

State Materials Laboratory 2013 Performance Measures

The State Materials Laboratory provides specialized materials testing and engineering expertise in construction materials, and materials quality acceptance programs in support of the state highway system construction program. The State Materials Lab has five different testing laboratories that provide materials expertise and materials testing on bituminous asphalt, liquid asphalt, structural materials (concrete, aggregate, soils, rock and geotextiles), chemical and electrical materials. The State Materials Laboratory also has a quality assurance section that supports materials approval requirements for Region Project Offices as well as providing fabrication inspection of fabricated materials. The performance measures shown below are broken up by the various sections in the State Materials Laboratory and provide an annual synopsis of the past years performance measures. These performance measures are utilized internally to measure our performance, make adjustments to work processes to ensure deadlines are met and improve the efficiency of the State Materials Laboratory operations.

Quality Assurance Section

Record of Materials

A Record of Materials (ROM) is prepared by the State Materials Laboratory Materials Quality Assurance Section for every WSDOT construction contract and many local agency construction contracts. The ROM report is a list of all major construction items intended for use on each specific contract, taking into account the contract which includes Contract Provisions, Contract Plans, Standard Specifications, Construction Manual, Standard Plans and the quantities of those materials deemed to require acceptance testing. It further identifies the minimum number of acceptance and verification samples required for acceptance of those materials, with reference to total quantities and respective specification criteria. Also listed are products requiring other actions, such as fabrication inspection, manufacturer's certificate of compliance, shop drawings or catalog cuts that may need to be performed or acquired prior to installation of each material in the field.

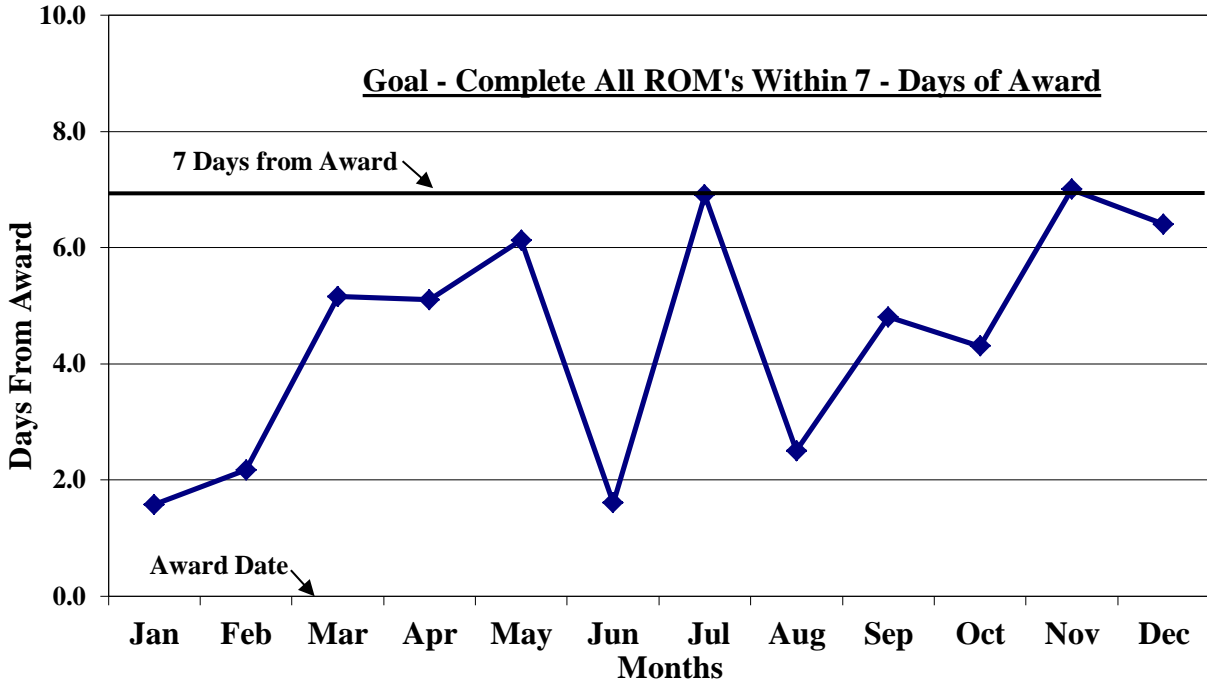
The ROM is processed by the State Materials Laboratory Materials Quality Assurance Section and forwarded electronically to every WSDOT Project Engineer's Office or appropriate Local Agency. The office administering the construction project can then provide this information to the Contractor and/or use it themselves to determine appropriate testing frequencies and acceptance criteria for each material or product used on the project.

2013 saw the retirement of the long term ROM Engineer and the hiring of the new ROM Engineer early 2014.

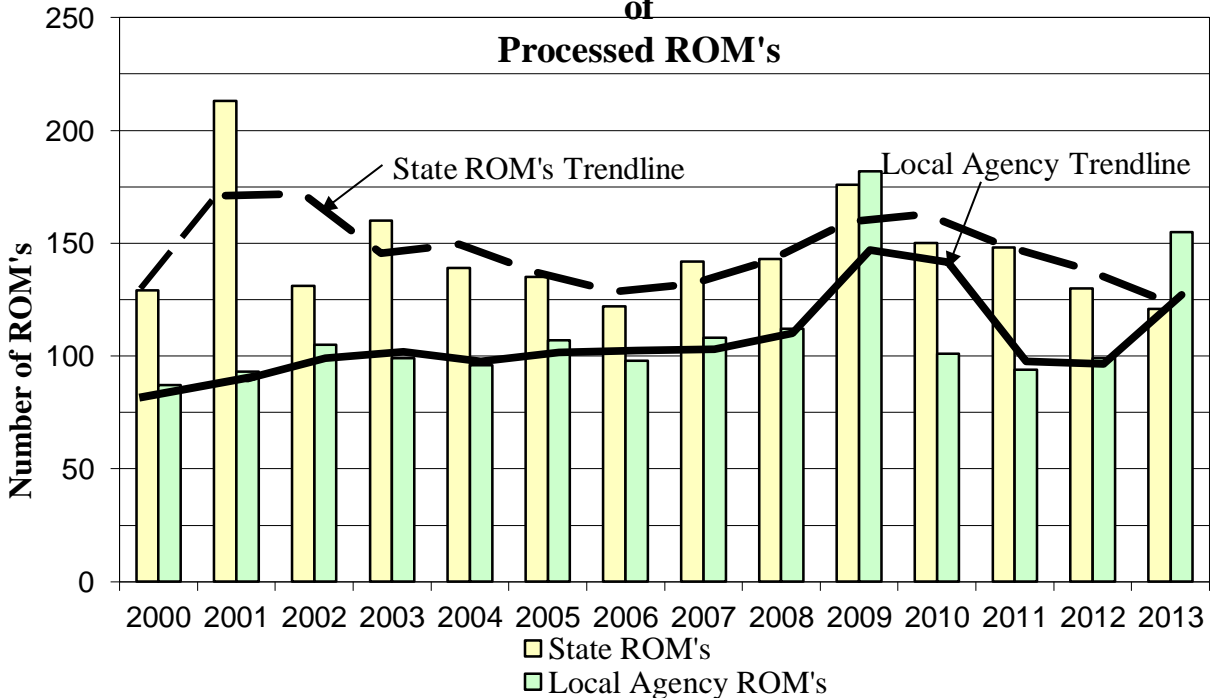
The State Materials Laboratory Materials Quality Assurance Section's goal is to complete the ROM within seven days after the contract is awarded. The performance goal was developed based on feedback from regional personnel and the necessity to wait as long as possible to allow for incorporating any last minute addendum that may apply to the contract.

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Record of Materials - 2013 Average Number of Days from Award for State Contacts



2000 to 2013 Trendline of Processed ROM's



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Request for Approval of Material and Catalog Cut

