virgin aggregates – **70%**
- [29] Blended aggregates (virgin and recycled/artificial) – **55%**
- [2] Other source (please specify) – **4%**

### 53 Respondents

#### Other sources (please specify) responses

- Recycled Materials only in subbase/RAP has to be 50% NJDOT approved crushed stone/gravel
- Sometimes base aggregates or crushed coarse aggregates are used during rotomixing.

## Category 1: Aggregate Sources and Properties

### 4. Does your agency have a list of approved aggregate types or sources for pavement construction applications?

- [29] Yes – **55%**
- [20] No – **38%**
- [9] Other (please explain) – **17%**

### 53 Respondents

#### Other sources, (please explain) responses

- Bound aggregates for HMA and PCC have approval processes unique to each material. Unbound aggregates are tested per project.
- <http://www.penndot.gov/ProjectAndPrograms/Construction/Pages/Construction-Bulletins.aspx>
- Material has to comply with specifications, Contractor can select/provide
- Ministry has specifications for aggregates to be used for base, subbase, AC etc. Ministry owns a number of gravel pits that have been used on various projects.
- Once approved on a project, some aggregates can in some cases be used by other projects for up to a year.
- The list is on our website (Oklahoma DOT)
- Run report at <https://mac.fdot.gov/smreports>
- We have pre-approved producers but still require quality testing.
- [http://info.scdot.org/Construction\\_D/SitePages/QualifiedProducts3.aspx](http://info.scdot.org/Construction_D/SitePages/QualifiedProducts3.aspx)

### 5. If you answered 'Yes' to Question 4, please provide the link to related reference / website:

*Note: The resources listed below are valid only by the publication date of this synthesis.*

- **Alabama:** <https://www.dot.state.al.us/mtweb/Testing/MSDSAR/pdf/QMSD/Li01.pdf>

- **Arizona:** <https://www.azdot.gov/docs/business/2008-standards-specifications-for-road-and-bridge-construction.pdf>
- **Arkansas:** [http://s3.amazonaws.com/zanran\\_storage/www.arkansashighways.com/ContentPages/2527046007.pdf](http://s3.amazonaws.com/zanran_storage/www.arkansashighways.com/ContentPages/2527046007.pdf)
- **Georgia:** <http://www.dot.ga.gov/PartnerSmart/Materials/Documents/qpl01.pdf>  
<http://www.dot.ga.gov/PartnerSmart/Materials/Documents/qpl02.pdf>
- **Idaho:** <http://apps.itd.idaho.gov/apps/materials/QPL.aspx> and Section 265.00: “Qualified Aggregate Material Suppliers”
- **Illinois:** <http://www.idot.illinois.gov/assets/uploads/files/doing-business/specialty-lists/highways/materials/materials-&-physical-research/aggregate/approvedaggregatesources.pdf>
- **Indiana:** <http://www.in.gov/indot/div/mt/appmat/pubs/apl03.pdf>
- **Iowa:** [https://iowadot.gov/Construction\\_Materials/materialsforms/T203.pdf](https://iowadot.gov/Construction_Materials/materialsforms/T203.pdf)
- **Kentucky:** <http://transportation.ky.gov/Materials/Documents/LAM.PDF>
- **Maryland:** <https://www.roads.maryland.gov/OMT/AggBlt.pdf>
- **Michigan:** [http://www.michigan.gov/documents/mdot/MDOT-MaterialSourceGuideComplete\\_Linked\\_181739\\_7.pdf](http://www.michigan.gov/documents/mdot/MDOT-MaterialSourceGuideComplete_Linked_181739_7.pdf)
- **Mississippi:** <http://sp.mdms.gov/Materials/Pages/Producer-Supplier.aspx>
- **Nebraska:** <http://dot.nebraska.gov/media/6379/gravrock2016.pdf>
- **New Jersey:** <http://www.state.nj.us/transportation/eng/materials/qualified/QPLDB.shtm>
- **New York:** <https://www.dot.ny.gov/divisions/engineering/technical-services/materials-bureau>
- **North Carolina:** <https://connect.ncdot.gov/resources/Materials/MaterialsResources/2017%20Aggregate%20QCQA%20Program%20Manual.pdf>
- **Ohio:** <http://www.odotonline.org/cmsportal/CertAggReport.asp?SelReport=07000-MaterialsAndTesting-7015-CertifiedSuppliersAggregate.rdl&reportName=Certified%20Aggregate>
- **Oklahoma:** <http://www.odot.org/materials/htm-smap/11068-ALL.html>
- **Pennsylvania:** <http://www.penndot.gov/ProjectAndPrograms/Construction/Pages/Construction-Bulletins.aspx>
- **Rhode Island:** [http://www.dot.ri.gov/documents/doingbusiness/materials/coarse\\_aggregates\\_2017.pdf](http://www.dot.ri.gov/documents/doingbusiness/materials/coarse_aggregates_2017.pdf)  
[http://www.dot.ri.gov/documents/doingbusiness/materials/fine\\_aggregates\\_2017.pdf](http://www.dot.ri.gov/documents/doingbusiness/materials/fine_aggregates_2017.pdf)
- **South Carolina:** <http://info2.scdot.org/Materials/Pages/QualifiedProd.aspx>
- **Tennessee:** <https://www.tdot.tn.gov/Applications/ProducerSupplier/Report>
- **Texas:** <http://www.txdot.gov/inside-txdot/division/construction/producer-list.html>
- **Virginia:** [http://www.virginiadot.org/business/resources/Materials/ApprovedLists/Materials\\_Approved\\_Lists.pdf](http://www.virginiadot.org/business/resources/Materials/ApprovedLists/Materials_Approved_Lists.pdf)
- **Washington State:** <http://www.wsdot.wa.gov/biz/mats/ASA/ASASearch.cfm>
- **Wisconsin:** <http://wisconsin.gov/Documents/doing-bus/eng-consultants/cnslt-rsrcs/tools/appr-prod/ap-current/225-aggrpt-5-17-2017.pdf>
- **Ontario:** <https://www.raqs.mto.gov.on.ca/login/raqs.nsf/english/Text/ViewConcretePavementAggregateLists?OpenForm>

**6. If you answered ‘Yes’ to Question 4, does your agency allow new materials into the list of approved aggregate sources for pavement construction applications?**

[2] Yes – **93%**

[27] No – **7%**

**29 Respondents**

If yes, (please state how often the approved list is updated) responses

- Monthly
- After testing to ensure aggregate meets required specifications.
- Annual quarry/pit evaluations.
- Annually or upon request.
- Approved list is updated whenever a new source has been identified or new data for a previous source is submitted.
- As needed.
- As needed when new sources come online.
- As often as new sources arrive and are approved by testing
- Continually, depending on requests and successful approvals or re-approvals.
- Contractors or suppliers may add sources when they need them. Approval is good for a 2 year period.
- Every 2 to 4 weeks.
- Every 3 months.
- Every three months.
- Please refer to SECTION 1001 of Arizona DOT MATERIAL SOURCES of the specifications (<https://www.azdot.gov/docs/business/2008-standards-specifications-for-road-and-bridge-construction.pdf>)
- The List of Approved Materials (LAM) is updated as new sources are added or changes need to be made to existing sources.
- Updated on a monthly basis based on prequalification procedures.
- We do allow new materials after quality testing. Frequency is as they are submitted and approved.
- When there is a new source approved, it is immediately put on the website.
- Whenever there is a new source to place on the list or one that is to be removed from the list. This could be daily, weekly, or monthly depending.
- Yearly Aggregate Testing
- As necessary, minimum yearly.
- Daily
- Everyday
- [http://ftp.dot.state.tx.us/pub/txdot-info/cst/TMS/400-A\\_series/pdfs/cnn499.pdf](http://ftp.dot.state.tx.us/pub/txdot-info/cst/TMS/400-A_series/pdfs/cnn499.pdf)
- Very infrequently

**7. Does your agency receive information regarding the geologic origins of natural (virgin) aggregates from producers?**

[21] Yes – **40%**

[31] No – **60%**

**52 Respondents**

**8. If you answered 'No' to Question 7, please check one of the following that applies**[9] It is done in-house (geologist/petrographer working for the agency) – **29%**[22] It is not required/requested by the agency – **71%****31 Respondents****9. Which of the following sand and gravel sources are used by your agency?****(Please check all that apply)**[2] Do not have gravel sources – **4%**[37] Glacial deposits – **71%**[14] Marine deposits – **27%**[20] Lacustrine (lake) deposits – **39%**[43] Fluvial (river) deposits – **83%**[16] Eolian (windblown) deposits – **31%**[2] Other (please list) – **4%****52 Respondents**Other (please list) responses

- Glaciolacustrine and Glaciofluvial.
- But now very limited unless upstate NY. Sand & Gravel pits a "dying breed" in NJ.

**10. Which of the following crushed stone sources are used by your agency?****(Please check all that apply)**[1] Do not have crushed stone sources – **2%**[45] Sedimentary rocks (e.g. limestone, dolomite, sandstone, etc.) – **85%**[27] Igneous (extrusive) rocks (e.g. basalt, scoria, etc.) – **51%**[43] Igneous (intrusive) rocks (e.g. granite, gabbro, etc.) – **81%**[38] Metamorphic rocks (e.g. quartzite, gneiss, etc.) – **72%**[1] Other (please list) – **2%****53 Respondents**Other (please list) responses

- We exclude shale, schist, slate and most sandstones (if we can classify as quartzite and meets physical tests, we will approve)

**11. What quality related natural (virgin) aggregate properties do you collect from aggregate producer? (Please check all that apply)**[31] Resistance to weathering by  $\text{Na}_2\text{SO}_4$  /  $\text{MgSO}_4$  Soundness – **66%**[38] Resistance to degradation, e.g., Los Angeles Abrasion test – **81%**[24] Resistance to polishing & degradation, e.g., Micro-Deval test – **51%**[35] Percent deleterious materials – **75%**[26] Plasticity, i.e. Atterberg limits (LL, PI) of portion passing No.40 (0.42 mm) – **55%**[7] Mineralogical composition – **15%**[31] Cleanliness, e.g., Sand Equivalent test – **66%**

- [11] Harmful clay content, e.g., Methylene Blue test – **23%**
- [37] Particle shape properties, i.e. angularity, surface texture, flatness and elongation – **79%**
- [22] Durability, e.g., freeze-thaw resistance test – **47%**
- [43] Specific gravity and absorption – **92%**
- [23] Alkali Silica or Alkali Carbonate Reactivity (ASR and/or ACR) – **49%**
- [6] Expansion from hydration reaction – **13%**
- [9] Other (please list) – **19%**

#### 47 Respondents

##### Other (please list) responses

- Agency performs above testing prior to production.
- Iowa Pore Index / Iowa quality number / XRF, XRD, TGA.
- Ministry does not collect data on aggregate properties from the Producer. Routine QA tests are conducted during course of the project to make sure that the aggregates used for the project meets Ministry's specifications.
- MoDOT Test Method TM-14 Water/Alcohol Freeze Test
- Only really gradation from producer; we test the rest, unless there is a continuing dispute/problem.
- Specific Gravity from Slag producers.
- WSDOT tests materials, LA, specific gravity, SE, degradation test addresses weathering and freeze thaw.
- We do not receive quality information from the producer.
- We have studded-tire abrasion/rutting issue in some areas of the State. The Nordic Abrasion test is used to measure hardness of coarse aggregate to be used in surface course HMA. We have a "hard aggregate policy" that stipulates the use of hard aggregate in the HMA surface course when AADT is more than 5,000/lane. Hard aggregate is defined as Nordic abrasion test value of less than 8.0. (Convention local soft aggregate has a Nordic Abrasion value of ~12). The Nordic abrasion test is similar to the Micro-Deval test, but uses larger drum with three metal strip in the drum. It is a harsher test than MicroDeval and LA abrasion. Our Nordic Abrasion test (ATM 312) is described in this manual starting page 312-1:  
[http://www.dot.state.ak.us/stwddes/desmaterials/mat\\_waqtc/assets/pdf/testman/2016/rev2/atmm2016r2\\_all.pdf](http://www.dot.state.ak.us/stwddes/desmaterials/mat_waqtc/assets/pdf/testman/2016/rev2/atmm2016r2_all.pdf)

