



Cement Laboratory Operation Report 2020

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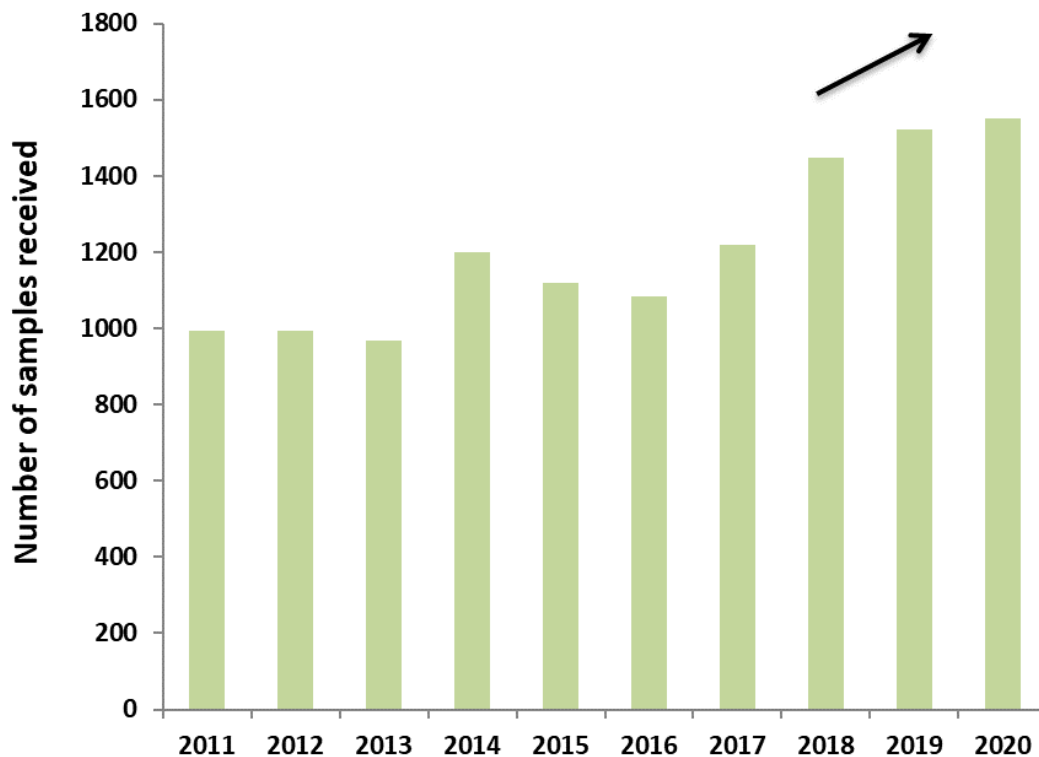
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Introduction

This report summarizes the cement laboratory operation in 2020. The document gives an overview of the overall status of testing for the Quality Monitoring (QM) program, actions taken for non-conforming materials, and how other requirements set by Departmental Material Specifications (DMS) 4600, 4610, 4620, 4630, 4635, and 4640 are followed in the cement laboratory. It also outlines the lab performance in Cement and Concrete Reference Laboratory (CCRL)'s Proficiency Sample Program. This report will help in the program evaluation and future planning.