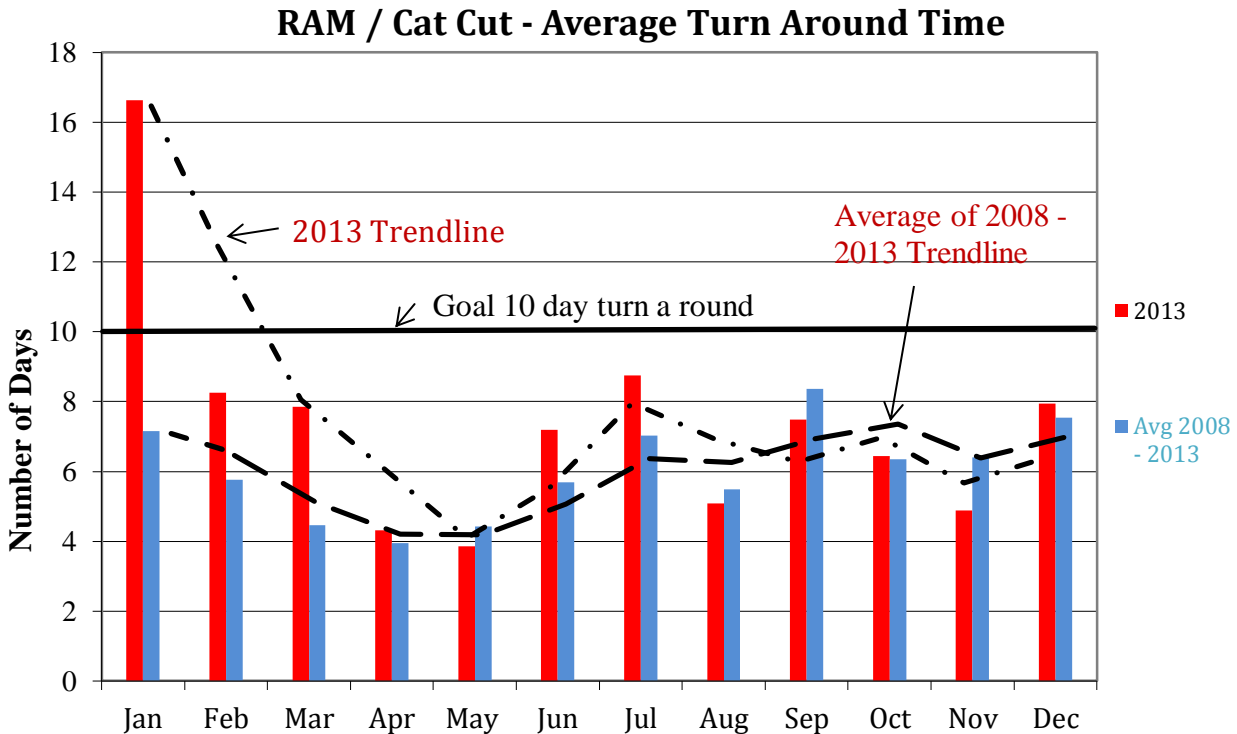
A Request for Approval of Material (RAM) is prepared by the Contractor and submitted to the Project Engineer's Office (PEO) for each product or material anticipated for use on a construction project. The purpose of a RAM is to approve a product or material prior to it being placed on a construction project. Depending on what is known about the product or material, testing may be done to determine if the product or material meets the requirements of the contract. In certain instances additional information is needed to review a product or material for approval. The review of Catalog Cuts is a method of verifying, for approval, products within the RAM process.

The RAM or Catalog Cut is processed by the PEO and forwarded to the State Materials Laboratory Materials Quality Assurance Section when the Project Office has insufficient information to approve the product or material. An alternate to submitting a RAM could be choosing a product or material already evaluated and approved via the QPL (Qualified Products List) process.

The State Materials Laboratory Materials Quality Assurance Section's Goal is to complete all RAMS and Catalog Cuts in the timeliest manner possible. Prior to approving a material or product on a RAM and Catalog Cut, the RAM Engineer will often need to consult with various Subject Matter Experts (SMEs) within WSDOT. The RAM Engineer is dependent on a multitude of SMEs to gain concurrence to approve the product or material submitted on a RAM or Catalog Cut. The most frequent engineering disciplines utilized are Hydraulics, Bridge & Structures, Environmental and the State Materials Laboratory experts such as Chemical, Physical Testing, Geotechnical, Electrical and Bituminous Materials. RAMs that must be sent to WSDOT's SMEs take longer to process.

The data has shown that the greatest impact in recent years to the RAM process was through training and in 2010 when the Construction Manual was modified to allow the Project Engineer Offices the ability to process more RAMs at the office level. Delegating approval of some RAMs has reduced the amount of RAMs submitted to the State Materials Laboratory, but has caused a longer period of time to process due to the increase in complexity of the material being submitted.

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Qualified Products List

The Qualified Products List (QPL) is a list of approved products, materials and systems identified by the Washington State Department of Transportation (WSDOT) Standard Specifications, General Special Provisions, Bridge Special Provisions and Standard Plan compiled by the State Materials Laboratory Materials Quality Assurance Section.

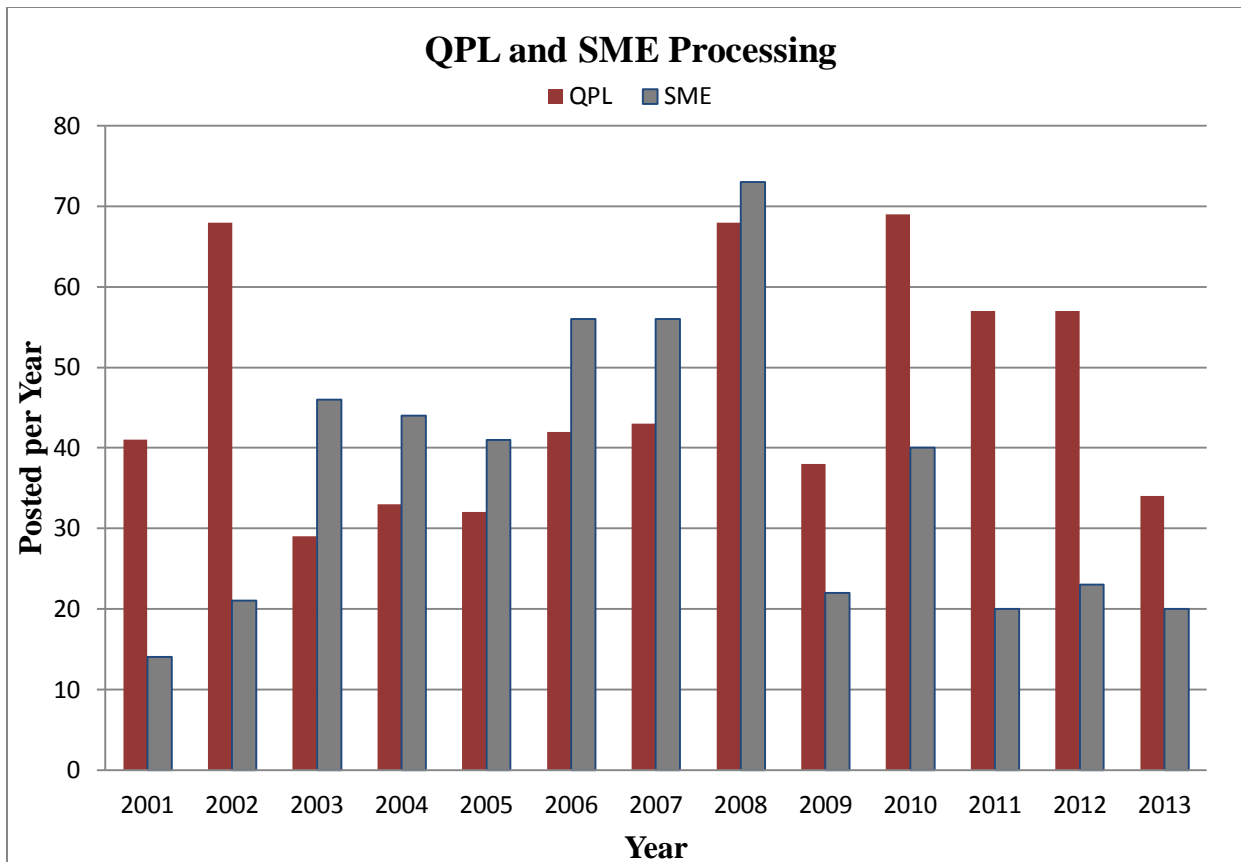
There are two ways that products can be reviewed and approved for inclusion in the QPL. The product manufacturer can contact WSDOT and request that the product be reviewed, or the Subject Matter Expert can recommend a product be included in the QPL after seeing a history of the product conforming to WSDOT standards.

The State Materials Laboratory Materials Quality Assurance Section's Goal is to make a tool available to Contractors and PEOs to assist in the planning and execution of WSDOT, County or Municipal road and highway construction projects. This is facilitated by providing products, materials and systems that have previous approval, which in turn saves both manpower and time.

2013 saw the retirement of the long term QPL Engineer and hiring of the new QPL Engineer.

The most current QPL is accessed at the web address that has been used in the past. That website address is <http://www.wsdot.wa.gov/Business/MaterialsLab/QPL.htm>.

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Aggregate Source Approval

The Aggregate Source Approval (ASA) Program is a computer-based program that is used statewide by Contractors, Aggregate Source Owners, Lessees, DNR, Tribes, Local Agencies, WSDOT Regional and Project Personnel. The ASA program determines the approval status of aggregate sources submitted for evaluation for potential use on transportation construction projects.