#### 12. Do you utilize natural (virgin) aggregate sources from other states/provinces?

- [44] Yes – **83%**
- [9] No – **17%**

#### 53 Respondents

#### 13. If you answered 'Yes' to Question 12, please check all that apply

- [15] Due to lack of adequate aggregate sources – **34%**
- [11] Due to the need for a better quality aggregate source – **25%**
- [21] Due to economical/environmental concerns – **48%**
- [23] Other (please briefly explain) – **52%**

#### 44 Respondents

Other (please briefly explain)

- Adds competition to our market.
- By request from source in close proximity to state line.
- Closer sources may be available near state borders.
- Closest to job site.
- Contractor's source their aggregates that make the most economic sense when bidding.
- Contractors have aggregate sources in adjoining states and use them to get work in Idaho. They must meet all the same quality requirements to be put on the QAMS list.
- Delaware does not have any aggregate quarries.
- Due to location of HMA plants along state border.
- If we have a PCC pre-caster in upstate NY, we use the aggregates from there after they meet our specs. by test result.
- Most imported rock comes into our coastal area where there is limited availability of quality aggregates.
- Need for friction course. Rail and ship imports compete in areas with no virgin aggregate.
- Out-of-State contractors hauling in material.
- Paving contractor's option, most likely an economical choice.
- Precast products.
- Producer request often pipe plants and precast.
- Proximity to production facility where aggregates are used or proximity to project.
- See background info in Question 11 (Other). Sources of hard aggregate are scarce in the state. In the southeastern part of the state, some projects requiring hard aggregate in the HMA surface course end up importing (by barge) coarse hard aggregate from Washington State or British Columbia.
- Sometimes projects near borders are better served by developed sources out of state.
- The western part of Nebraska does not have much for coarse aggregate (ledge rock) and it is more economical to import aggregate from other states (Wyoming, South Dakota, Colorado) than to haul it from the eastern part of Nebraska.
- There are sources in adjacent states that supply to Indiana due to geographic proximity.
- To increase competition, lowering prices and improving quality.
- When Contractor elects to use them.
- Producers propose and utilize out of state sources.

**14. Do you blend aggregate from different sources?**[41] Yes – **77%**[12] No – **23%****53 Respondents****15. If you answered 'Yes' to Question 14, please check all that apply and indicate the reason for blending.**[26] To improve the quality – **63%**[16] To meet target gradation specification for unbound subbase/base course – **39%**[38] To meet target gradation specification for asphalt mixture design – **93%**[28] To meet target gradation specification for concrete mixture design – **68%**[19] To utilize marginal (out of spec) aggregate sources – **46%**



[13] To utilize quarry by-product – **32%**

[9] Other (please explain) – **22%**

#### **41 Respondents**

##### Other (please explain) responses

- Conserve pure silica sand sources for concrete pavement and Surface Aggregate Classification “A” aggregate in asphalt pavements.
- For skid resistance.
- For surface course HMA, if coarse hard aggregate is to be used from one specific hard aggregate material source, then the fine aggregate fraction for the same HMA is often from a different, softer aggregate material source. Hence aggregates from different sources are blended.
- Friction and % crushed for HMA.
- The blending occurs at the time of plant mixing. Source/ product stockpiles are not allowed to be blended for bituminous.
- This is a producer’s decision.
- To meet friction specs.
- To support batch plants that are not near pit sources.
- Asphalt surface course polish resisting aggregates (insoluble residue).

#### **16. If you answered 'Yes' to Question 14, what materials do you often blend to meet aggregate quality requirements for constructing any pavement layer? (please check all that apply)**

[38] Virgin + Virgin – **95%**

[15] Virgin + Marginal – **38%**

[32] Virgin + Recycled (RAP or RCA or artificial aggregates) – **80%**

[11] Virgin + Quarry By-product – **28%**

[1] Other (please list) – **3%**

#### **40 Respondents**

##### Other (please list) responses

- We don't blend to improve quality (NB)

#### **17. Do you have specifications or special provisions for constructing pavement layers with the following materials?**

[6] Marginal (out of specification) virgin aggregate – **23%**

[4] Marginal (out of specification) recycled aggregate – **15%**

[9] Nontraditional aggregate (e.g., large size virgin or recycled aggregate, e.g., above 1.5-in. top size or primary crusher run size material) – **35%**

[8] Quarry By-product (less than 6 mm in size) – **31%**

[3] Filter aggregates, e.g., for pavement interlayers, etc. – **12%**

[8] Recycled glass, as a base material – **31%**

[8] Other (please indicate) – **31%**

#### **26 Respondents**

Other (please indicate) responses

- For asphalt and concrete, aggregates need to meet quality requirements before being incorporated. How and with what that is done is proposed in a QC plan and approved / rejected.
- Glass has died after Federal bonus payment removed. We use 15% RAP in surface course and 25% in base course.
- No.
- No, we don't have specification for construction pavement layers with above types of materials.
- See WSDOT Std. Specification 9-03.21(1)C and 9-03.21(1)E.
- Up to 10% by weight crushed glass (cullet) smaller than 3/8-inch may be uniformly blended with natural soil-aggregate material prior to project delivery and placement. Blended material should meet the gradation specification requirements of the layer in question (base, subbase, etc.)
- Must meet specifications.
- None.

**18. If you utilize Reclaimed Asphalt Pavement (RAP) in your pavement layers construction, please mark quality related source properties for which RAP materials are screened for.**

- [2] Do not utilize RAP – **4%**
- [18] Source properties of the aggregate – **38%**
- [42] Residual asphalt binder content – **88%**
- [22] Residual asphalt binder property – **46%**
- [28] Specific gravity (bulk) – **58%**
- [6] Polishing properties, e.g., Micro-Deval loss – **13%**
- [6] Percent deleterious/contamination – **13%**
- [2] Freeze-thaw resistance – **4%**
- [13] Other (please list) – **27%**

**48 Respondents**Other (please list) responses

- After asphalt binder extraction, aggregate gradation is determined.
- Contractor provides mix designs.
- Effective specific gravity back calculated from Rice and AC.
- For wearing courses over 15% by weight of RAP the skid resistance of RAP is dependent on where the original aggregate came from.
- If RAP is generated from an (Idaho Transportation Department) ITD pavement, the quality is assumed to be good. If not, all the quality tests must be performed.
- Material Transfer Device (MTD) is determined for the RAP material.
- Maximum particle size.
- RAP is not allowed in PCC
- Same gradation requirements apply as if product were all virgin aggregate.
- We don't use RAP very much, once a while we use RAP.
- Decant, plasticity index, gradation. RAS (Recycled Asphaltic Shingles): deleterious, gradation
- Gradation testing is also done.
- The requirements would be different depending on proposed use.

**19. If you utilize Recycled Concrete Aggregate (RCA) in your pavement layers construction, please mark quality related source properties for which RCA materials are screened for.**

- [19] Do not utilize RCA – **40%**
- [8] Source properties of the aggregate – **17%**
- [15] Los Angeles abrasion loss – **32%**
- [8] Specific gravity (bulk)/Absorption – **17%**
- [4] Polishing & degradation properties, e.g., Micro-Deval loss – **9%**
- [10] Percent deleterious/contamination – **21%**
- [3] Freeze-thaw resistance – **6%**
- [4] Alkali Silica Reactivity (ASR) – **9%**
- [15] Other (please list) – **32%**

**47 Respondents**

Other (please list) responses

- Aggregate Durability Index, AASHTO T210.
- Decant, Organic Impurities, gradation.
- Developing Specifications.
- Florida's Limerock Bearing Ratio Test, similar to CBR. RCA is not permitted in new concrete pavement. RCA is not permitted in new asphalt pavement unless the concrete came from an FDOT project.
- Gradation.
- May be allowed for use in unbound materials but required to meet or exceed those material's requirements.
- N/A.
- Plasticity.
- RCA comes from (Idaho Transportation Department) ITD pavements and are assumed to meet quality requirements. ASR testing is performed if the RCA is to be used in the concrete layer.
- Use RCA only in sub-base at this time.
- WSDOT Degradation Test
- We don't use RCA.
- Only for subbase.
- Only utilized in base courses.

**20. If you utilize Artificial/By-product aggregates such as Steel Furnace Slag (SFS) and Blast Furnace Slag (BFS) in your pavement layers construction, please mark quality related source properties these materials are screened for.**

**SFS quality related property (please check)**

- [23] Do not utilize – **55%**
- [7] Chemical composition – **17%**
- [2] Mineralogical properties – **5%**
- [17] Specific gravity (bulk) – **41%**
- [4] Polishing & degradation properties e.g., Micro-Deval loss – **10%**
- [8] Freeze-thaw resistance – **19%**
- [7] Expansion properties – **17%**

**42 Respondents**

Other SFS (please list) responses

- Has to meet normal requirements for material type it is being used.
- LA-Abrasion
- Must meet the requirements as virgin aggregates and DMS-11000  
([http://www.txdot.gov/business/resources/dms.html?CFC\\_target=http%3A%2F%2Fwww.dot.state.tx.us%2Fapps-cg%2Fmaterial\\_specifications%2Fdms\\_series.htm%3Fseries%3D11000](http://www.txdot.gov/business/resources/dms.html?CFC_target=http%3A%2F%2Fwww.dot.state.tx.us%2Fapps-cg%2Fmaterial_specifications%2Fdms_series.htm%3Fseries%3D11000))
- Only for subbase
- SFS undergoes all tests that a virgin coarse aggregate would for source approval.
- Steel Slag is not allowed in PCC
- Gradation
- Soundness
- Wear, soundness, gravities, absorption.

**BFS quality related property (please check)**

- [23] Do not utilize BFS – **52%**
- [7] Chemical composition – **16%**
- [2] Mineralogical properties – **5%**
- [17] Specific gravity (bulk) – **39%**
- [5] Polishing & degradation properties e.g., Micro-Deval loss – **11%**
- [11] Freeze-thaw resistance – **25%**
- [6] Expansion properties – **14%**

**44 Respondents**Other BFS (please list) responses

- BFS undergoes all tests that a virgin coarse aggregate would for source approval.
- F&E
- Has to meet normal requirements for material type it is being used.
- LA Abrasion
- Must meet the requirements as virgin aggregates and DMS-11000  
([http://www.txdot.gov/business/resources/dms.html?CFC\\_target=http%3A%2F%2Fwww.dot.state.tx.us%2Fapps-cg%2Fmaterial\\_specifications%2Fdms\\_series.htm%3Fseries%3D11000](http://www.txdot.gov/business/resources/dms.html?CFC_target=http%3A%2F%2Fwww.dot.state.tx.us%2Fapps-cg%2Fmaterial_specifications%2Fdms_series.htm%3Fseries%3D11000))
- See WSDOT Std. Specification 9-03.21(1)D and 9-03.21(1)EWSDOT allows 20 percent or less
- Gradation
- Only for subbase
- Soundness
- Wear, soundness, gravities, absorption

**21. If you utilize RAP, RCA, SFS or BFS, please state what restrictions (if any) do you place on these recycled and/or artificial/by-product aggregates for use in pavement construction?**45 Total Response

- RCA: TCLP may be required. Specific gravity and LA-Abrasion is performed routinely - No steel slag is used. BFS: Only in concrete to remediate. ASR issue in concrete
- Maximum RAP content expressed as a percentage of total asphalt mix-Maximum size, RAP and virgin asphalt binder to meet the design binder grade