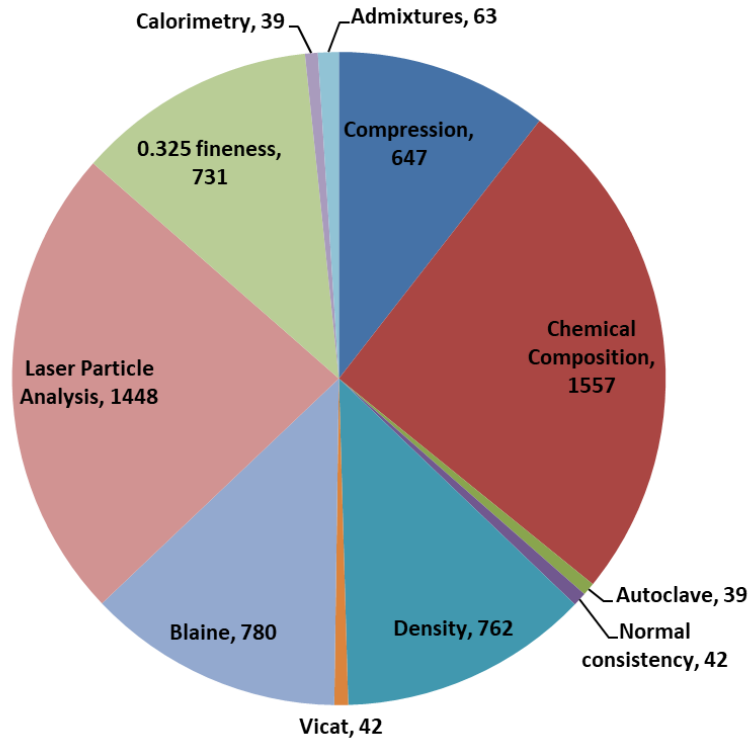
Work load

The ascending trend of the number of samples received in the cement lab continued in 2020 and a total of 1552 samples were received and tested. This shows 2% increase compared to 2019, 43% compared to 2016, and 60% compared to 2013.



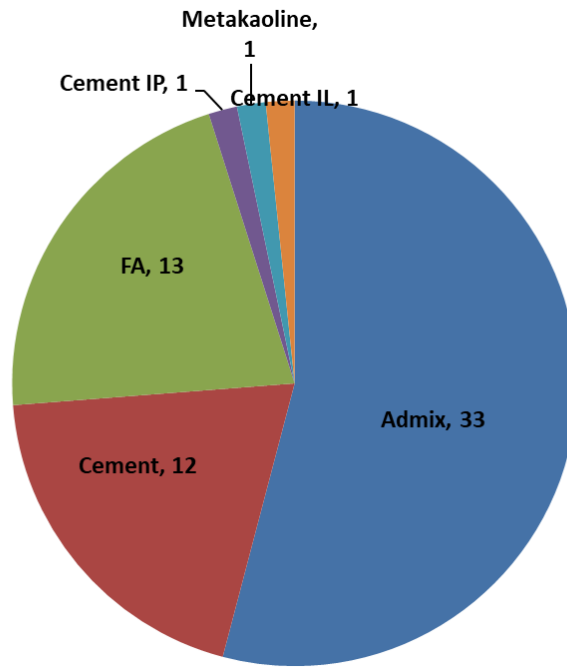
More than 6150 tests were performed on the QM samples (breakdown in the following figure). In addition, there were numerous tests conducted for in-house research projects such as R3 testing, μ XRF, carbon analysis of fly ash, etc.

Number of tests conducted 2020



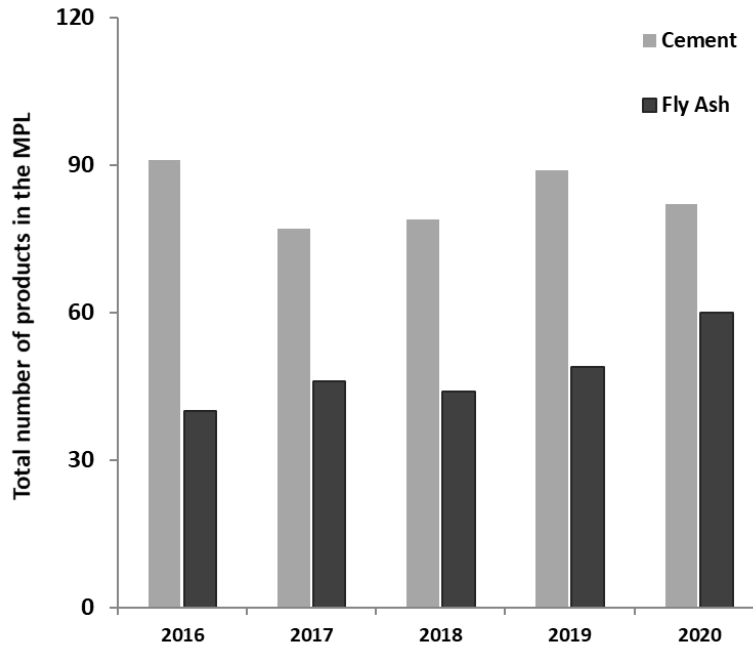
Sixty-one requests for pre-qualifications (PQ) were processed (30% increase compared to 2019). While 56 approvals were granted, five products did not meet the specifications and were not able to obtain the approval. All PQ requests were processed within maximum 10 days after receiving all required samples and paperwork.