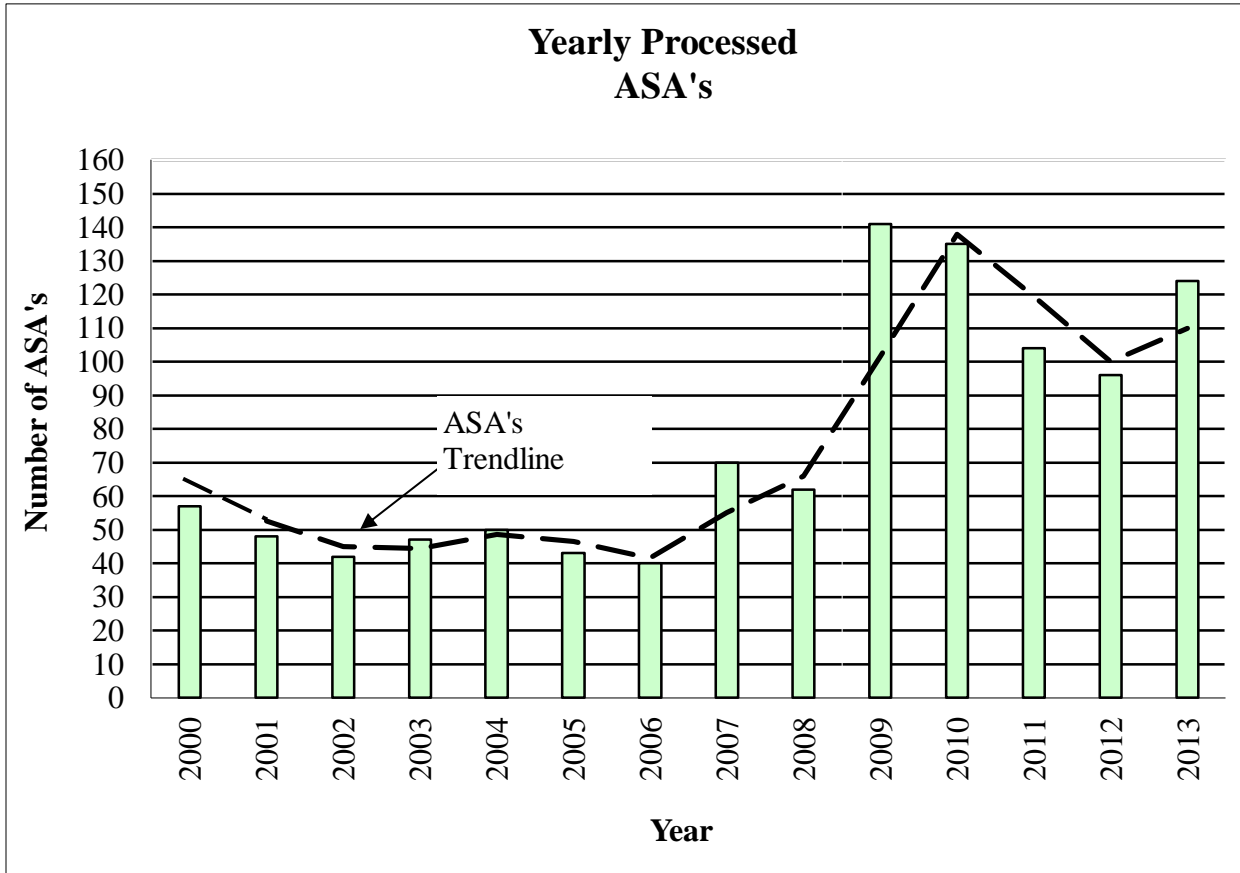
The sampling of aggregate material sources for evaluation is critically important in the direct support of the highway and local municipality construction programs.

The Aggregate Sources Approval (ASA) application stores the details of Aggregate Sources historically used by contracts in Washington State. The ASA application is designed to allow the user to query the database for only the source or sources that meet the search criteria and also allows examination of each in greater detail.

2013 saw the retirement of the long term ASA Engineer.

The State Materials Laboratory Materials Quality Assurance Section Goal is to be proactive and maintain a reliable database of approved aggregate sources that both governmental and private sector entities have access to for potential use on transportation construction projects.

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Compliance Reviews

As part of the WSDOT's Stewardship Agreement with the FHWA, the WSDOT is required to review contract compliance in the materials documentation area, these compliance reviews are a "spot check", verifying compliance with WSDOT's materials documentation requirements. The State Materials Laboratory Materials Quality Assurance Section has been tasked with conducting Compliance Reviews and acting as unbiased auditors verifying contracts meet materials documentation requirements.

The requirements are covered in the WSDOT Construction Manual 9-1.2F(2)IV, State Materials Laboratory - Compliance Review for Materials Certification Process. A Compliance Review goal is to perform a review on at least one contract for each project office once every two years. The reason Compliance Reviews are performed is to review previous materials documentation, assist Project Offices in maintaining adequate materials acceptance practices for future contracts, and to be proactive in initiating possible changes to the Construction Manual and Standard Specifications.

The Compliance Review findings are discussed with Project Office personnel during the wrap-up meeting after the review. A final letter covering the compliance review findings is then prepared and shared with WSDOT and the FHWA to document the Compliance Review findings.

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Tracking and Charting Compliance Reviews

Each item reviewed during the Compliance Review is evaluated, tracked, and charted in the following areas.

Field Verification

Was the material verified in the field by the inspector for what material was approved to be used by the RAM/QPL and proper acceptance criteria?

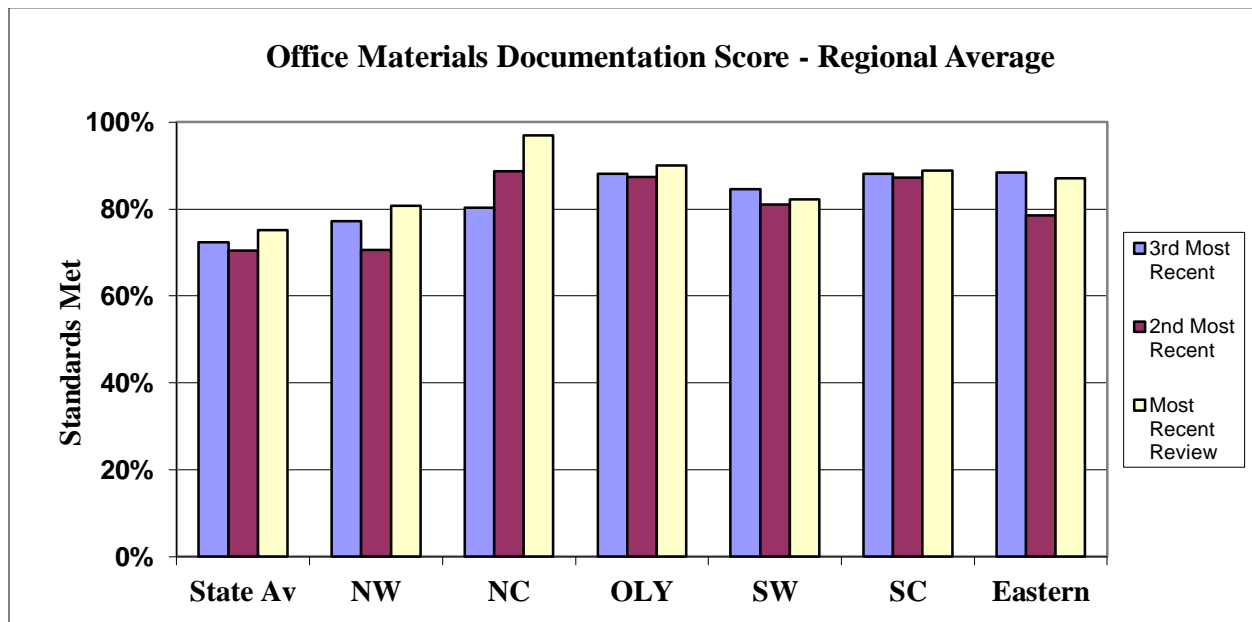
Office Materials Documentation Score

Each criterion mentioned below counts 25% of the Office Materials Documentation Score.