- 30% binder replacement max. for bottom lift of RAP Asphalt Pavements 15% binder replacement maximum for top lift of RAP Asphalt Pavements
- Allowable RAP percentages in HMA: 1) Max. 15% RAP in Type II-A mix (19mm NMAS; Marshall 75 blows; min. 90% 2-face fracture). 2) Max. 25% RAP in Type II-B mix (19mm NMAS; Marshall 50 blows; min. 80% 1-face fracture). 3) No RAP is allowed in Superpave mixes.
- As the amount of RAP is increased (> 20%), the binder grade needs to be adjusted by reducing the lower temperature grade by -6 degrees or blend charts need to be utilized (>40%).
- Base and Subbase for RCA only and Asphalt Pavement for RAP only.
- Depending on application have a percent max that can be used within the layer.
- Do not allow RAP or RCA from non-state sources/pavements.
- Final product must be equal to or better than product with virgin materials only.
- For Recycled Materials See WSDOT Std. Spec. 9-03.21 Recycled Materials RAC - Recycled Concrete Rubble Aggregate Recycled concrete aggregates are coarse and fine aggregates manufactured from hardened concrete mixtures. Recycled concrete aggregate may be used as coarse aggregate or blended with coarse aggregate for Commercial Concrete. Recycled concrete aggregate shall meet all of the requirements for coarse aggregate contained in Section 9-03.1(4) or 9-03.1(5). In addition to the requirements of Section 9-03.1(4) or 9-03.1(5), recycled concrete shall: 1. Contain an aggregated weight of less than 1 percent of adherent fines, vegetable matter, plastics, plaster, paper, gypsum board, metals, fabrics, wood, tile, glass, asphalt (bituminous) materials, brick, porcelain or other deleterious substance(s) not otherwise noted; 2. Be free of harmful components such as chlorides and reactive materials unless mitigation measures are taken to prevent recurrence in the new concrete.
- High traffic loading: 20% RAP max in wearing courses. Most other asphalt paving is 30% RAP max.
- Limit % used in particular layers, i.e. binder, wearing surfaces for RAP.
- Max 25% Rap aggregates in Bottom lift and Max 20% Rap aggregates in top lift.
- Max. 15% RAP in asphalt concrete. RAP can be used on bottom half of Base.
- Maximum 15% RAP of total weight for Plant Mix. Must be from approved source (usually from existing project or previous highway project).
- May not be used under HMA or SMA pavements.
- Meet Mix Design Requirements.
- No RAP in surface. Up to 25% in base and binder courses with change in binder grade.
- Minimum 4% AC and mix must meet FDOT specifications. Minimum AC 2.5% for coarse portion above #4 sieve if fractionated. RCA is not permitted in new concrete pavement. RCA is not permitted in new asphalt pavement unless the concrete came from an FDOT project.
- Please see DMS -11000 at:  
([http://www.txdot.gov/business/resources/dms.html?CFC\\_target=http%3A%2F%2Fwww.dot.state.tx.us%2Fapps-cg%2Fmaterial\\_specifications%2Fdms\\_series.htm%3Fseries%3D11000](http://www.txdot.gov/business/resources/dms.html?CFC_target=http%3A%2F%2Fwww.dot.state.tx.us%2Fapps-cg%2Fmaterial_specifications%2Fdms_series.htm%3Fseries%3D11000))
- RAP - Gradation SFS- Quality, Chemical composition.
- RAP - Total content is limited depending on asphalt pavement layer and contributed binder content RCA - Limited to use in base applications. Have not allowed to be used in concrete mixes Gradation and durability restrictions for all 4.
- RAP - Up to 35% allowed Crushed Hydraulic Cement Concrete - Must be state approved concrete prior to crushing. Do not use as subbase or aggregate base when any subsurface drainage system is present except when CHCC is cement stabilized.
- RAP 15% surface, 25% base course, RCA only in sub-base. Shingles 5% but only pre-consumer.
- RAP and SFS are not allowed in PCC.

- RAP dust to asphalt ratio as identified in AASHTO M 323; stockpiles must be tested for gradation & A/C content every 1,000 Tons during manufacture. RCA must meet AASHTO M 319, except for gradation.
- RAP in HMA- Max used 50% by wt. RAP in HMA - Binder grade bump when used above 20%. Blending charts used when above 25%.
- RAP is limited to 25% of total mix unless specifically allowed. There are no percent restrictions in blends for the others so long as specified aggregate properties are met. RCA is not allowed for concrete use.
- RAP is limited to the extent that the binder replacement is no more than 20% or 30%. Steel Slag is limited to 25% of the total aggregate.
- RAP is restricted to various percentages of the HMA mixture depending on the layer. RCA is used as an unbound aggregate base course layer.
- RAP is used and binder contribution from RAP is restricted to 20%.
- RAP may be used as the top 3" of unbound base layer. RCA is allowed at up to 50% by weight in unbound base/subbase layers. RAP is used in HMA mixes up to 30% (dependent upon P200 and binder content variability).
- RAP used in base courses must be tested by contractor for environmental conformance.
- RAP, SFS, BFS have maximum amounts added to the material such as concrete and asphalt mixtures
- RAP: [http://www.scdot.org/doing/technicalPDFs/supTechSpecs/SC-M-407\\_06-11.pdf](http://www.scdot.org/doing/technicalPDFs/supTechSpecs/SC-M-407_06-11.pdf) . We don't use RCA very often and when we do it is limited to CA only with an absorption of less than 10%. We use slag even less.
- RCA - only for subbase and fill. SFS & BFS - only for subbase and fill RAP - used extensively in asphalt pavements and some seal coats only. below 15% by weight few restrictions. above 15% wearing course skid restrictions also RAP binder properties need to be tested and base binder may be adjusted to achieve final binder requirements. RAP specification is currently under review.
- RCA is only used in unbound base courses. Maximum of 30% RAP allowed in ACHM.
- SFS and BFS may be used as base but must be blended with virgin aggregate. Restricted to 7% foundry slag or 75% steel mill slag.
- SFS is not permitted in asphalt or concrete pavement. BFS is not permitted in concrete pavements.
- SFS is only allowed in intermediate mixes according to ODOT Supplement 1071. BFS is allowed in Asphalt Surface and Intermediate according to standard 703.04 & 703.05 specifications.
- Unbound Bases and most Subbases : RAP, RCA, Air-Cooled BFS, Nickle slag up to 100%, RAP up to 30%. Hot Mix Binder Courses: Up to 40% RAP
- Visual stripping
- We have limits on the amount of RAP an Asphalt Mix Designs and also limit SFS & BFS in PCC. RCA is not used in PCC or AC. SFS and BFS is also tested in proposed PCC mix designs prior to approval.
- We only use RAP but not frequently
- Slag is only allowed in asphalt surface layers. RAP is only allowed as part of the aggregate blend for asphalt layers.

## Category 2: Aggregate Sampling, Quality Control, Tests, and Ranges

### 22. Who is responsible for testing aggregate materials and providing input properties for the design of pavement layers that incorporate aggregates?

- [43] In-house geotechnical/materials laboratory – **81%**
- [17] Retained external geotechnical consultant/materials laboratory – **32%**
- [3] University laboratory (under research subcontract) – **6%**
- [16] Aggregate producer – **30%**
- [22] Contractor testing and laboratory – **42%**
- [9] Other (please indicate) – **17%**

#### 53 Respondents

##### Other (please indicate) responses

- Department establishes desired properties for material being used and Contractor must meet criteria.
- In house pavement design engineer and materials testing laboratory.
- In house testing laboratory.
- In-House for quality and verification of contractors QC.
- Once a year, the Missouri DOT samples material being produced from approved ledge combinations. This data is used to confirm contractor submitted data and for monitoring purposes.
- Pavement layer designs are based on minimum aggregate quality requirements and not on source specific values.
- Pavement layers are designed using Saskatchewan method. This method uses charts which have predefined CBR values for granular layers. In practice, the actual CBR values of granular materials used may be lower.
- Mostly in-house, but in case of a dispute, private testing labs are required before we will look at it again.

### 23. How frequently does your agency check the acceptance of material for use in field application? (Please check all that apply)

- [20] Prior to the use on every major construction project – **39%**
- [6] More than twice every year – **12%**
- [2] Twice every year – **4%**
- [24] Once a year – **46%**
- [5] Less than once a year – **10%**
- [21] Other (please indicate)- **40%**

#### 52 Respondents

##### Other (please indicate) responses

- A series of samples are taken for initial approval, then tested annually.
- All sources are sampled and tested biennially. Production samples are tested during production for NYSDOT work.
- Based on source history and tons produced.
- Depends on location(distance) and volume of use.

- Depends on what the aggregate is being used for. Some aggregate tested once, some tested every so many tons.
- During the production and during the design.
- Freeze Thaw, AASHTO T161 performed less frequently due to limited Freeze thaw chamber capacity.
- Material Quality to stay on approved list is checked annually. Routine samples are taken from the quarries based on tonnage produced. Samples are also pulled from projects, concrete plants, asphalt plants, etc. for acceptance.
- Material acceptance is checked through Producer QC program at mine and reduced frequency Verification testing by FDOT. The goal is to visit each Florida mine weekly. Out of state mines are verified quarterly. Out of country mines are mandatorily tested at redistribution terminals.
- May do additional material verification for new blast.
- Most of the aggregate sources owned by the ministry have been tested in the past and results from this testing are available for reference. For private/Contractor owned sources, testing is done during crushing stage.
- Most of the time we retain consultants to perform the quality control on aggregate production projects who check and test on hourly basis during the production of aggregates; sometimes we make the contractor responsible for quality control and ask him to retain a geotechnical firm to test the aggregate during production and provide us the report at the end regarding the quality of aggregate signed by a Professional Engineer.
- Per project and a five year cycle.
- Per the current Guide Schedule (<http://txdot.gov/business/resources/materials/guide-schedule.html>)
- Prep-Approved sand & gravel sources every 5 years minimum. For PCC every 6000 tons
- Project by Project basis.
- Quality is checked annually by Central Office and acceptance samples are collected as material is placed on state projects to accept the quality of the materials supplied.
- Sources are approved before incorporation into a project and then tested at our established QA frequencies for materials.
- The Contractor selects materials for the project. The source selected must be on the QAMS list.
- Once every 50,000 tons.

**24. How does your agency obtain samples from project sites to perform required tests? (Please check all that apply)**

- [13] Samples shipped from aggregate producer and tested in agency (DOT) lab – **25%**
- [43] Samples obtained by agency and tested in agency (DOT) lab – **81%**
- [18] Samples checked/inspected at the source (quarry) location – **34%**
- [7] Other (please indicate) – **13%**

**52 Respondents**

Other (please indicate) responses

- No samples are obtained. The Contractor submits information to have his source placed on the Qualified Aggregate Material Suppliers (QAMS) list.
- Samples are obtained by Consultant/Contractor and tested by consultant/contractor
- Samples are taken by the Contractor and delivered to Consultant QA labs (i.e. or Referee labs, when required) by the Contract Administrator for Testing.
- Samples are tested by Ministry's Consultant lab.



- Samples obtained from Contractor at location to be used (Plant, Stock-Pile, On-site) in the presence of Agency Staff.
- Samples taken by DOT personnel on projects. Samples taken by DOT personnel at concrete and asphalt plants.
- Samples collected by contractor witnessed by the department and delivered to department for testing.

**25. Does your agency perform tests for checking virgin aggregate quality requirements for construction of pavement layers?**

[49] Yes – **96%**

[2] No – **4%**

**51 Respondents**

26. Please refer to the following table related to "Aggregate Quality Requirements for Virgin Coarse Aggregates" and mark all the related tests/procedures.