Number of Pre-Qualification requests



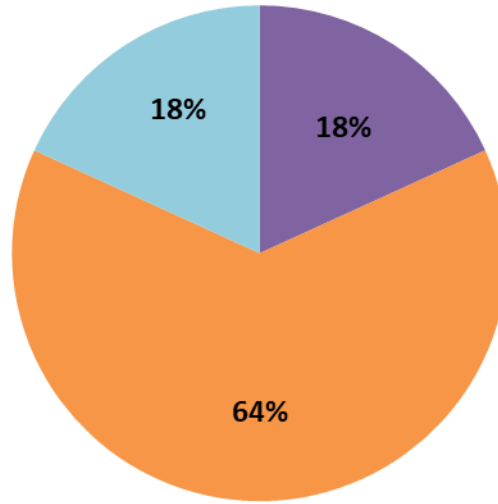
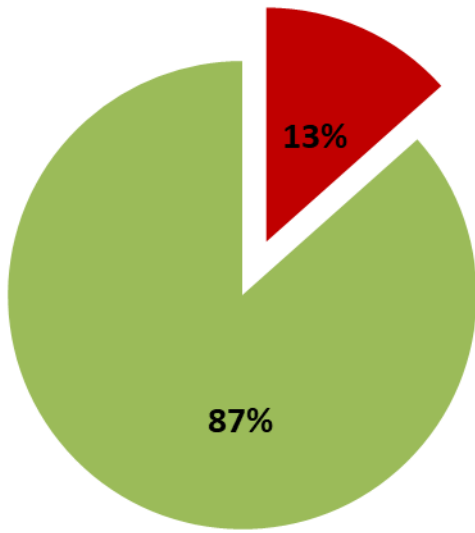
Suppliers

One hundred and forty five products were listed in the cement, fly ash, and slag MPLs by the end of 2020.



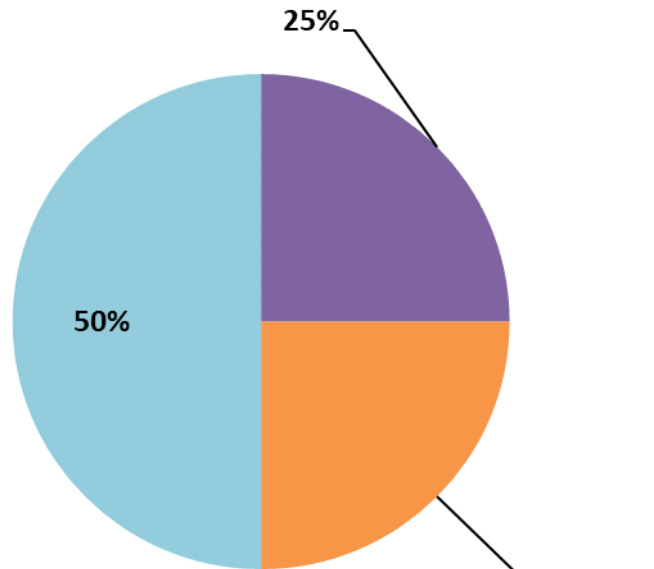
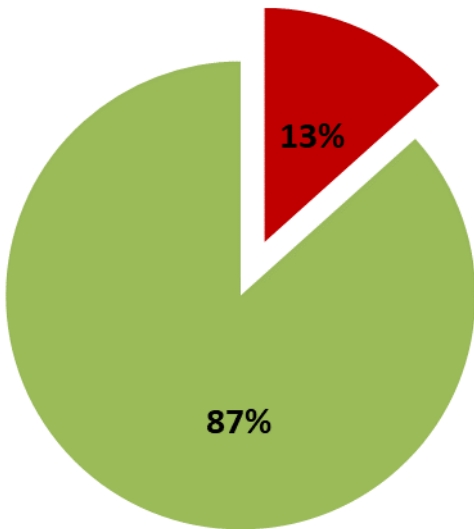
As per DMS 4600, 4610, and 4620, monthly samples are required to maintain the approval. The following two charts show how the cement and fly ash suppliers kept up with this requirement and why insufficient number of samples were received from a few sources. The chart shows that samples from $\approx 87\%$ of the products on the approved list are received regularly in the cement lab. There were legitimate reasons for not sending samples for most of the products as shown in the graph (plant shut down, no production or import, etc.).