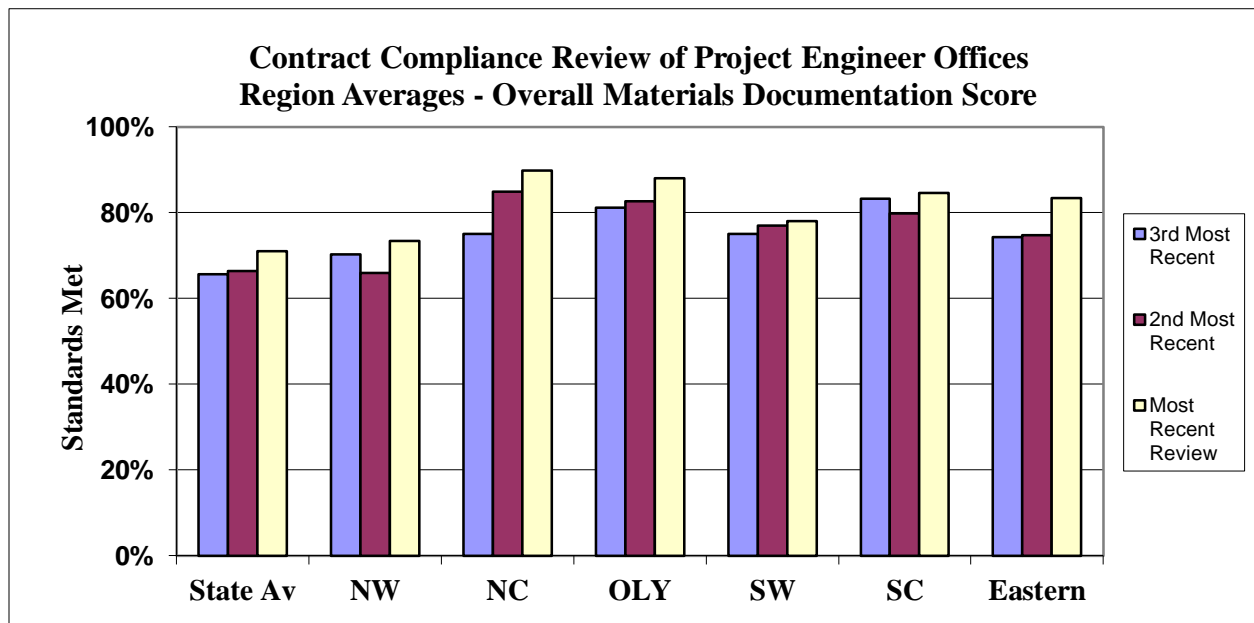
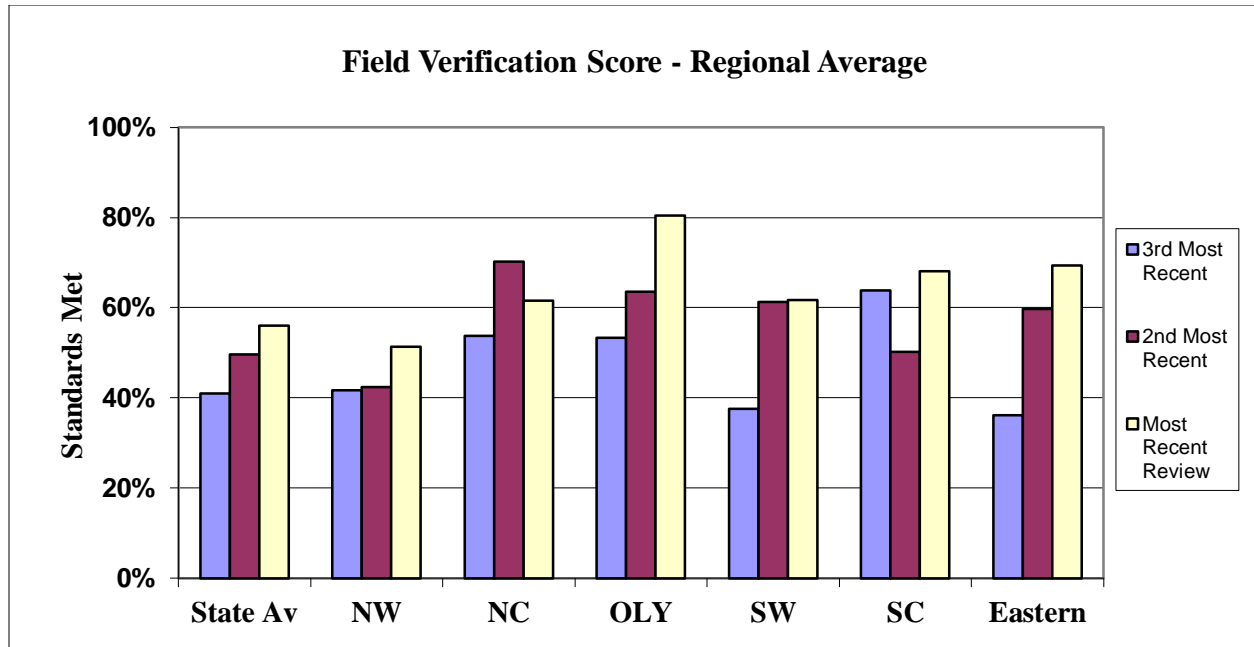
- Were the Pay Ledger and Field Note Records consistent for materials paid?
- Was the maintained ROM (tracking program) being kept up for quantity used, proper materials acceptance, and other documentation requirements as needed per 9-1.2 and 9-1.2CA of the Construction Manual?
- Was a RAM or QPL used prior to material placement and used correctly per 1-06.1 of the Standard Specifications and 9-1.3B of the Construction Manual?
- Was the proper acceptance criteria received and approved prior to placement, i.e. Acceptance Sample, Catalog Cut, Manufacture Certification of Compliance, Approved for Shipment 'Tag' or 'Stamp' or Shop Drawing per the Standard Specifications, Standard Plans, Construction Manual and the Contract Specials and Plans?

Overall Materials Documentation Score

The four parts of the Office Materials Documentation Score are added to the Field Verification Score and then divided by "5".



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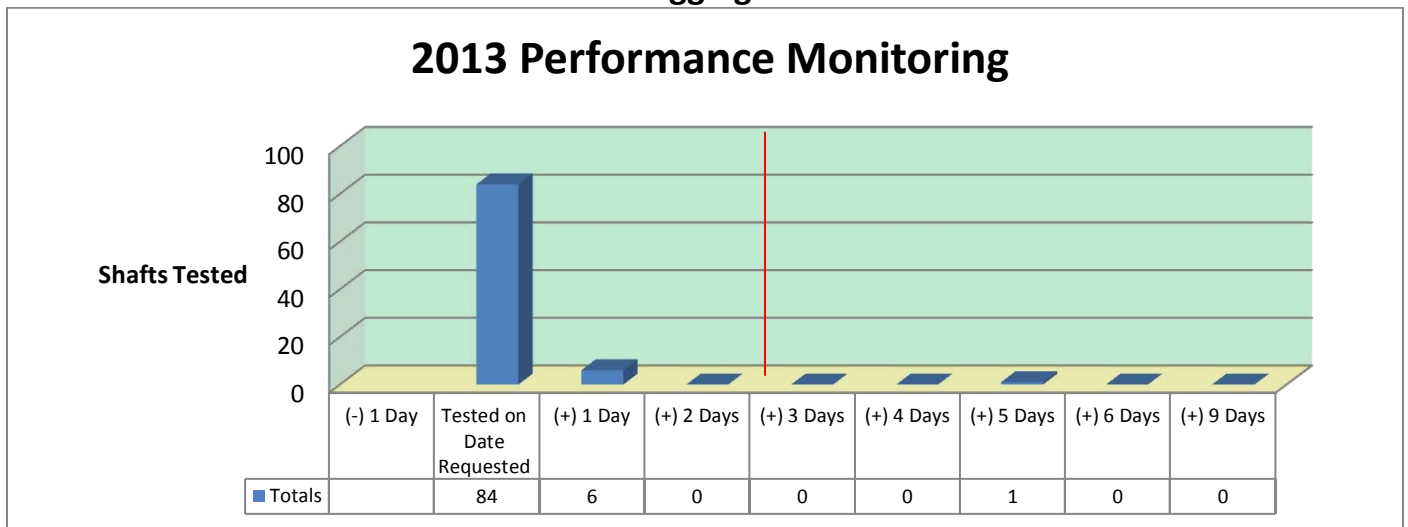
Fabrication inspection Section

Crosshole Sonic Logging Testing (CSL)

The Materials Fabrication Inspection office performs all In-plant inspections for all WSDOT construction contracts for roads and bridges. 17 years ago the fabrication office started providing CSL testing to the Regional Project Engineer's office throughout the State.

The performance measure will track our response time in performing CSL testing, from the test date requested by the Project Office to the date of actual testing. The goal is to respond no later than 48 business hours from the test date requested.

Crosshole Sonic Logging Performance Monitor 2013



Request Date for Testing Compared to Date Tested

This year all of the shafts tested were within the 2 Day specification with the exception on 1 shaft, which was able to be rescheduled to accommodate workload and staffing between contractor and WSDOT.

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Bituminous Materials Section

Hot Mix Asphalt Mix Design Anti-Strip Evaluation 2013

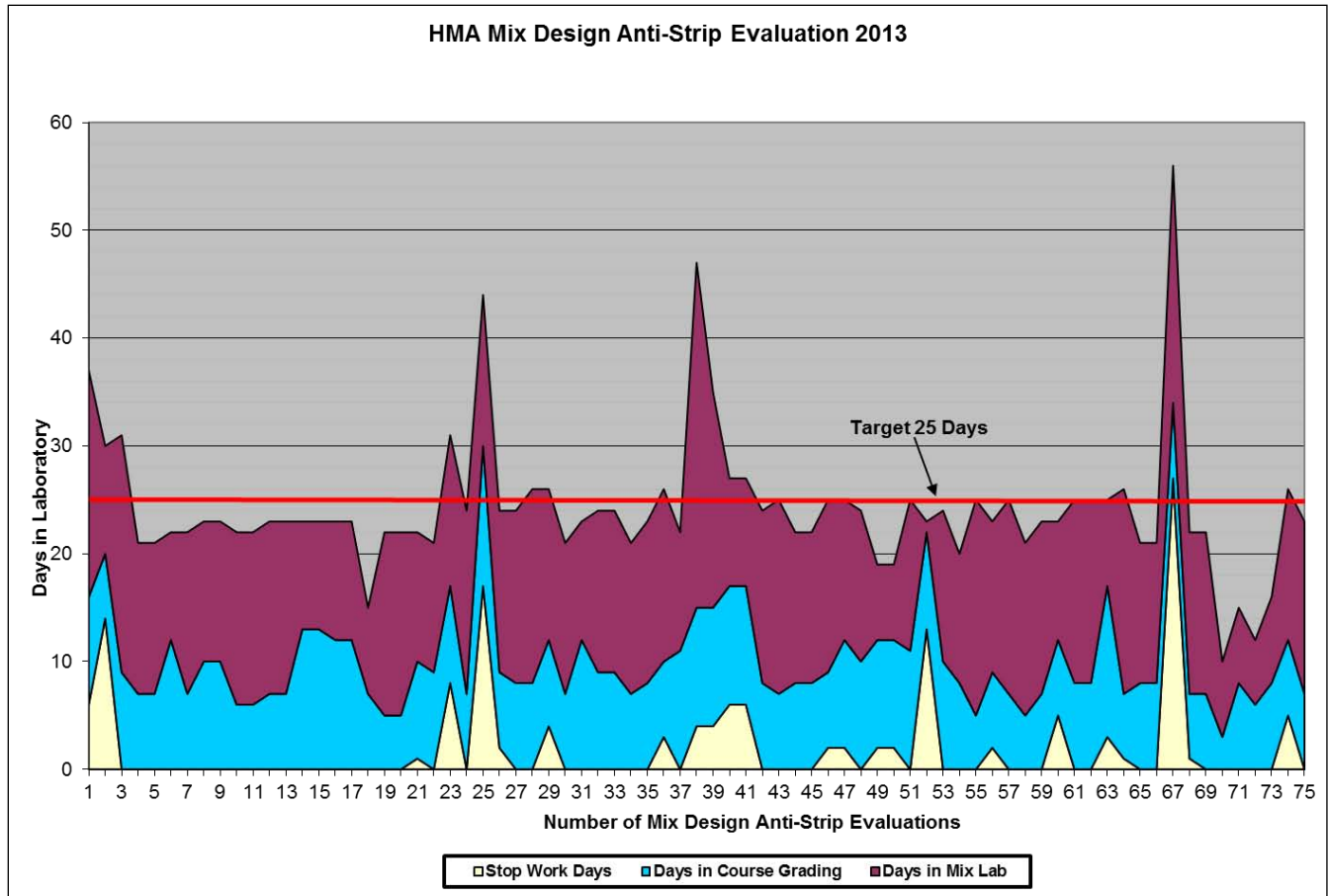
Standard Specification 5.04.3(7)A Mix Designs, states “Prior to the production of Hot Mix Asphalt (HMA), the Contractor shall determine a design aggregate structure and asphalt binder content in accordance with WSDOT Standard Operating Procedure 732. Once the design aggregate structure and asphalt binder content have been determined, the Contractor shall submit the HMA mix design on DOT form 350-042 demonstrating that the design meets the requirements of Sections 9-03.8(2) and 9-03.8(6). A mix design anti-strip evaluation report will be provided within 25 calendar days after a mix design submittal has been received at the State Materials Laboratory in Tumwater.”