Section 1 – Aggregate Quality Requirements for Virgin Coarse Aggregates				
Quality Test Name / Description	No Test Required No. of Respondents (Percentage)	AASHTO No. of Respondents (Percentage)	ASTM No. of Respondents (Percentage)	Test Procedure by Your Agency No. of Respondents (Percentage)
Na <sub>2</sub> SO <sub>4</sub> / MgSO <sub>4</sub> Soundness	4 (4/21=19%)	31 (72)	4 (15)	9 (30)
Los Angeles Abrasion loss	-	41 (95)	6 (22)	5 (17)
Deleterious Materials	5 (24)	19 (44)	6 (22)	18 (60)
Particle Angularity	4 (19)	25 (58)	11 (41)	12 (40)
Flat & Elongated Ratio	1 (5)	14 (33)	22 (82)	14 (47)
Durability: Freeze-Thaw	11 (52)	13 (30)	6 (22)	10 (33)
Polishing / Skid Resistance	12 (57)	6 (14)	4 (15)	7 (23)
Porosity	17 (81)	6 (14)	1 (4)	4 (13)
<b>Total No. of Respondents</b>	<b>21</b>	<b>43</b>	<b>27</b>	<b>30</b>
Other Tests	Degradation			Idaho IT-15, Alaska ATM 313, WSDOT
	Specific gravity and maximum absorption	T85 Modified		
	Micro-Deval (MD) durability	T 327		
	Sand Equivalent (SE)	T 176		
	Organic impurities, coal and lignite	T 21		
	Lightweight chert	T 19		
	Aggregate durability index	T 210		
	Crushed fragments		D 5821	
	Silicon dioxide, insoluble residue		C 114	
	Nordic abrasion value of coarse aggregates			Alaska ATM 312
	Clay lumps, shale, Soft Particles, and Friable particles			Nebraska NDR T 504, Pennsylvania PTM 620
	MgO / IR to determine limestone / dolomite and sandstone			Illinois DOT
	Air degrade			Oregon TM 208
	Deleterious materials			OHDL 9, PTM 519
	Insoluble residue			Oklahoma OHDL 25
	Metallic Iron			Pennsylvania PTM 518
	Petrographic Number			Prince Edward Island

#### Coarse Aggregate Test Key

<b>NMS</b>	Na <sub>2</sub> SO <sub>4</sub> / MgSO <sub>4</sub> Soundness	<b>FER</b>	Flat & Elongated Ratio
<b>LAA</b>	Los Angeles Abrasion loss	<b>DFT</b>	Durability: Freeze-Thaw
<b>DM</b>	Deleterious Materials	<b>PSR</b>	Polishing / Skid Resistance
<b>PA</b>	Particle Angularity	<b>PR</b>	Porosity

Agency	No Test Required								AASHTO								ASTM								Test Procedure by Agency							
	NMS	LAA	DM	PA	FER	DFT	PSR	PR	NMS	LAA	DM	PA	FER	DFT	PSR	PR	NMS	LAA	DM	PA	FER	DFT	PSR	PR	NMS	LAA	DM	PA	FER	DFT	PSR	PR
AL									x	x	x	x	x		x																	
AK			x			x	x	x	x	x		x									x							x	x			
AZ									x	x	x			x														x	x			
AR									x	x	x	x		x							x		x									
CO							x	x	x	x	x			x			x	x	x			x						x	x			
CT						x	x	x	x	x	x									x	x											
FL				x	x	x	x		x		x															x	x					
GA									x	x		x															x		x			
ID							x		x	x	x	x									x	x		x								
IL																									x	x	x		x	x	x	
IN									x	x	x	x		x							x				x				x	x		
IA										x						x											x					x
KS	x							x		x					x												x	x	x	x		
KY								x		x													x		x		x	x	x	x		
ME										x		x								x	x											
MD									x	x	x	x	x	x	x	x																
MN									x	x			x							x							x	x				
MS									x	x																						
MO									x	x		x		x							x						x					
MT									x	x		x	x																			
NE									x	x	x	x		x		x					x											
NV									x	x	x																	x	x			
NH	x		x			x	x	x		x		x	x																			
NJ						x	x	x	x	x		x									x						x					
NM							x		x	x		x	x	x		x									x	x	x	x	x	x		x
NY								x		x									x	x	x				x					x	x	
NC									x	x	x	x	x		x	x																
ND						x	x	x	x	x		x									x						x					
OH									x	x											x	x	x					x				
OK	x			x				x		x				x													x				x	
OR				x		x	x	x	x	x	x		x																			
PA						x				x		x				x					x				x		x			x		
RI	x		x			x	x	x		x		x	x																			
SC									x	x	x	x																x				
SD									x	x																		x				
TN								x	x	x	x	x	x	x	x		x	x	x	x	x	x	x									
TX																		x								x	x	x	x			
VT									x	x											x	x						x	x			
VA									x	x	x			x							x	x										
WA									x	x	x	x							x	x									x			
WI							x	x	x	x	x	x		x							x											
WY			x			x		x	x	x		x	x		x																	
ON																									x							
NB																											x	x	x	x		
MB													x	x											x	x	x			x	x	
BC									x	x	x	x	x	x			x	x	x	x	x	x										
PE			x	x		x		x									x	x			x		x									
SK																											x					
AB										x																	x	x	x			
YT																		x	x	x	x	x										

27. Please refer to the following table related to "Aggregate Quality Requirements for Virgin Fine Aggregates" and mark all the related tests/procedures.

Section 2 – Aggregate Quality Requirements for Virgin Fine Aggregates				
Quality Test Name / Description	No Test Required No. of Respondents (Percentage)	AASHTO No. of Respondents (Percentage)	ASTM No. of Respondents (Percentage)	Test Procedure by Your Agency No. of Respondents (Percentage)
Na <sub>2</sub> SO <sub>4</sub> / MgSO <sub>4</sub> Soundness	9 (9/21=43%)	24 (59)	5 (50)	7 (29)
Atterberg Limits	7 (33)	25 (61)	4 (40)	6 (25)
Deleterious Materials	7 (33)	22 (54)	6 (60)	13 (54)
Uncompacted Void Content	8 (38)	27 (66)	5 (50)	3 (13)
Micro-Deval for Degradation & Polishing Properties	16 (76)	10 (24)	4 (40)	7 (29)
Sand Equivalent	3 (14)	29 (71)	4 (40)	10 (42)
<b>Total No. of Respondents</b>	<b>21</b>	<b>41</b>	<b>10</b>	<b>24</b>
Other Tests	Dry Strength			Alberta
	Degradation			Idaho IT-15
	Sand-sized acid insoluble residue content		D 3042 modified	
	Organic impurities	T 21, T 71		
	Specific Gravity & Absorption	T 84, T 85		
	Clay Lumps			Nebraska NDR T504
	Hydrometer for clay-sized material, color for organics of natural sands, and mortar strength if color is too high			Illinois
	Lightweight and clay content			Saskatchewan STP 206-09, STP 206-15
	Air Degrade			Oregon TM 208
	Deleterious			Oklahoma OHD L 9
	CBR			Virginia VTM-7

Fine Aggregate Test Key	
<b>NMS</b>	Na <sub>2</sub> SO <sub>4</sub> / MgSO <sub>4</sub> Soundness
<b>ATL</b>	Atterberg Limits
<b>DM</b>	Deleterious Materials
<b>UVC</b>	Uncompacted Void Content
<b>MDP</b>	Micro-Deval for Degradation & Polishing Properties
<b>SE</b>	Sand Equivalent

Agency	No Test Required						AASHTO						ASTM						Test Procedure by Agency					
	NMS	ATL	DM	UVC	MDP	SE	NMS	ATL	DM	UVC	MDP	SE	NMS	ATL	DM	UVC	MDP	SE	NMS	ATL	DM	UVC	MDP	SE
AL							x	x	x	x		x												
AK			x		x		x	x		x		x								x				
AZ								x	x			x										x		x
AR	x				x			x	x	x		x												
CO							x	x	x	x			x	x	x	x							x	x
CT					x		x	x	x	x		x												
FL	x	x		x	x	x																x		
GA	x				x					x												x		x
ID					x		x		x	x		x		x										
IL																				x		x		
IN							x	x	x	x	x									x			x	
IA																						x		
KS	x										x										x	x		x
KY					x			x	x	x		x								x		x	x	
ME										x	x	x												
MD							x	x	x		x													
MN									x	x		x												
MS							x																	
MO								x		x	x	x										x		
MT							x	x		x		x												
NE							x	x	x	x		x												
NV				x	x		x	x	x															x
NH	x	x	x	x	x							x												
NJ					x		x	x		x	x	x										x		
NM				x			x	x	x		x	x								x	x	x		x
NY		x			x	x			x	x										x				
NC							x	x	x		x	x												
ND	x		x		x			x		x		x												
OH							x	x		x		x												
OK	x	x		x								x					x					x		
OR				x	x		x	x	x			x												
PA		x	x		x		x			x		x												
RI	x	x	x		x					x		x												
SC							x	x	x															x
SD							x					x				x								
TN							x		x	x		x	x			x	x		x					
TX																				x	x	x		x
VT							x			x		x												
VA							x	x	x	x		x									x			
WA									x	x		x				x			x					
WI	x			x	x	x		x	x							x								
WY							x	x		x		x											x	
NB																	x						x	
MB										x										x	x	x		x
BC							x	x	x	x	x	x	x	x	x	x	x	x					x	x
PE		x	x	x									x					x	x					
SK																						x		x
AB								x				x										x	x	
YT													x	x	x	x	x							

**28. Does your agency perform tests for checking Recycled Asphalt Pavement (RAP) quality requirements for construction of pavement layers?**

[33] Yes – **66%**

[17] No – **34%**

**50 Respondents**

**29. Please refer to the following table related to "Aggregate Quality Requirements for Recycled Asphalt Pavement" and mark all the related tests/procedures.**

Section 3 – Aggregate Quality Requirements for RAP				
Quality Test Name / Description	No Test Required No. of Respondents (Percentage)	AASHTO No. of Respondents (Percentage)	ASTM No. of Respondents (Percentage)	Test Procedure by Your Agency No. of Respondents (Percentage)
Residual Asphalt Binder Content	13 (13/13=100%)	21 (96)	3 (75)	10 (77)
Micro-Deval for Polishing & Degradation Properties	12 (92)	4 (18)	-	1 (8)
Deleterious Materials	-	3 (14)	-	4 (31)
Expansion Properties	13 (100)	1 (5)	-	-
Flat & Elongated Ratio	10 (77)	5 (23)	1 (25)	1 (8)
Durability: Freeze-Thaw	13 (100)	2 (9)	-	-
<b>Total No. of Respondents</b>	<b>13</b>	<b>22</b>	<b>4</b>	<b>13</b>
Other Tests	Degradation			Idaho IT-15
	Consensus properties		M 323	
	Specific gravity and absorption		T 84, T 85	Saskatchewan STP 204-09

RAP Test Key	
<b>RAC</b>	Residual Asphalt Binder Content
<b>MDP</b>	Micro-Deval for Polishing & Degradation Properties
<b>DM</b>	Deleterious Materials
<b>EP</b>	Expansion Properties
<b>FER</b>	Flat & Elongated Ratio
<b>DFT</b>	Durability: Freeze-Thaw

Agency	No Test Required						AASHTO						ASTM						Test Procedure by Agency					
	RAC	MDP	DM	EP	FER	DFT	RAC	MDP	DM	EP	FER	DFT	RAC	MDP	DM	EP	FER	DFT	RAC	MDP	DM	EP	FER	DFT
AL							X																	
AK		X	X	X		X	X				X													
AZ							X												X					
CO		X	X	X	X	X													X					
CT		X	X	X	X	X	X																	
FL		X	X	X	X	X													X					
ID		X	X	X		X	X				X													
IL																			X	X				
IA							X																	
KS		X	X	X	X	X													X					
ME							X	X																
MD											X	X												
MS							X																	
MO							X	X													X			
NV		X	X	X	X	X	X																	
NH		X	X	X	X	X	X																	
NJ							X														X			
NM		X		X		X	X		X		X								X		X		X	
NY																			X					
NC							X	X	X															
ND		X	X	X	X	X	X																	
OR		X	X	X	X	X	X																	
PA							X										X							
SC							X																	
TN							X						X											
TX																					X			
WA													X											
WY		X	X	X	X	X	X																	
MB		X	X	X	X	X													X					
BC							X	X	X	X	X	X												
PE													X											
SK																			X					
AB																			X					

**30. Does your agency perform tests for checking Recycled Concrete Aggregate (RCA) quality requirements for construction of pavement layers?**

[20] Yes – **40%**

[30] No – **60%**

**50 Respondents**

**31. Please refer to the following table related to “Aggregate Quality Requirements for Recycled Concrete Aggregate” and mark all the related tests/procedures.**