Cement (2020)



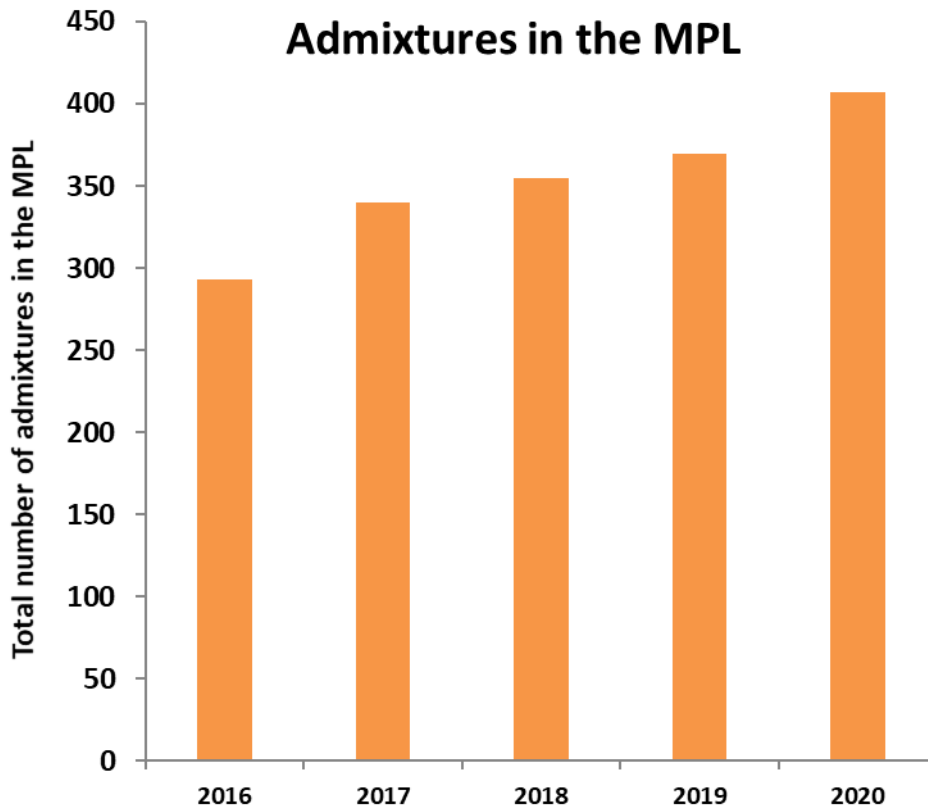
- suppliers that sent less than 6 samples
- suppliers that sent at least 6 samples
- is sending samples
- import, not getting samples every month
- Special cement, not produced every month

Fly Ash (2020)