Factors that can affect the 25 day completion schedule:

- Work-load in Physical Testing Section
- Undersized or non-representative samples
- Delays in asphalt binder shipments from suppliers
- Work-load in the Bituminous Materials Section, including test section work
- Special handling of HMA designs and specialty bituminous mixture designs
- FTE's
- Equipment and laboratory space
- Overtime authorization

In 2013 the Bituminous Materials Section completed 75 HMA mix design anti-strip evaluations with an average of 24 calendar days. 60 of these mix design anti-strip evaluations were either completed on or before their due date. 15 mix design anti-strip evaluations were not completed within 25 calendar days. Of these 15 mix design anti-strip evaluations: 3 design evaluation reports were delayed due to the contractor not submitting enough aggregate to the State Materials Laboratory for mix design testing, 2 designs were late due to failing test results resulting in re-testing, 1 design was late due to the contractor submitting a mix design with incorrect gyration level resulting in re-testing, 3 mix design evaluation were put on hold due to the State Materials Laboratory receiving a late shipment of asphalt binder, 1 mix design failed High RAP mix design binder testing, 1 Porous Asphalt mix design (PHMA) required specialized testing including additional aggregate soundness testing, 1 mix design was delayed due to slow local agency response to requested information, and 3 designs needed additional time for aggregate preparation.

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Performance Graded (PG) Asphalt Binder Testing 2013

As stated in the Construction Manual section 9-4.2, PG asphalt binder samples must be approved prior to use. Materials must be approved by the Qualified Product List or Request for Approval of Material (RAM). Samples for verification conformance will be taken based on the frequencies stated in section 9-3.7 (Acceptance Sampling and Testing Frequency Guide). PG asphalt binder samples for verification are taken with every other mix acceptance sample, every 1600 tons of Hot Mix Asphalt (HMA) produced on a construction project.

In 2012 WSDOT added a test method to the PG binder specification, 9-02.1(4). The test added was the Elastic Recovery Test (T301). The Elastic Recovery test on specific grades (PG64-28, 70-28, 76-28 and 70-22), is designed to test the elastic response of asphalt binders. In order to meet this specification some type of elastomeric modification must be done to achieve the minimum of 60% recovery. The goal of this added test is to effectively identify properties which will increase the performance of pavements constructed with these modified binders.

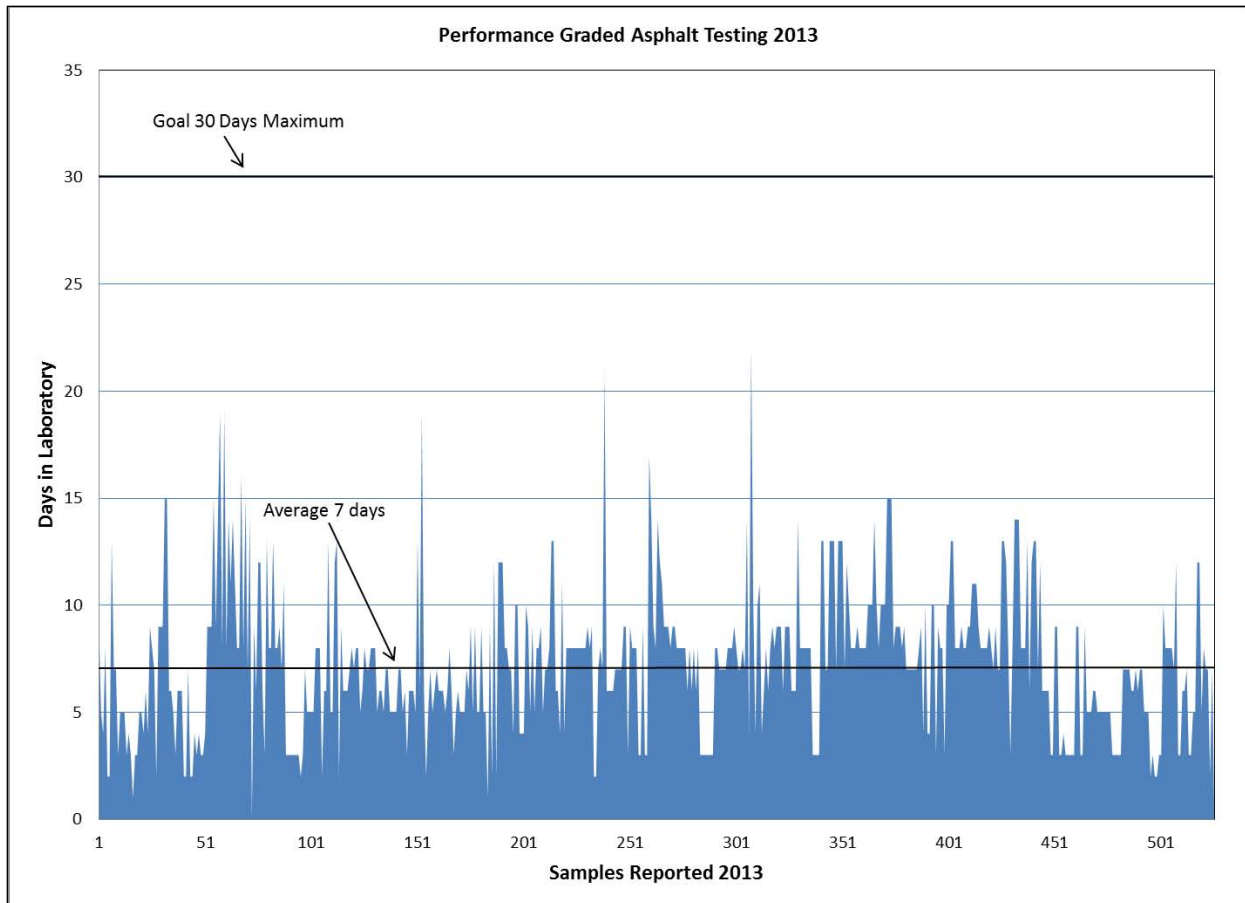
Due to the large volume of samples received during the construction season, the Liquid Asphalt Laboratory does not test all samples. For PG samples, the first, third, fifth and every fifth sample thereafter are tested per contract, per supplier. If a sample does not meet specification, previous and subsequent samples are tested

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until the window of failure is captured. This policy brackets any failing samples, indicating the extent of the failure.

The Bituminous Materials Section goal for Performance Graded Asphalt Binders is to have all samples that are tested and logged out within 30 days. Additional samples outside the normal testing protocol may need to be tested in order to achieve the 30 day goal.