<b>Section 4 – Aggregate Quality Requirements for RCA</b>				
<b>Quality Test Name / Description</b>	<b>No Test Required No. of Respondents (Percentage)</b>	<b>AASHTO No. of Respondents (Percentage)</b>	<b>ASTM No. of Respondents (Percentage)</b>	<b>Test Procedure by Your Agency No. of Respondents (Percentage)</b>
Los Angeles Abrasion Loss	1 (1/5=20%)	14 (93)	2 (67)	3 (38)
Absorption	5 (100)	6 (40)	2 (67)	1 (13)
Deleterious Materials	5 (100)	4 (27)	3 (100)	5 (63)
Alkali-Silica Reactivity	5 (100)	3 (20)	3 (100)	1 (13)
Micro-Deval for Polishing & Degradation Properties	5 (100)	2 (13)	1 (33)	3 (38)
Durability: Freeze-Thaw	4 (80)	2 (13)	2 (67)	3 (38)
Specific Gravity	4 (80)	6 (40)	3 (100)	3 (38)
<b>Total No. of Respondents</b>	<b>5</b>	<b>15</b>	<b>3</b>	<b>8</b>

Other responses

- Same as coarse aggregates
- Indicated tests for structural asphalt pavement. Limerock Bearing Ratio for Base
- Please refer to the coarse aggregate section of Table III of our guide schedule (<http://txdot.gov/business/resources/materials/guide-schedule.html>)

<b>RCA Test Key</b>	
<b>LAA</b>	Los Angeles Abrasion Loss
<b>AB</b>	Absorption
<b>DM</b>	Deleterious Materials
<b>ASR</b>	Alkali-Silica Reactivity
<b>MDP</b>	Micro-Deval for Polishing & Degradation Properties
<b>DFT</b>	Durability: Freeze-Thaw
<b>SG</b>	Specific Gravity



Agency	No Test Required							AASHTO							ASTM							Test Procedure by Agency						
	LAA	AB	DM	ASR	MDP	DFT	SG	LAA	AB	DM	ASR	MDP	DFT	SG	LAA	AB	DM	ASR	MDP	DFT	SG	LAA	AB	DM	ASR	MDP	DFT	SG
CO								x	x	x			x	x	x	x	x			x	x					x		
CT		x	x	x	x	x	x	x																				
FL																						x	x	x				x
IL																						x		x	x	x	x	x
IA								x																			x	
KS		x	x	x	x			x																			x	x
MD								x	x	x	x	x	x	x														
MS								x																				
MO								x	x			x		x										x				
NH	x	x	x	x	x	x	x																					
NJ								x																x				
NC								x	x	x	x			x														
OK		x	x	x	x	x	x	x																				
PA									x					x														
SD								x																				
TX																						x		x		x		
VA								x																				
WA								x	x	x	x			x			x	x				x						
WI		x	x	x	x	x	x	x																				
BC															x	x	x	x	x	x	x							

**32. Does your agency perform tests for checking Steel Furnace Slag (SFS) or Blast Furnace Slag (BFS) quality requirements for construction of pavement layers?**

[15] Yes – **29%**

[37] No – **71%**

**52 Respondents**

**33. Please refer to the following table related to "Aggregate Quality Requirements for Steel Furnace Slag" and mark all the related tests/procedures**

<b>Section 5 – Aggregate Quality Requirements for SFS</b>				
<b>Quality Test Name / Description</b>	<b>No Test Required No. of Respondents (Percentage)</b>	<b>AASHTO No. of Respondents (Percentage)</b>	<b>ASTM No. of Respondents (Percentage)</b>	<b>Test Procedure by Your Agency No. of Respondents (Percentage)</b>
Chemical Composition	2 (2/4=50%)	2 (22)	2 (67)	2 (29)
Mineralogical Properties	3 (75)		2 (67)	
Specific Gravity		8 (89)	2 (67)	4 (57)
Micro-Deval for Polishing & Degradation Properties	3 (75)	1 (11)		2 (29)
Expansion Properties	4 (100)	2 (22)	1 (33)	3 (43)
Durability: Freeze-Thaw	3 (75)	2 (22)	1 (33)	2 (29)
<b>Total No. of Respondents</b>	<b>4</b>	<b>9</b>	<b>3</b>	<b>7</b>

Other responses

- LA Abrasion.
- Same as coarse aggregates.
- Please refer to Table IA and II of our guide schedule (<http://txdot.gov/business/resources/materials/guide-schedule.html>)
- Same as coarse aggregates and PMT 130 expansion for SFS

<b>SFS Test Key</b>	
<b>CC</b>	Chemical Composition
<b>MP</b>	Mineralogical Properties
<b>SG</b>	Specific Gravity
<b>MDP</b>	Micro-Deval for Polishing & Degradation Properties
<b>EP</b>	Expansion Properties
<b>DFT</b>	Durability: Freeze-Thaw

Agency	No Test Required						AASHTO						ASTM						Test Procedure by Agency					
	CC	MP	SG	MDP	EP	DFT	CC	MP	SG	MDP	EP	DFT	CC	MP	SG	MDP	EP	DFT	CC	MP	SG	MDP	EP	DFT
AL									X															
AR	X	X		X	X				X			X												
IL																			X		X		X	
IN									X	X		X											X	X
IA																					X			X
KY		X		X	X	X				X									X		X			
MS							X																	
NE													X	X	X			X	X					
NY	X				X	X								X							X	X		
NC									X		X													
ND																								
OH									X		X													
PA									X														X	
TN		X		X	X	X	X		X				X		X									
TX																						X		

34. Please refer to the following table related to "Aggregate Quality Requirements for Blast Furnace Slag" and mark all the related tests/procedures.

Section 6 – Aggregate Quality Requirements for BFS				
Quality Test Name / Description	No Test Required No. of Respondents (Percentage)	AASHTO No. of Respondents (Percentage)	ASTM No. of Respondents (Percentage)	Test Procedure by Your Agency No. of Respondents (Percentage)
Chemical Composition	3 (3/4=75%)	1 (11)	1 (33)	1 (20)
Mineralogical Properties	3 (75)		2 (67)	
Specific Gravity	1 (25)	7 (78)	1 (33)	3 (60)
Micro-Deval for Polishing & Degradation Properties	3 (75)	1 (11)		2 (40)
Expansion Properties	4 (100)	2 (22)	2 (67)	1 (20)
Durability: Freeze-Thaw	2 (50)	2 (22)	1 (33)	2 (40)
<b>Total No. of Respondents</b>	<b>4</b>	<b>9</b>	<b>3</b>	<b>5</b>

Other responses

- LA Abrasion.
- Same as coarse aggregates.
- Please refer to Table IA and II of our guide schedule (<http://txdot.gov/business/resources/materials/guide-schedule.html>)

BFS Test Key	
<b>CC</b>	Chemical Composition
<b>MP</b>	Mineralogical Properties
<b>SG</b>	Specific Gravity
<b>MDP</b>	Micro-Deval for Polishing & Degradation Properties
<b>EP</b>	Expansion Properties
<b>DFT</b>	Durability: Freeze-Thaw

Agency	No Test Required						AASHTO						ASTM						Test Procedure by Agency					
	CC	MP	SG	MDP	EP	DFT	CC	MP	SG	MDP	EP	DFT	CC	MP	SG	MDP	EP	DFT	CC	MP	SG	MDP	EP	DFT
AL									x															
AR	x	x		x	x				x			x												
IL																					x			x
IN									x	x		x											x	x
KY		x		x	x	x			x										x		x			
MD											x						x							
MS							x																	
NE													x	x	x		x	x						
NY	x				x									x							x	x		
NC									x		x													
OH									x															
PA									x															
TN	x	x	x	x	x	x																		
TX																						x		

## Category 3: Procedures for Approving Aggregate Sources

### 35. What method does your agency use to approve aggregate?

- [16] No Approved List of Aggregates: Aggregates are tested prior to the use on every major pavement construction job – **30%**
- [16] Preapproval – Option A: Aggregate source property data are collected from producer and checked for approval on a periodic basis – **30%**
- [3] Preapproval – Option B: Aggregate source property data are collected from a third party certified aggregate testing laboratory on a periodic basis – **6%**
- [38] Approval by Agency Lab: Aggregate samples collected from producer and tested at your agency lab for approval on periodic basis – **72%**
- [8] Other (please elaborate) – **15%**

### 53 Respondents

#### Other (please elaborate)

- Active Commercial Sources are routinely tested year round, irregularly used sources are tested prior to paving.
- Ministry does not have any requirement for approval of aggregate source. Regular QA testing is done during the course of project.
- Pre-approval samples are collected and tested at our lab to add source to the LAM. Site visits and collection of samples are conducted annually at each source to ensure quality. Acceptance samples are collected on material supplied to state projects and tested at our labs.
- Preapproved but still tested on a project level basis at frequencies specified in our Material Sampling Guide.
- Qualified Aggregate Material Source, (QAMS) list is maintained for asphalt mixture aggregate, concrete aggregate, and base aggregate. Contractor must reapply every two years.
- Source approval is performed by Department, subsequent physical testing is performed by independent laboratories and review by Department
- Sources are Prequalified to related business by meeting personnel testing and quality control requirements. Aggregates are approved through an initial battery of tests and a continued tonnage and risk based approach.
- Meet specifications, contractor may select a source other than specified.

### 36. If your agency uses “Preapproval – Options A or B” or “Approval by Agency Lab,” how often does your agency perform this approval? (please check all that apply)

- [16] Once a year – **47%**
- [4] Once every two years – **12%**
- [1] Once every three years – **3%**
- [6] Based on producer requests – **18%**
- [11] Other frequency (please indicate) – **32%**

### 34 Respondents

#### Other frequency (please indicate)

- 1 year for quarry spalls, riprap, scour, and rock for rock walls. 5 years for mineral aggregate and concrete aggregate. Quality concern sources are on stockpile approval.
- 3 Years for Quarries 5 Years for Pit.

- Approval remains in effect unless mine commits and infraction. Certification of products is continuously based on QA program 23CFR627B.
- As indicated in Material Sampling Guide, every 3,000 ton or 6,000 ton depending on mix design.
- Contractors are required to submit producer or third party testing from state certified labs prior to start of any project.
- Department performs testing for initial source approval and boundary extensions
- Once on design-build project
- Once, during the preconstruction/design phase of the specific project.
- T 161 performed less frequently.
- Twice per year.
- Before material used on a project or historical results of alternative sources.

**37. Related to determining the quality of a certain aggregate source, please provide as much relevant information you have available, and to the best of your knowledge, to populate the table below and then proceed to the next question.**

#### ***34 Respondents***

ALASKA		CONNECTICUT	
	List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality		List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality
Fine aggregate	Only agency conducts test	Fine aggregate	T11, T21, T27, T84, T96, T104, T112, T255, T304
Coarse aggregate	Only agency conducts test	Coarse aggregate	T11, T19, T27, T85, T96, T104, T112,
Recycled Asphalt Pavement	Asphalt content by extraction, and resulting aggregate gradation: The contractor will submit asphalt content and gradations from 10 representative samples collected from the proposed RAP source.	Recycled Asphalt Pavement	Environmental testing when used in base courses
Recycled Concrete Pavement	RAC not used	Recycled Concrete Pavement	Environmental testing when used in base courses
Steel Furnace Slag	SBC not used	Steel Furnace Slag	not used
Blast Furnace Slag	BFS not used	Blast Furnace Slag	mill cert - pozzolan material
GEORGIA		IDAHO	
	List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality		List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality
Fine aggregate	Gradation, Sand Equivalent, Deleterious Material,	Fine aggregate	Idaho IT-15, Idaho IT-116, AASHTO T-84, AASHTO M 6, AASHTO T100, Idaho IT-13
Coarse aggregate	Gradation, Deleterious Material, LA Abrasion, Specific Gravity	Coarse aggregate	Idaho IT-15, Idaho IT-116, AASHTO T-85, AASHTO M 80, AASHTO T 303
Recycled Asphalt Pavement		Recycled Asphalt Pavement	AASHTO T 96, AASHTO T335, AASHTO T 304, Idaho IT-15
Recycled Concrete Pavement	same as coarse aggregate	Recycled Concrete Pavement	
Steel Furnace Slag		Steel Furnace Slag	
Blast Furnace Slag		Blast Furnace Slag	