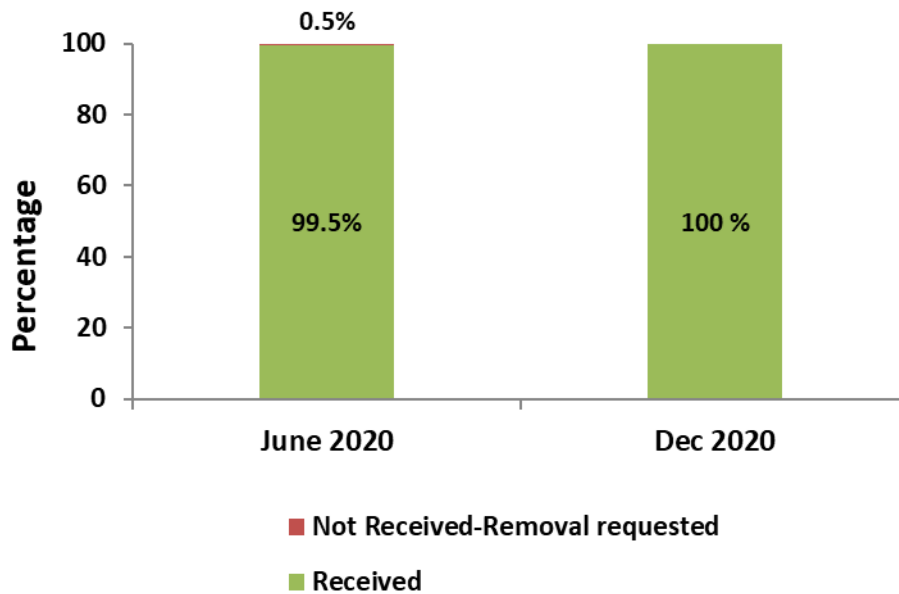
- suppliers that sent less than 6 samples
- suppliers that sent at least 6 samples
- is sending samples
- not imported
- plant is down

There are also ≈407 admixtures in the MPL by the end of 2020.



According to DMS 4640, semi-annual notarized certifications (in June and December), stating that there has been no chemical alteration of the product since originally submitted for approval, are required to maintain approval status. This was obtained from the producers as shown in the following figure. The certification was not given for two products and they were removed from the MPL as per manufacturer withdrawal requests.

Semi-annual Admixtures' certifications



Failure in Test Results

The rate of failure of the approved products was significantly lower than 2019. Eight samples failed only once in chemical composition requirements (LOI or C₃A content). For fly ash samples, there was fineness issue with a source that occurred more than once. The section has been working with the distributor to address the issue. The plant has been down very often in 2020 though. That was the only approved sample with more than 1 failure occurrence.

Performance in CCRL Proficiency Sample Program (PSP)

CCRL Proficiency Samples Program (PSP) are part of the cement laboratory's accreditation requirements and required for the AASHTO Accreditation Program (AAP). The following two charts summarize the performance of the cement lab in testing of the PSP samples (any score <3 is considered unsatisfactory). The average score of each group increased since 2019 for all categories except 1 and they were close to perfect rating (5) and even the lab made straight 5 in chemical analysis of pozzolans in 2020. Out of 286 scores received for all samples, 97% were satisfactory. Table 3 gives the details of the tests that low ratings were obtained and the actions taken to correct the issues. Overall, the ratings indicate the consistency and reliability of the testing results in the lab.

The lab was also inspected by CCRL in November 2020 for equipment, quality system, procedures, etc. and no major deficiency was found during the inspection.