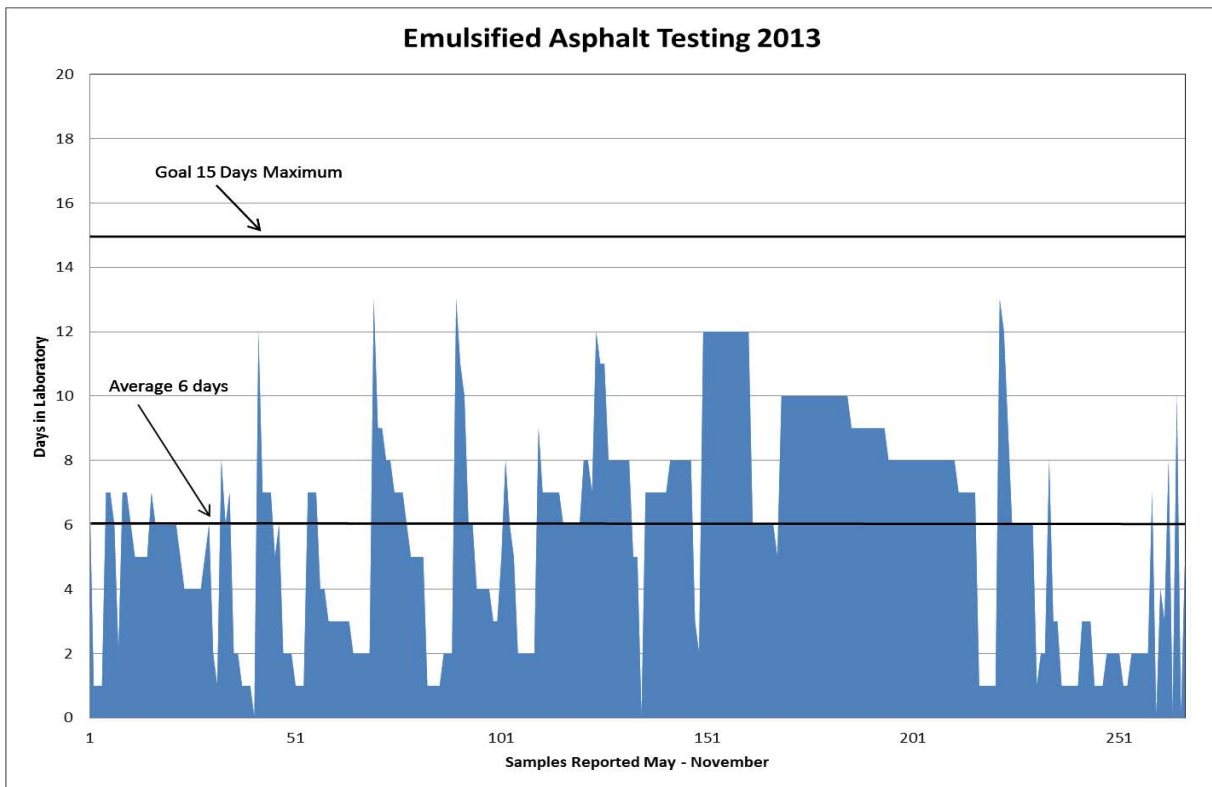
In 2013 the goals for Performance Graded Asphalt Binder samples were met on 100% of samples received. This goal was achieved largely due to the use of the Materials Testing System (MATS) to track samples that are considered Non-Testers. By tracking these samples more efficiently, we were able to reduce the average number of days these samples were in the lab before testing and reporting.



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Emulsified Asphalt Testing 2013

As stated in the Construction Manual section 9-4.2, Emulsified Asphalt samples must be approved prior to use. Materials must be approved by the Qualified Product List or Request for Approval of Material (RAM). Samples for verification conformance will be taken based on the frequencies stated in section 9-3.7 (Acceptance Sampling and Testing Frequency Guide). Emulsified asphalt shall be sampled from every other shipment to the project. The first emulsified asphalt sample taken for each day of production, per contract, receives a complete battery of tests per Standard Specification 9-02.1(6) and 9-02.1(6)A. All other samples taken that day will be tested for viscosity only. The chart indicates the days in the Materials Laboratory for all emulsion samples tested in 2013.



The Bituminous Materials Section goal for Emulsified asphalt is to have all samples tested and logged out within 15 days. To achieve this goal the Liquid Asphalt Laboratory may utilize overtime to ensure that testing is completed within a timely manner. In 2013 the performance goals for Emulsified Asphalt samples were met on 100% of samples received.

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Electrical Section

Traffic Signal Controller Testing 2013

The attached chart, titled "Traffic Signal Controller Assembly Testing 2013" represents the amount of time used for each of the traffic controller assemblies tested at the State Materials Lab from 9/30/2012 to 10/1/2013. The length of the bar represents the total time the controller assembly was resident in the shop for testing. The bar is divided into two sections: the lower section represents the amount of time used by the lab to complete the evaluation of the controller assembly; the upper section represents the amount of time spent waiting for the vendor to correct problems discovered during the evaluation.

The average number of days required to complete the evaluation of a traffic controller assembly for the period of 9/30/2012 and 10/1/2013 was 60 days, compared to 34 from the previous reporting period. During the same reporting period the average Vendor Delay increased from an average of 20 days to an average of 25 days while the average Test Time was 20 days. Presented in the following table are the statistics of each of the distributions: Total Time, Vendor Delay, and Test Time, for 2011, 2012 and 2013.

Year	2011			2012			2013		
	Total Time	Vendor Delay	Test Time	Total Time	Vendor Delay	Test Time	Total Time	Vendor Delay	Test Time
Average	41	12	30	34	20	13	60	25	20
Max	126	94	126	104	104	52	138	117	48
STD	26	22	20	21	21	12	34	23	12

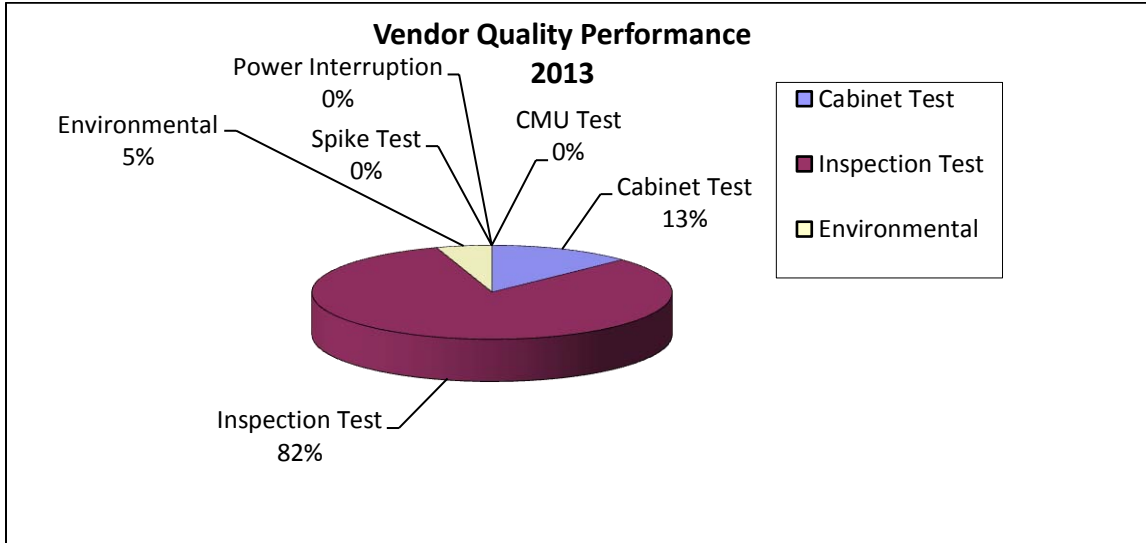
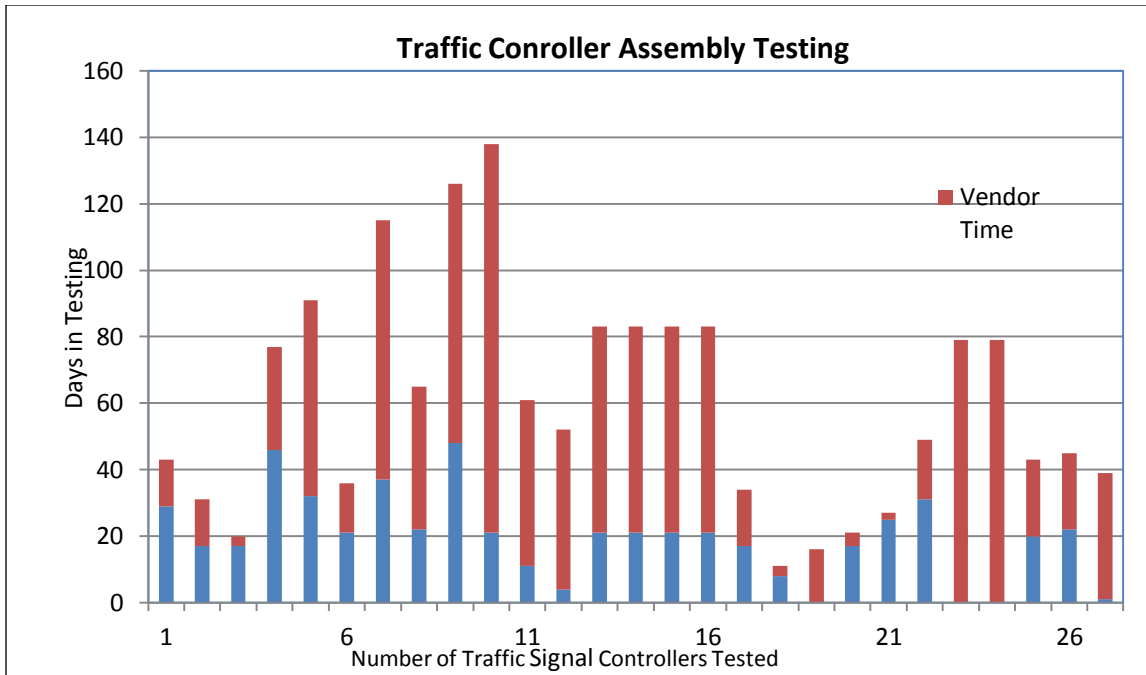
In an analysis of the data used in the chart the average total time went from 34 days shown for year 2012 to 60 for 2013. The increase in average total time can attributed to extended Vendor delay seen in year 2012. The increased average test time is explained by time of the year when the controller cabinets were delivered for tested in 2013 several cabinets were delivered late in the year. In addition there were 14 uninterruptable power supply cabinets tested during the reporting period (not included in the table above or the charts). The goal of not exceeding a total time of 29 days for testing was not achieved. The goal the next reporting period will remain the same not to exceed 29 days. To improve the statistics shown in the table above, we will continue to impress on the manufactures the importance of improving their QC program.