ILLINOIS		
	List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality	Number of Classes to Define the Aggregate Quality (One, Two, Three, Four, Five, Other)
Fine aggregate	None	Three
Coarse aggregate	None	Four
Recycled Asphalt Pavement	Residual asphalt and gradation for use in HMA mixes; all other test performed by agency	2
Recycled Concrete Pavement	None	4
Steel Furnace Slag	Specific Gravity	1
Blast Furnace Slag	Specific Gravity	4
KENTUCKY		
	List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality	Number of Classes to Define the Aggregate Quality (One, Two, Three, Four, Five, Other)
Fine aggregate	none	3 (Asphalt only, concrete and polish-resistant)
Coarse aggregate	none	5 (General concrete, Freeze-thaw concrete, asphalt, polish-resistant and general aggregate)
Recycled Asphalt Pavement	none	
Recycled Concrete Pavement	none	
Steel Furnace Slag	none	1
Blast Furnace Slag	none	1

MAINE		MISSISSIPPI	
	List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality		List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality
Fine aggregate	T 304, T 176 - (HMA aggregate)	Fine aggregate	Not required by mandate
Coarse aggregate	T 327, T 335, D 4791	Coarse aggregate	Not required by mandate
Recycled Asphalt Pavement	T 327	Recycled Asphalt Pavement	Not required by mandate
Recycled Concrete Pavement		Recycled Concrete Pavement	Not required by mandate
Steel Furnace Slag		Steel Furnace Slag	Not required by mandate
Blast Furnace Slag		Blast Furnace Slag	Not required by mandate
MISSOURI			
	List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality		
Fine aggregate			
Coarse aggregate			
Recycled Asphalt Pavement	Micro-Deval testing if not from a state route, percent asphalt residue, and calculated Gse		
Recycled Concrete Pavement	LA Abrasion and percent deleterious		
Steel Furnace Slag			
Blast Furnace Slag			

MONTANA		
	List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality	Number of Classes to Define the Aggregate Quality (One, Two, Three, Four, Five, Other)
Fine aggregate	AASHTO T 11, T 21, T 27, T 84, T 104, T 112, T 113, MT 213 (Sand Equivalent)	One
Coarse aggregate	AASHTO T 11, T 27, T 85, T 104, T 96, T 112, T 113, MT 233 (Micro-Deval)	One
Recycled Asphalt Pavement	same as coarse and fine listed previously	One
Recycled Concrete Pavement	same as coarse and fine listed previously	One
Steel Furnace Slag	NA	NA
Blast Furnace Slag	NA	NA
NEVADA		
	List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality	Number of Classes to Define the Aggregate Quality (One, Two, Three, Four, Five, Other)
Fine aggregate	AASHTO T113, T104, T21, T11, T112, ASTM C87	ONE
Coarse aggregate	AASHTO T112, T96, T104	ONE
Recycled Asphalt Pavement	AASHTO T164, T30	ONE
Recycled Concrete Pavement	N/A	
Steel Furnace Slag		
Blast Furnace Slag		

NEW HAMPSHIRE		
		List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality
	Fine aggregate	Gradation
	Coarse aggregate	LA Wear, ASR
	Recycled Asphalt Pavement	A/C content, gradation
	Recycled Concrete Pavement	Gradation
	Steel Furnace Slag	
	Blast Furnace Slag	
NEW MEXICO		
	List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality	Number of Classes to Define the Aggregate Quality (One, Two, Three, Four, Five, Other)
Fine aggregate	AASHTO T-11, T-27, T-84, T-176, T-255, T-304	Once a Month at TTCP
Coarse aggregate	AASHTO T-27, T-85, T-96, T-104, T-255, T-335, ASTM D4791	Once a Month at TTCP
Recycled Asphalt Pavement	AASHTO T-30, T-96, T-209, T-308, T-335, ASTM D4791	Once a Month at TTCP
Recycled Concrete Pavement	We dont use Recycled Concrete Pavements	None
Steel Furnace Slag	None	None
Blast Furnace Slag	None	None

NEW YORK			
		List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality	Number of Classes to Define the Aggregate Quality (One, Two, Three, Four, Five, Other)
	Fine aggregate	organic impurities, acid-insoluble residue, specific gravity	one class with individual restrictions by source i.e. pcc, wearing surface restrictions
	Coarse aggregate	shale check, non-carbonate count	one class with individual restrictions by source i.e. pcc, wearing surface restrictions
	Recycled Asphalt Pavement	gradation, binder content	one
	Recycled Concrete Pavement		one
	Steel Furnace Slag		one (steel and blast furnace slag is not differentiated)
	Blast Furnace Slag		one (steel and blast furnace slag is not differentiated)
OHIO			
		List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality	
	Fine aggregate	Refer to section 703 of the Spec Book and Supplement 1069	
	Coarse aggregate	Refer to section 703 of the Spec Book and Supplement 1069	
	Recycled Asphalt Pavement	Do not use for Pavements	
	Recycled Concrete Pavement	Do not use for pavements	
	Steel Furnace Slag	Refer to section 703 of the Spec Book and Supplement 1071	
	Blast Furnace Slag	Refer to section 703 of the Spec Book	

OKLAHOMA		
	List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality	Number of Classes to Define the Aggregate Quality (One, Two, Three, Four, Five, Other)
Fine aggregate	Producer not required to conduct tests	don't define by class, but by application (asphalt, concrete, etc.)
Coarse aggregate	Producer not required to conduct tests	don't define by class, but by application (asphalt, concrete, etc.)
Recycled Asphalt Pavement	binder content	
Recycled Concrete Pavement	Producer not required to conduct tests	don't define by class, but by application (asphalt, concrete, etc.)
Steel Furnace Slag	N/A	N/A
Blast Furnace Slag	N/A	N/A
OREGON		
	List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality	Number of Classes to Define the Aggregate Quality (One, Two, Three, Four, Five, Other)
Fine aggregate	ODOT TM 208, AASHTO T104, AASHTO T176, AASHTO T90, AASHTO T176	1
Coarse aggregate	AASHTO T104, AASHTO T96, ODOT TM 208, AASHTO T335, AASHTO T113, ODOT TM 225, ODOT TM 229	1
Recycled Asphalt Pavement		
Recycled Concrete Pavement		
Steel Furnace Slag		
Blast Furnace Slag		

PENNSYLVANIA		
	List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality	Number of Classes to Define the Aggregate Quality (One, Two, Three, Four, Five, Other)
Fine aggregate	Quality testing done by the agency.	5
Coarse aggregate	Quality testing done by the agency.	3
Recycled Asphalt Pavement	Quality testing done by the agency.	1
Recycled Concrete Pavement	Quality testing done by the agency.	1
Steel Furnace Slag	Quality testing done by the agency.	1
Blast Furnace Slag	Quality testing done by the agency.	1
TENNESSEE		
	List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality	
Fine aggregate	Sodium Sulfate Soundness, Absorption, Specific Gravity	
Coarse aggregate	Sodium Sulfate Soundness, LA Wear, Absorption, Specific Gravity	
Recycled Asphalt Pavement		
Recycled Concrete Pavement		
Steel Furnace Slag	Sodium Sulfate Soundness, LA Wear, Absorption, Specific Gravity	
Blast Furnace Slag		

UTAH		
		List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality
Fine aggregate		Concrete: AASHTO M 6 Asphalt AASHTO T 304, T 176, T 89 & 90, T 19, T 104, T 112 Unbound T 89 & 90, T 96, t 11 & 27, T 193, M 145
Coarse aggregate		AASHTO M 80 for concrete Asphalt AASHTO T 304, T 176, T 89 & 90, T 19, T 104, T 112 Unbound Unbound T 89 & 90, T 96, t 11 & 27, T 193, M 145
Recycled Asphalt Pavement		RAP AASHTO Specific gravity, binder content, and type
Recycled Concrete Pavement		Meet material requirements for use in unbound materials, not allowed for reuse in concrete.
Steel Furnace Slag		Meet material requirements for use in unbound materials
Blast Furnace Slag		Meet material requirements for use in unbound materials
VERMONT		
		List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality
Fine aggregate		T104, T176, T304(a),
Coarse aggregate		T96, ASTM D5821, D 4791
Recycled Asphalt Pavement		M320, R29
Recycled Concrete Pavement		
Steel Furnace Slag		
Blast Furnace Slag		AASHTO M 302



WASHINGTON		
	List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality	
Fine aggregate	ASTM C 1293 for concrete applications. Must be cordnated with WSDOT.	
Coarse aggregate	Same as fine aggregate	
Recycled Asphalt Pavement	Test in accordance with Section 9-03.21 of the WSDOT Standard Specifications	
Recycled Concrete Pavement	same as RAP	
Steel Furnace Slag	same as RAP	
Blast Furnace Slag	not used as an aggregate. Ground Granulated Blast Furnace Slag is used as a cementitious material	
WISCONSIN		
	List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality	Number of Classes to Define the Aggregate Quality (One, Two, Three, Four, Five, Other)
Fine aggregate	AASHTO T11, T27, T30, T37, T89, T90, T84, T304, and T176	One
Coarse aggregate	AASHTO T27, T30, T96, T85, T103, and T104 ASTM D4791 and D5821	One
Recycled Asphalt Pavement	AASHTO T164	One
Recycled Concrete Pavement	AASHTO T96	One
Steel Furnace Slag	AASHTO T96, T104, T89, and T90	One
Blast Furnace Slag	AASHTO T96, T104, T89, and T90	One

WYOMING		
	List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality	Number of Classes to Define the Aggregate Quality (One, Two, Three, Four, Five, Other)
Fine aggregate	Sand Equivalent, Fine Aggregate Angularity, Plastic Index	Five
Coarse aggregate	LA Abrasion loss, Flat and Elongated, Fractured Faces, Soundness (MGS04) Loss	Five
Recycled Asphalt Pavement		
Recycled Concrete Pavement		
Steel Furnace Slag		
Blast Furnace Slag		
ALBERTA (CANADA)		
	List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality	
Fine aggregate	Gradation Analysis, Atterberg Limit, Classification, Dry Strength	
Coarse aggregate	Gradation Analysis, Percent Fracture, Flakiness, LA Abrasion, Micro Deval, Deleterious Matter	
Recycled Asphalt Pavement	Residual Binder Content,	
Recycled Concrete Pavement		
Steel Furnace Slag		
Blast Furnace Slag		

BRITISH COLUMBIA (CANADA)		
		List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality
	Fine aggregate	as before
	Coarse aggregate	as before
	Recycled Asphalt Pavement	as before
	Recycled Concrete Pavement	Developing
	Steel Furnace Slag	N/A
	Blast Furnace Slag	N/A
NEW BRUNSWICK (CANADA)		
		List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality
	Fine aggregate	Gradation
	Coarse aggregate	Gradation, Flat & Elongated
	Recycled Asphalt Pavement	Residual, Asphalt Binder Content, Specific Gravity
	Recycled Concrete Pavement	
	Steel Furnace Slag	
	Blast Furnace Slag	

ONTARIO (CANADA)			
		List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality	Number of Classes to Define the Aggregate Quality (One, Two, Three, Four, Five, Other)
Fine aggregate		Gradation, Organic Impurities, Micro-Deval Abrasion, Accelerated Mortar Bar, Concrete Prism Expansion, Acid Insoluble Residue, Plastic Fines, Petrographic Examination, Contamination, Coefficient of Permeability	Other
Coarse aggregate		Gradation, Wash Pass 75 micron, Abosartion, Flat and Elongated Particles, Petrographic Number, Unconfined Freeze-Thaw (or Magnesium Sulfate Soundness), Micro-Deval Abrasion, Accelerated Mortar Bar, Concrete Prism Expansion, Potential Alkali Reactivity	Other
Recycled Asphalt Pavement			
Recycled Concrete Pavement			
YUKON (CANADA)			
		List Any Test Conducted By Producer (by Agency Mandate) for Determining the Quality	Number of Classes to Define the Aggregate Quality (One, Two, Three, Four, Five, Other)
Fine aggregate		Petrographic Analysis, Micro-Deval Abrasion, sieve analysis, percentage of crush faces, moisture content, soundness test, Atterberg Limits, Deleterious Material, void ratio, CBR, sand equivalent,	3
Coarse aggregate		Petrographic Analysis, LA Abrasion, Soundness, Deleterious Material, Porosity, Specific Gravity, %age of crush faces, Sive analysis, Angularity, Durability to Freez and thaw, polishing skid resistance, Flat and elongated particles	3
Recycled Asphalt Pavement		None	
Recycled Concrete Pavement		None	
Steel Furnace Slag		None	
Blast Furnace Slag		None	