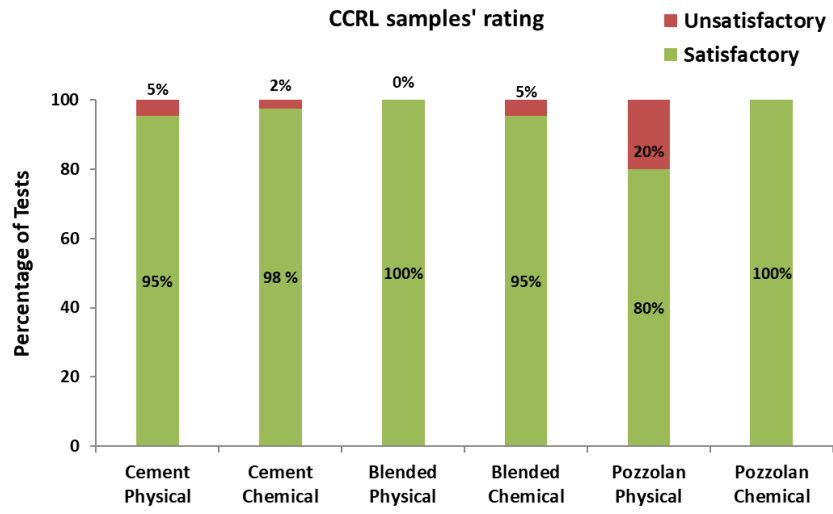
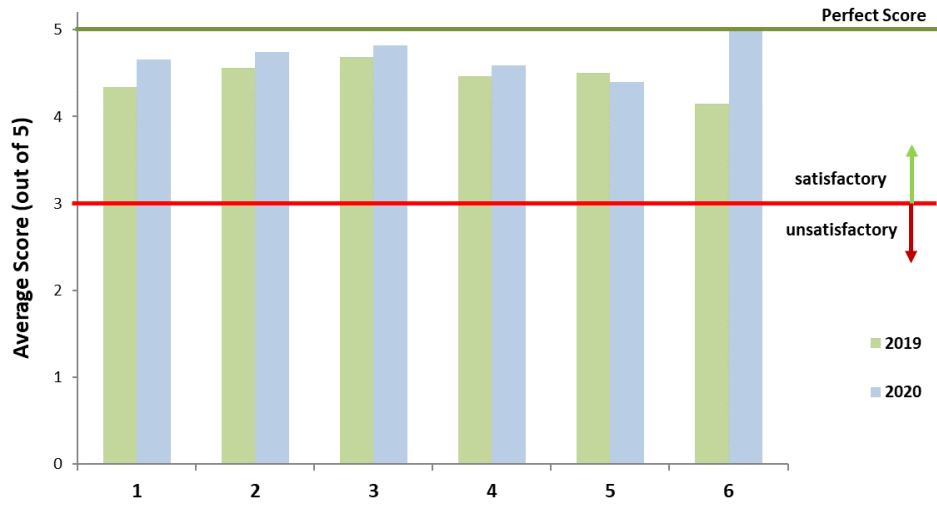


Table 3. Detail of the CCRL PSP ratings

Cement Physical			
Total number of values rated	Number of satisfactory ratings	Number of unsatisfactory ratings	% satisfactory
44	42	2	95.5
Low ratings			
Test	Number of occurrence	Reason	Action taken to correct the issue
Blaine	1	Likely to be an unrepresentative sample	Likely to be an unrepresentative sample
Vicat	1	It could have been something simple such as recording a wrong time as the initial time, dirty needle, incorrect handling	The technician was re-trained and observed
Cement Chemical			
Total number of values rated	Number of satisfactory ratings	Number of unsatisfactory ratings	% satisfactory
168	164	4	97.6%
Low ratings			
Test	Number of occurrence	Reason	Action taken to correct the issue
Si, Na	4	It could have been sample contamination or calibration issue	Substantial change has been made to the calibration of the XRF to minimize the error to make it even better.
Blended Cement Physical			
Total number of values rated	Number of satisfactory ratings	Number of unsatisfactory ratings	% satisfactory
22	22	0	100%
Blended Cement Chemical			
Total number of values rated	Number of satisfactory ratings	Number of unsatisfactory ratings	% satisfactory
22	21	1	95.5%
Low ratings			
Test	Number of occurrence	Reason	Action taken to correct the issue
Ca	1	It could have been sample contamination or calibration issue	Substantial change has been made to the calibration of the XRF to minimize the error.

Pozzolan Physical			
Total number of values rated	Number of satisfactory ratings	Number of unsatisfactory ratings	% satisfactory
10	8	2	80%
Low ratings			
Test	Number of occurrence	Reason	Action taken to correct the issue
Density	2	Equipment malfunctioning	The equipment issue was fixed
Pozzolan Chemical			
Total number of values rated	Number of satisfactory ratings	Number of unsatisfactory ratings	% satisfactory
20	20	0	100%

Concluding Comments

The work load and number of tests slightly increased in 2020. Except a few cases, all suppliers are complying with the requirements of the QM program. The very low failure rate in the products tested in the lab implies that the QM program for cementitious materials effectively ensured the required quality of the materials needed in state projects. The reliability and credibility of the monitoring system were evaluated by national entities (AASHTO and CCRL) through inspection and proficiency sample programs and performance of the lab in all aspects was successful.