During the reporting period of 9/30/12 to 10/1/13 a total of 27 traffic controller cabinet assemblies were tested. There was a total of 140 nonconforming items identified while testing the 27 cabinets. 96% of the 27 cabinets tested had at least one non-conforming item. The chart titled "Vendor Quality Performance 2013" shows the distribution of the nonconforming items with respect to the test that identified the nonconforming item. This chart is included to provide information on the continued tracking of nonconforming items seen during traffic controller assembly testing. The most interesting feature about the chart is that more than 95% of the identified nonconforming items continue to be found in the Inspection Test (82%) and Cabinet test (13%).

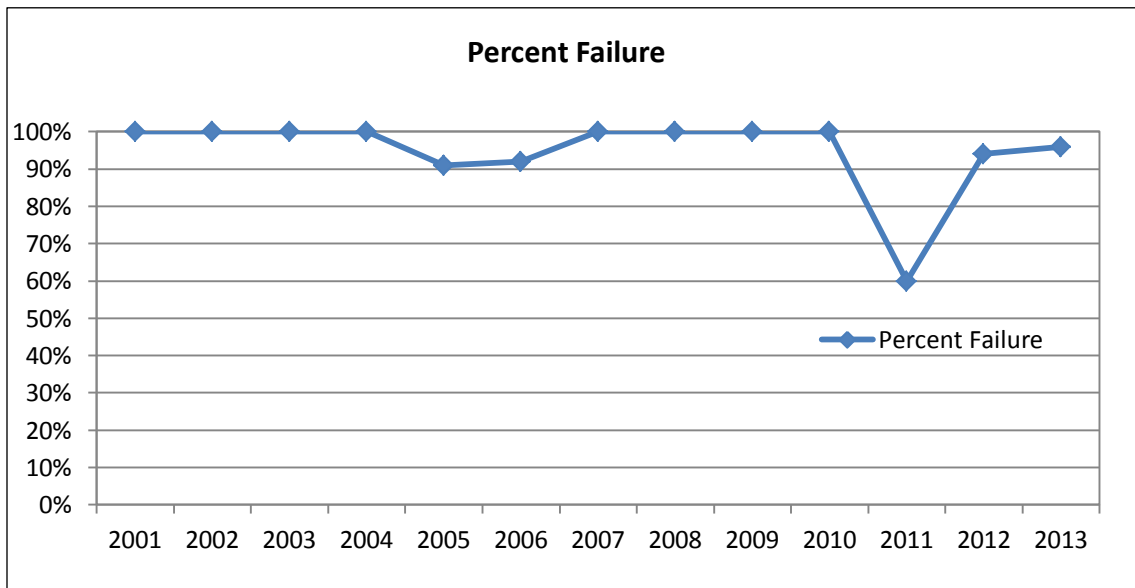
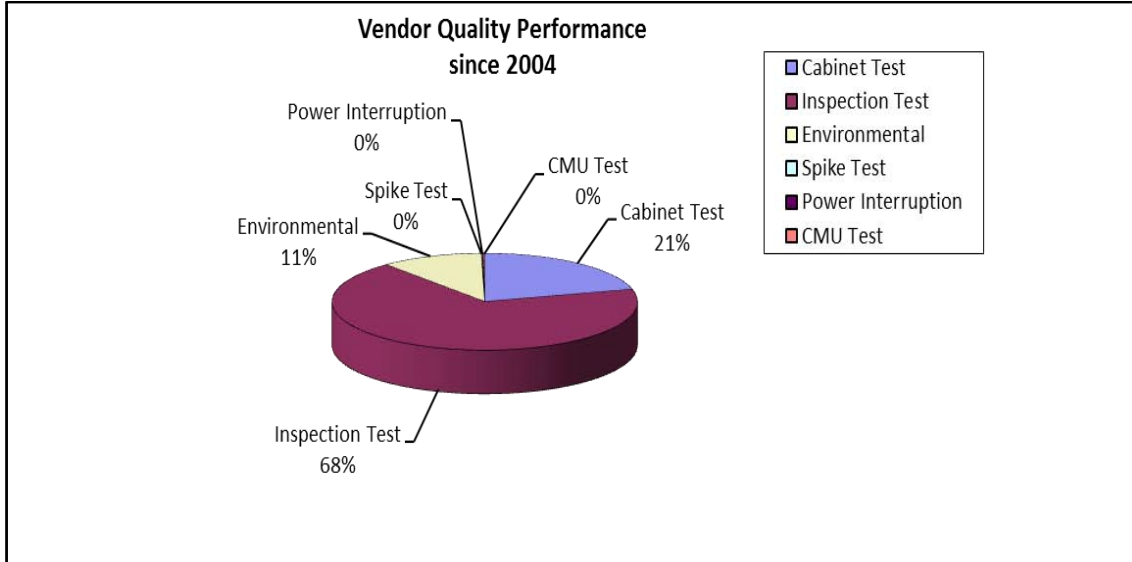
The charts labeled "Vendor Quality Performance since 2004" and "Percent Failure" represent a summary of testing data collected since year 2000. The percentages shown in the "Vendor Quality Performance since 2004" reflect the same distribution as the individual years, where 89% of the non-conforming items could be

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eliminated if manufacture/contractor would take the time to verify correct equipment was installed and the internal wiring is correct prior to delivery for testing. The information provided in the "Percent Failure" chart shows that the year to year average is 95% of the cabinets tested have one or more non-conforming item.



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Chemical Laboratory

Paint Evaluation 2013

Standard Specification 9-8.1(7) Acceptance states “Except for batches of paint in total project quantities of 20 gallons or less that are accepted on manufacturer certificate, the manufacturer shall not ship any batch of paint until the paint has been tested and released by the WSDOT Materials laboratory.” To release the paint for use on a contract ASTM test procedures must be performed on each type. Upon meeting the required specifications a passing test report and entry to the Qualified Products List is given each specific lot number of paint.

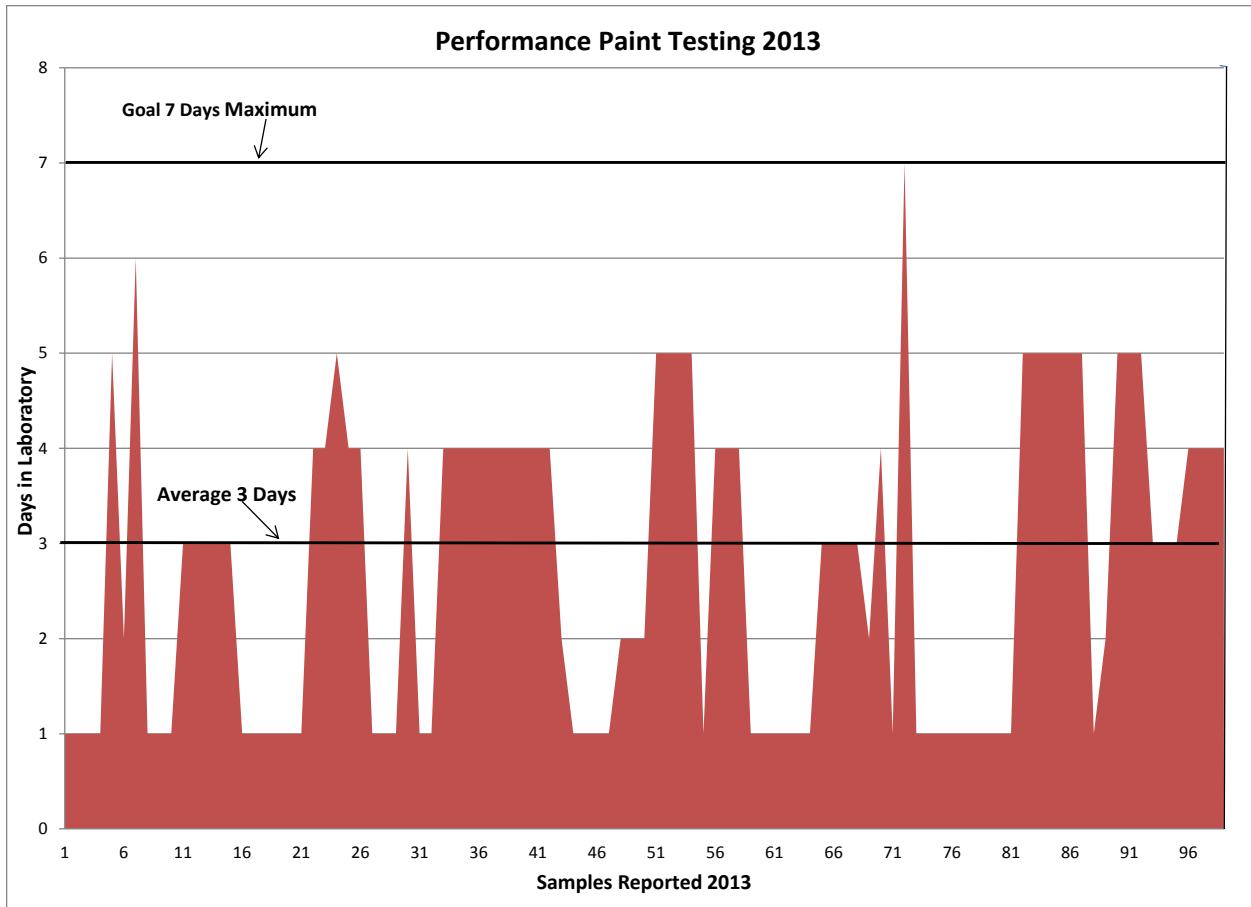
Factors that can affect completion time:

- Delay in paint sample or transmittal from project office
- Undersized or non-representative sample
- Unusual paint sample
- Inadequate information on transmittal
- Workload and staffing (FTE's) in the Chemical Laboratory

- Types of paint tested:
 - Pigmented sealer requires resin identification by ASTM D2621 and color matching in accordance with ASTM D2244
 - Traffic paint requires ASTM testing methods D711, D1475, D2639, D562, D2697 and D2621
 - Moisture Cured Polyurethane Paints such as Zinc-filled primer, Intermediate/Stripe Coat and Top Coat requires ASTM test methods D1475, D2698, D2639, D2697, and D2621

In 2013 the Chemical Laboratory completed testing on 94 paint samples for a total of 372 test procedures. 100% of these were completed on or before the required date.