**38. Do you classify aggregate quality based on the use in a certain layer of pavement?**[23] Yes – **44%**[29] No – **56%***52 Respondents*

**If ‘Yes’, please refer to the table below and identify pavement layer and associated aggregate quality class. Note: Please provide as much relevant information you have available, and to the best of your knowledge, to populate the table below and then proceed to the next question.**

ALASKA			ALABAMA			
	Fine Aggregate	Coarse Aggregate		Fine Aggregate	Coarse Aggregate	Recycled Asphalt Pavement (RAP)
Asphalt Surface Course		A (min. 90% 2-face fracture); B (min. 80% 1-face fracture); Superpave (min. 98% 2-face fracture).	Asphalt Surface Course		Limit Limestones use based on BPN test.	Limit based on %
Asphalt Base Course		A (min. 90% 2-face fracture); B (min. 80% 1-face fracture); Superpave (min. 98% 2-face fracture).	Asphalt Base Course			Limit based on %
Portland Cement Concrete			Portland Cement Concrete	Limestones not allowed on mainline due to poishing	Limestones not allowed on mainline due to poishing	
Base Course		C-1 and D-1 gradations				
Subbase Course		A to E gradations				
Drainage Layer						
Filter Layer						
Stabilized Base Course		C-1 and D-1 gradations				
Stabilized Subbase Course						
Surface Treatment		A to G gradations				

**ILLINOIS**

	Fine Aggregate	Coarse Aggregate	Recycled Asphalt Pavement (RAP)	Recycled Concrete Pavement (RCA)	Steel Furnace Slag (SFS)	Blast Furnace Slag (SBS)
Asphalt Surface Course	B	B	B	B	B	B
Asphalt Base Course	C	C	C	C		C
Portland Cement Concrete	A	A		A		A
Base Course		D		D		D
Subbase Course		D		D		D
Drainage Layer	B	D		D		D
Filter Layer	B	D		D		D
Stabilized Base Course		D		D		D
Stabilized Subbase Course	B	D		D		D
Surface Treatment	B	B		B	B	B

**INDIANA**

	Fine Aggregate	Coarse Aggregate	Recycled Asphalt Pavement (RAP)	Recycled Concrete Pavement (RCA)	Steel Furnace Slag (SFS)	Blast Furnace Slag (SBS)
Asphalt Surface Course		Class B	N/A	N/A	Class B	Class B
Asphalt Base Course		Class D	N/A	N/A	Class D	Class D
Portland Cement Concrete		Class AP	N/A	N/A	Class AP	Class AP
Base Course		Class D	N/A	N/A	Class D	Class D
Subbase Course		Class D	N/A	N/A	Class D	Class D
Drainage Layer		Class D	N/A	N/A	Class D	Class D
Filter Layer						
Stabilized Base Course		Class D	N/A	N/A	Class D	Class D
Stabilized Subbase Course		Class D	N/A	N/A	Class D	Class D
Surface Treatment		Class B	N/A	N/A	Class B	Class B

MISSISSIPPI		
	Fine Aggregate	Coarse Aggregate
Asphalt Surface Course	40% max abrasion loss. 20% max soundness loss.	40% max abrasion loss. 20% max soundness loss.
Asphalt Base Course	40% max abrasion loss. 20% max soundness loss.	40% max abrasion loss. 20% max soundness loss.
Portland Cement Concrete	40% max abrasion loss. 15% max soundness loss.	40% max abrasion loss. 15% max soundness loss.
Base Course	45-50% max abrasion loss	45-50% max abrasion loss
Subbase Course	45-50% max abrasion loss	45-50% max abrasion loss
Drainage Layer	45-50% max abrasion loss	45-50% max abrasion loss
Filter Layer	45-50% max abrasion loss	45-50% max abrasion loss
Stabilized Base Course	45-50% max abrasion loss	45-50% max abrasion loss
Stabilized Subbase Course	45-50% max abrasion loss	45-50% max abrasion loss
Surface Treatment	40% max abrasion loss. 20% max soundness loss.	40% max abrasion loss. 20% max soundness loss.

NEW JERSEY						
	Fine Aggregate	Coarse Aggregate	Recycled Asphalt Pavement (RAP)	Recycled Concrete Pavement (RCA)	Steel Furnace Slag (SFS)	Blast Furnace Slag (SBS)
Asphalt Surface Course			15%			NONE LEFT
Asphalt Base Course			25%			"
Portland Cement Concrete						"
Base Course				Base only	only in a soil Agg.	"



NEW YORK						
	Fine Aggregate	Coarse Aggregate	Recycled Asphalt Pavement (RAP)	Recycled Concrete Pavement (RCA)	Steel Furnace Slag (SFS)	Blast Furnace Slag (SBS)
Asphalt Surface Course	no classification	must meet % non-carbonate requirements	no classification	not used in pavement	no classification	no classification
Asphalt Base Course	no classification	no classification	no classification		no classification	no classification
Portland Cement Concrete	must meet 25% AIR requirement	must meet stricter soundness testing, freeze thaw testing, must meet non-carbonate count as designated by friction requirements	not used		no classification	no classification
Base Course						
Subbase Course	must meet soundness requirements	must meet soundness requirements				
Drainage Layer		must meet soundness requirements				
OHIO						
	Fine Aggregate	Coarse Aggregate	Recycled Asphalt Pavement (RAP)	Recycled Concrete Pavement (RCA)	Steel Furnace Slag (SFS)	Blast Furnace Slag (SBS)
Asphalt Surface Course	703.05	703.05				703.05
Asphalt Base Course	703.04	703.04			703.04	
Portland Cement Concrete	703.02	703.02				703.02
Base Course						
Subbase Course	703.17	703.17		703.17	703.17/703.14	703.17

TENNESSEE					
	Fine Aggregate	Coarse Aggregate	Recycled Asphalt Pavement (RAP)	Recycled Concrete Pavement (RCA)	Steel Furnace Slag (SFS)
Asphalt Surface Course		Type 1, 2, 3, 4			Type 1, 2, 3, 4
Asphalt Base Course					
Portland Cement Concrete		Type 1, 2, 3, 4Type			Type 1, 2, 3, 4

TEXAS		
	Fine Aggregate	Coarse Aggregate
Asphalt Surface Course		At least 50% SAC A
Asphalt Base Course		
Portland Cement Concrete	Acid Insoluble 60% minimum on riding surface	
Base Course		
Subbase Course		
Drainage Layer		
Filter Layer		
Stabilized Base Course		
Stabilized Subbase Course		
Surface Treatment		SAC A or B as indicated by Plans

ALBERTA (CANADA)			BRITISH COLUMBIA (CANADA)				
	Fine Aggregate	Coarse Aggregate		Fine Aggregate	Coarse Aggregate	Recycled Asphalt Pavement (RAP)	Recycled Concrete Pavement (RCA)
Asphalt Surface Course		Designation 1 Class 10,12.5, and 16 mm	Asphalt Surface Course	yes	yes		
Asphalt Base Course		Designation 1 Class 25 mm	Asphalt Base Course	yes	yes	yes	
Portland Cement Concrete			Portland Cement Concrete				
Base Course		Designation 2 Class 20,25, and 40 mm	Base Course	yes	yes		yes
Subbase Course		Designation 6 Class 80 or 125 mm	Subbase Course	yes	yes		yes
Drainage Layer			Drainage Layer	yes	yes		
Filter Layer		Designation 8 Class 25 mm	Filter Layer	yes	yes		
Stabilized Base Course		Designation 7 Class 40 mm	Stabilized Base Course	yes	yes		
Stabilized Subbase Course			Stabilized Subbase Course	yes	yes		
Surface Treatment		Seal Coat - Designation 3 Class 12.5A, 12.5B, 12.5C and 16 mm	Surface Treatment	yes	yes		

NEW BRUNSWICK (CANADA)		
	Fine Aggregate	Coarse Aggregate
Asphalt Surface Course	Micro 18	Micro 15
Asphalt Base Course	Micro 22	Micro 18

ONTARIO (CANADA)			
	Fine Aggregate	Coarse Aggregate	Recycled Asphalt Pavement (RAP)
Asphalt Surface Course	Consensus Properties: Traffic Category A, B, C, D and E	Consensus Properties based on Traffic Category A, B, C, D and E	Premium Rap - a term used for RAP coming from our Category D and E mixes
Asphalt Base Course	Consensus Properties: Traffic Category, A, B, C, D and E	Consensus Properties based on Traffic Category A, B, C, D and E	
Portland Cement Concrete	No distinction for physical properties	Concrete Pavement Versus Other Concrete	
Base Course	No distinction for physical properties	Granular A, M or O	
Subbase Course	No distinction for physical properties	Granular BI, BII or BIII	
Drainage Layer			
Filter Layer			
Stabilized Base Course			
Stabilized Subbase Course			
Surface Treatment	Based on Gradation Class: Class 2 and 4 Physical Properties	Based on Gradation Class: Classes 1, 2, 3, 4, 5, 6	

YUKON (CANADA)		
	Fine Aggregate	Coarse Aggregate
Asphalt Surface Course	Sand Mix	Paving Aggregate 12.5mm
Asphalt Base Course	Fines between 3-10%	Granular "A"
Portland Cement Concrete		
Base Course	Fines not more than 6%	Granular A
Subbase Course	Fines not more than 8%	Granular "B", "C" or "E"
Drainage Layer		
Filter Layer		
Stabilized Base Course		
Stabilized Subbase Course		
Surface Treatment	Fines not more than 5%	Coarse Aggregate 20mm

**39. If you blend aggregate to improve quality (e.g., Virgin + Marginal, Virgin + Quarry By-product, etc.), do you have a procedure to control the quality of the blended product?**

[16] Yes – **36%**

[26] No – **59%**

[15] If 'Yes', please explain – **34%**

**44 Respondents**

If 'Yes', please explain responses

- All aggregates must be approved before blending. This will allow for confidence that all aggregates meet the minimums of the standard specs.
- Blend must meet specification requirements for intended use.
- Blended Aggregates are treated as a source and must meet standard specifications for aggregates.
- Blended sample must pass all quality tests as unblended would.
- Both components of the blend must be tested individually as well as the final product. The producer must also address blending process in their Operations Plan as well as adhere to individual requirements determined by the specific reason for blending material.

- Mechanical blending through interlocked feeders.
- Mix Designs AASHTO R-35, M320, M323, NMDOT Specifications 423, 424, 509
- Natural Pit Run Filler from other sources may be required to bring Volumetric properties into spec. There is a spec for the requirements of Pit Run Filler.
- Need to clarify that we do not blend aggregate. Not no to whether we have a procedure. Thanks.
- Periodic agency tests on material sampled during construction.
- QC plan is submitted and approved / disapproved by the district materials Engineer / Manager
- Quality control plan submitted by producer.
- The product must be blended by pugmill to a consistent ratio and tested according to that specific blend. Aggregates are blended and stockpiled prior to delivery to an Asphalt Plant.
- To meet specifications
- Composite blend must meet same quality specifications as non-blended

## Category 4: Aggregate Related Performance Records

**40. Select from the options below performance related laboratory test(s) which your agency performs on aggregate sources before utilization in pavement construction. (Please check all that apply)**

[12] Skid resistance tests, e.g., British Pendulum or similar – **57%**

[6] Triaxial shear strength tests – **29%**

[9] Repeated load triaxial resilient modulus test (AASHTO T 307, NCHRP 1-28, etc.) - **43%**

[2] Repeated load triaxial permanent deformation test – **10%**

[7] Other (please indicate) – **33%**

### 21 Respondents

#### Other (please indicate) responses

- AASHTO T-283
- BPN only on limestone aggregates.
- None
- T 307 for research purposes
- "R" Value testing.
- Insoluble residue test as a measure of skid (polishing) resistance in asphalt surface layer.
- none

**41. Is aggregate quality tracked linked to the performance of a certain pavement layer?**

[12] Yes – **23%**

[39] No – **77%**

### 51 Respondents

**If 'Yes', please refer to the table below and mark with an "X" the related aggregate quality or source deficiency issue causing poor performance of a pavement layer\*\*:**

**Note:** Responding agencies' abbreviations are included in the table below.

Aggregate Quality Issue	*Pavement Layer									
	ASC	ABC	PCC	BC	SBC	DR	FI	S_BC	S_SBC	ST
Source deficiency	TN, NV, NB, MO, AK, WY	NV, NB	NE, TN, NV, MO, IL	NV, WY	-	-	-	-	-	TN, NV, IL
Blending	TN		-	-	-	-	-	-	-	-
Utilizing RAP	TN, KS, NV, NJ, MO, IL	TN, KS, NV, NJ, MO	-	-	-	-	-	-	-	TN, NV
Utilizing RCA	-	-	NV	TN	NJ	-	-	-	-	-
Utilizing SFS	TN, NV	IL	TN	-	-	-	-	-	-	TN
Utilizing BFS	NV	-	-	-	-	-	-	-	-	-
Weathering soundness	NV, NB, WY	NV, NB	NV	-	-	-	-	-	-	NV
Degradation resistance	TN, NV	NV	TN, NV	NV	-	-	-	-	-	TN, NV
Polishing resistance	NY, MD, TN, KS, NV, IL, AK, WY	-	NY, TN, MO	-	-	-	-	-	-	NY, TN, NV, IL
Plasticity of fines	NV, MO, WY	NV, MO	NV	NV	-	-	-	-	-	NV
Mineralogical composition	NV	NV	NV	-	-	-	-	-	-	NV
Clay content	NV, WY	NV	NE, NV	NV	-	-	-	-	-	NV
Particle shape	NV	-	-	IL	IL	IL	IL	IL	IL	NV
Durability: Freeze-thaw	NV, NB	NB	NE, KS, NV, MO, IL	-	-	-	-	-	-	NV
Alkali Silica Reactivity	-	-	NE, KS, NV, NJ, IL, WY	-	-	-	-	-	-	-
*ASC: Asphalt Surface Course ABC: Asphalt Base Course PCC: Portland Cement Concrete BC: Base Course SBC: Subbase Course				DR: Drainage Layer FI: Filter Layer S_BC: Stabilized Base Course S_SBC: Stabilized Subbase Course ST: Surface Treatment						

42. Optional: please provide reference (if available) to any document, report, or case history that includes further details about aggregate quality/source deficiency issues causing poor pavement performance.

- Alaska: Hard Aggregate Resistance to Studded Tires: Alaskan Experience:  
<http://trrjournalonline.trb.org/doi/abs/10.3141/1874-03>

**43. Please list the most common aggregate quality related pavement distresses which have been observed by your agency?**

*Flexible Pavement Distresses*

**37 Respondents**

Responses – The abbreviation of the agency is written in parenthesis

- Stripping (CO)
- Stripping, polishing (NC), (MB)
- Aggregate polishing, popouts and breakdown of coarse aggregate (ON)
- Cracking, aggregate Stripping (WY)
- Cracking, longitudinal cracking (MD)
- Joint problems, block cracking, thermal cracking (NM)
- Joint cracking, rutting, shoving (TN)
- Moisture stripping, cracking (NB)
- Moisture susceptible aggregates, aggregate freeze / thaw damage (PA)
- Most distresses are non-aggregate related (UT)
- N/A, mix related (FL)
- Occasionally broken aggregate under roller (RI)
- Pick outs, raveling (SK)
- Pop-outs, raveling (IN)
- Popouts & some polishing (MN)
- Popouts, raveling, polishing, premature deterioration (OH)
- Raveling and rapid oxidation from high amount of RAP (MO)
- Raveling, fatigue cracking, de-bonding, bleeding, block cracking (AZ)
- Raveling, popouts (ME)
- Rutting, cracks, alligator cracks (YT)
- Striping, Rutting (NV)
- Stripping (OK), (KS)
- Stripping – raveling (PE)
- Stripping, rutting, raveling, and cracking (WI)
- Surface HMA rutting due to abrasive effects of studded -tires. Frost-susceptibility issue of unbound base course: spring weakening and winter frost-heaving are being observed with less frequency since the 2003 implementation of a "stabilized base course" policy where no base course is placed without some sort of stabilization/treatment (asphalt, emulsion, foamed-asphalt, etc.) (AK)
- Thermal cracking, polishing (IL)
- Aggregate crushing/breaking during construction (TX)
- Longitudinal, reflective, bottom up cracking, rutting, fatigue alligator, pot holes (BC)
- Polishing (NY)
- Raveling, segregation, coarse rock loss (AB)
- Rutting (MI)
- Rutting, raveling, fatigue cracking, transverse and longitudinal cracking, reflective cracking (ND)
- Soundness and abrasion (MS)
- Wet pavement friction loss, minor rutting and shoving (AR)



*Rigid Pavement Distresses***31 Respondents**

Responses – The abbreviation of the agency is written in parenthesis

- ASR (CO)
- N/A (ME), (BC)
- ASR (NC), (AR), (NY)
- ASR cracking
- ASR, cracking due to CoTE (coefficient of thermal expansion) of coarse aggregate (TX)
- ASR, sulfate attack (PA)
- Alkali silica and carbonate reactivity of both coarse and fine aggregates and polishing of fine aggregate (ON)
- Alkali-Silica Resistivity; Freeze-thaw Expansion (IL)
- Although not very common, clay balls or light weight pieces has an impact on the concrete surface, strength, and durability (NE)
- Cracks (YT)
- D-cracking (IN), (KS)
- D cracking and Pop outs (WI)
- D-cracking on the west side of the state (MO)
- Durability Cracking, Corner Breaks, Joint Spalling (NM)
- Freeze Thaw Damage, popouts, and staining (OH)
- Joint faulting (MD)
- Map cracking, ASR, Scaling (NV)
- Most distresses are non-aggregate related (UT)
- N/A, mix or subbase related (FL)
- Panel cracking, Spalling, excessive curling and warping, Polishing of surfacing, ASR and ACR related damage (WY)
- D-cracking, joint deterioration, pop outs (MB)
- Freeze thaw (MI)
- Popouts (OK)
- Pumping, shrinkage cracking, crack edges, joint deterioration (AZ)
- Shrinkage cracking, spalling (TN)
- Soundness and abrasion (MS)
- Spalling, joint faulting, linear, longitudinal and transverse cracking, corner breaks, popouts (ND)

*Composite pavement distresses***13 Respondents**

Responses – The abbreviation of the agency is written in parenthesis

- N/A (FL), (BC)
- Cracks, Rutting (YT)
- Delamination (OH)
- Moisture susceptible aggregates (PA)
- Most distresses are non-aggregate related (UT)
- Striping, Rutting, ASR (NV)
- We don 't have Composite Pavements (NM)

- De-bonding, releveling, striping (AZ)
- Reflective cracking (ND)
- Soundness and abrasion (MS)
- Stripping, polishing (MB)
- This can be a problem, reflective cracking (NJ)

*Surface Treatment or unpaved road distresses*

## **21 Respondents**

Responses – The abbreviation of the agency is written in parenthesis

- Aggregate breakdown under traffic (too soft/deleterious), dirty aggregate (PA)
- Aggregate loss, bleeding (NC)
- Aggregate polishing, popouts and breakdown of coarse aggregate (ON)
- Chips seals de-bonding from roadway within one year (WY)
- Loss of frictional properties (MD)
- Most distresses are non-aggregate related (UT)
- N/A (FL)
- Polishing (OH)
- Polishing (KS)
- Raveling, delamination, polishing (TN)
- Raveling (ME)
- Rutting, cracks, subgrade failure, oxidation, raveling (YT)
- Striping, raveling (NV)
- Stripping issues for seal coat aggregates in case adhesive agent is not used (SK)
- Stripping of chert gravels (IL)
- Stripping, raveling or spalling (NM)
- Aggregate crushing/breaking under rollers (TX)
- Bleeding, polishing, thinning (AB)
- Potholes, surface cracking (BC)
- Rutting, stripping, polishing (MB)
- Soundness and abrasion (MS)

**44. Does your agency have environmental (e.g., leaching, etc.) or performance (e.g., cracking, etc.) concerns regarding the use of recycled aggregate (RAP, RCA) or artificial/by-product aggregate (SFS, BFS) in pavement layers?**

[29] Yes – **57%**

[22] No – **43%**

## **51 Respondents**

**45. If your answer to the above question was “Yes”, what environmental/performance issues your agency has been particularly concerned with (e.g., leaching, cracking etc.)? Is your agency doing any research in this area? Please list and explain.**

## **29 Respondents**

- Answer was yes due to performance concerns, too high of a RAP content can result in premature cracking (UT)

- Any recycled materials used in base courses must be tested by contractor for environmental compliance prior to delivery (CT)
- Bituminous mixtures replacing 20% of the binder experiencing raveling and early oxidation making the mix brittle and prone to cracking. Have been doing some in-house research to adjust specifications accordingly. Also looking about performance tests such as FIT test (i.e. SCB at intermediate temp.) and Hamburg loaded wheel test (MO)
- Can't be used in ephemeral drainages or high water table conditions (MT)
- Concern with RCA in rigid or flexible pavement due to amount of fines from crushing. No research is being done (AR)
- Concerned with potential leaching with RCA, but product rarely used (ME)
- Cracking when using high RAP content mixtures, (50% range). No research currently underway but may be in the future (ID)
- Cracking, tracking the cracking performance on high RAP projects to see if there is a correlation between amount of virgin AC and cracking (KS)
- Do not allow RCA near drainage systems (edge drains) (SD)
- Early Cracking due to stiff asphalt, but not really a RAP aggregate issue (OR)
- For recycled concrete aggregates, leaching. No research currently on this issue (AB)
- HMA cracking and wheel path erosion (VT)
- Higher pH of RCA if used in same area as metallized pipe (FL)
- Hot Mix: Polishing of coarse aggregates caused by the contractor using a higher percentage and less quality RAP in our premium surface courses than is indicated in the mix design. Unbound Bases: Leaching of blast furnace slag (ON)
- Leaching is a concern with some RCA crushing areas and when high #200 material is generated (PA)
- Leaching of Steel Slag (IL)
- Leaching of high PH water leaving the right of way from the use of RCA & BFS. The formation of tufa in under drains due to the use of RCA (OH)
- Please see DMS-11000 (TX)  
[http://www.txdot.gov/business/resources/dms.html?CFC\\_target=http%3A%2F%2Fwww.dot.state.tx.us%2Fapps-cg%2Fmaterial\\_specifications%2Fdms\\_series.htm%3Fseries%3D11000](http://www.txdot.gov/business/resources/dms.html?CFC_target=http%3A%2F%2Fwww.dot.state.tx.us%2Fapps-cg%2Fmaterial_specifications%2Fdms_series.htm%3Fseries%3D11000)
- RCA - leaching pH (WA)
- RCA- Leaching (TN)
- RCA-issues with leachate RAP- concerns regarding decreased life of pavement. We are not performing research (KY)
- We are concerned with loss of fatigue resistance in surface courses when using RAP (RI)
- We do not use RCA in concrete due to the fact it may have ASR in it (DE)
- Yes, leaching is a concern with slag in unbound layers (IN)
- Cracking - Advanced Characterization Testing of RAP mixtures Designed and Produced Using a "RAP Binder Contribution Percentage" (NY)
- Leaching and cracking as we move more in using RCA and RAP. No research at this point (BC)
- Leaching of high pH and tufa plugging up edge drain systems (MI)
- Leaching. But mostly large stockpile of RAP stored at quarry as by product of milling (NJ)
- pH value check (MD)

This is the End of Questionnaire  
 Thank you for your Cooperation!