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Chemical Laboratory

Epoxy Evaluation 2013

Standard Specification 9-8.1(7) Acceptance states "Acceptance of the Epoxy Bonding Agents for use on the project shall be based on a passing test report from the State Materials Laboratory." A passing test report is given once the epoxy material has completed bond strength and compressive yield strength testing requirements for the specific epoxy type and ASTM C881 requirements. The construction manual states that a test report will be provided within 21 calendar days after the material has been received at the State Materials Laboratory in Tumwater. Epoxy testing is completed within 15 calendar days with exception of Type II which has a 14 test procedure. Final reports are expedited to Material Laboratory office assistants who then forward the final report to the appropriate project office.

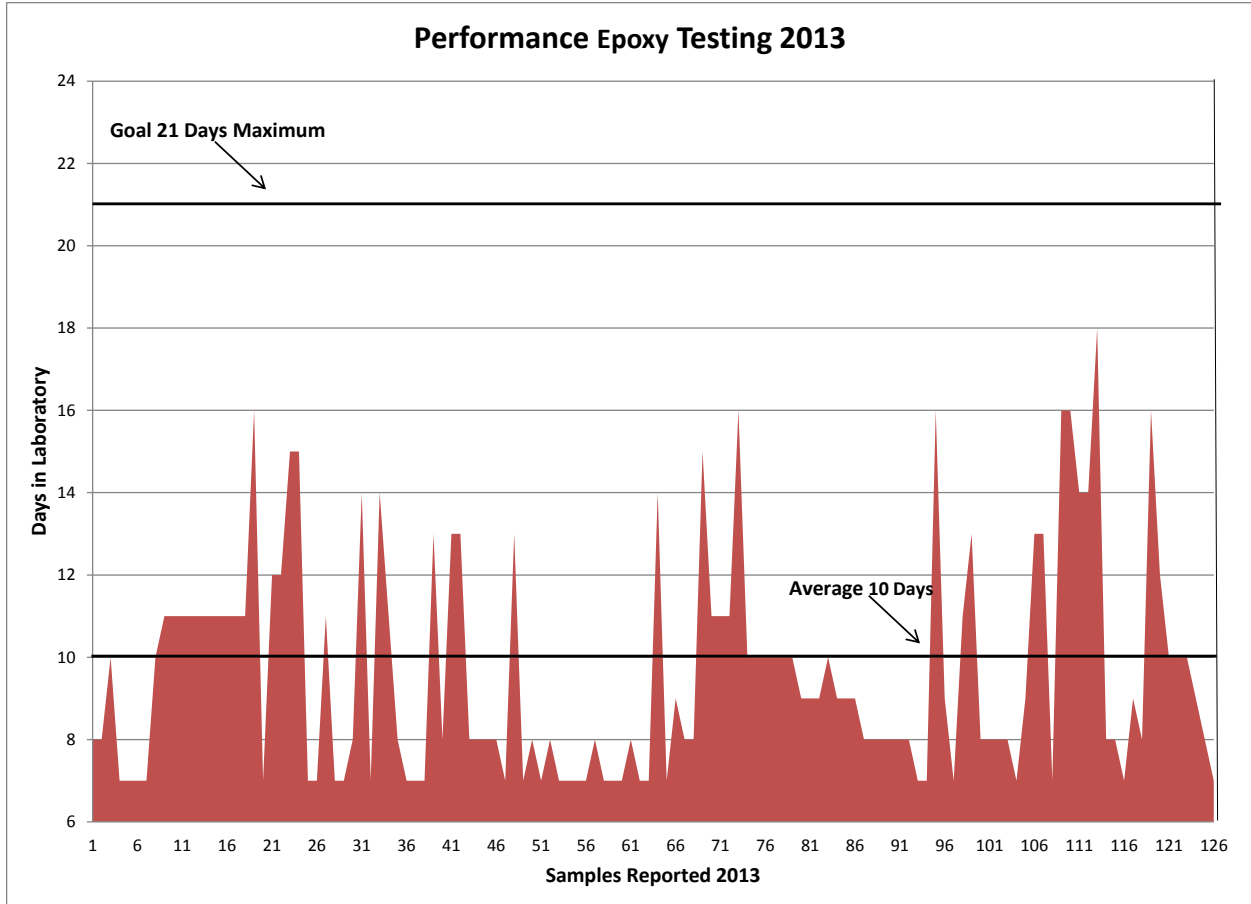
Factors that can affect completion time:

- Delay in epoxy sample or transmittal from project office
- Undersized or non-representative sample
- Inadequate information on transmittal
- Workload and staffing (FTE's) in the Chemical Laboratory
- Equipment collaboration with Physical Testing Laboratory for Compressive/Bond tests

- Types of Epoxy tested:
 - Types I, IV, and VI require 2 day bond strength and 7 day compressive yield
 - Types II, III, V, and VII require 14 day bond strength and 7 day compressive yield

In 2013 the Chemical Laboratory completed testing on 126 Epoxy samples for a total of 378 test procedures. 100% completion was achieved within the required date.

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Physical Testing Section

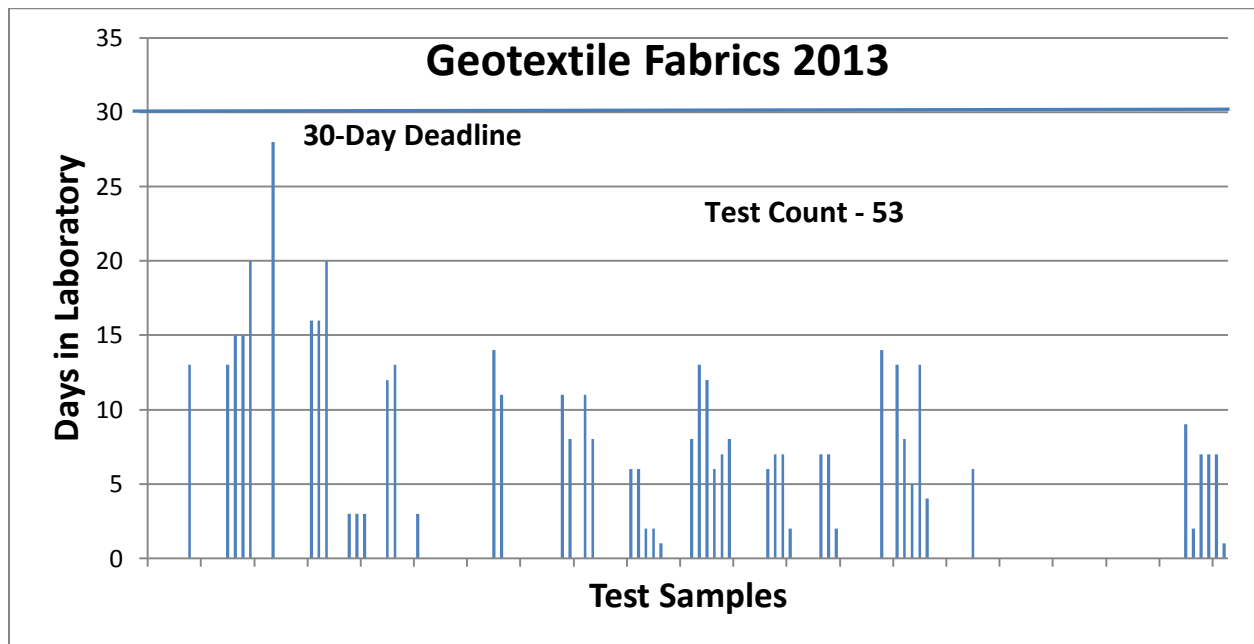
Geosynthetic Material Acceptance Testing

WSDOT Standard Specification 9-33.4(3) Acceptance Samples states “Acceptance testing information will be provided within 30 calendar days after the sample and the required information for each geosynthetic type have been received at the State Materials Laboratory in Tumwater”.

Factors that can affect the testing schedule:

- Incomplete documentation – often the documentation required is incomplete
- Workload
- Staffing
- Equipment and laboratory space
- Shipping delays
- Overtime authorization

In 2013, the Physical Testing Section completed testing on 140 geotextile samples, of which 53 were fabric samples and 87 were geogrid samples. All 140 samples were completed within the 30-day deadline.



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