For Information Only

Update to Management's Response to Auditor General's Report regarding the Impact of Changes to Road Design

Presented To:	Operations Committee
Presented:	Monday, Dec 03, 2012
Report Date	Wednesday, Nov 28, 2012
Type:	Presentations

Recommendation

For information only.

Introduction

On August 14, 2012, the Auditor General presented his report entitled "Impact of Changes to Road Design" to the Audit Committee. In the report, the Auditor General provided thirteen (13) recommendations based on his review and findings. Seven (7) of the recommendations have been implemented with the remaining six (6) to be implemented by the spring of 2013 or shortly afterwards.

This report will explain the procedures and guidelines in place that ensure the City is receiving what is specified in contract documents.

Background

The Auditor General reviewed the following contracts for the basis of his report:

1. Contract ENG08-18 Main Street (M.R. 15) from Highway 69 North to Belisle;
2. Contract ENG10-19 Highway 69 North (M.R. 80) from Frost to Glenn;
3. Contract ISF09-04 Lasalle Boulevard from Falconbridge to Notre Dame;
4. Contract ENG11-22 Regent Street from Loach's Road to the By-Pass;
5. Contract ENG11-21 Radar Road from Hydro Road to 2 km East.

Contracts ENG08-18 Main Street and ENG10-19 Highway 69 North were widening projects. Contracts ISF09-04 Lasalle, ENG11-21 Radar, and ENG11-22 Regent were asphalt rehabilitation projects. In reviewing these contracts, the Auditor General identified 13 recommendations. The recommendations were based on a review of evaluation of asphalt testing, cross-fall, reclaimed asphalt pavement (RAP), and the handling of progress payments.

Signed By

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Management agreed to all of the recommendations of the Auditor General; however, several questions were raised regarding concerns and issues identified in the Auditor General's report and presentation that will be addressed in this report.

Report Findings

Attached to this report is all the background information described in detail that references manuals, procedures, protocol, and guidelines along with a status update to the recommendations of the Auditor General's report.

Summary

- **The Infrastructure Services Department subscribes to the theory of continuous quality improvement.**

  Road infrastructure rehabilitation and repair is recognized as one of the highest priorities for the City of Greater Sudbury. The total annual investment and percent of contribution into our roads from the tax levy is significant and justifies staff's professional attention, and the scrutiny of independent observers. The infrastructure department subscribes to the theory of continual total quality improvement, and as such, an independent audit is a welcome component of that theory.

  The Auditor General has identified a number of recommendations focused on the roads capital investment program. In total, there are thirteen recommendations principally related to the area of quality assurance, which is the City's process of checks and balances associated with inspection of contract work. The majority of the recommendations have been implemented already and will be in place for the 2013 construction season. A number of the recommendations would fall into the category of good practice and will involve staff monitoring their internal processes and making adjustments as required.

- **Staff have always incorporated a multiple barrier approach for inspection and testing in accordance with industry guides and standards.**

  Quality Assurance and Quality Control is a complex process of redundant checks and balances to ensure that work is performed in general conformance with specifications and standards. For City road projects, staff have adopted inspection procedures developed principally through the Municipal Engineers Association (MEA) and as described in documents referenced as the Ontario Provincial Standard Specifications (OPSS). Generally, the process requires the contractor to perform quality control testing while City staff or independent companies perform quality assurance testing. City inspectors observe contractor procedures and monitor activities such as granular material quality, subgrade and granular compaction, weather conditions, and temperature and compaction of asphalt products. No one test is sufficient to warrant satisfaction or rejection of a finished product. The summary of all of the information must be taken into consideration in determining the acceptance of the finished road.

  It should also be noted that if individual test results indicate non-compliance with a specification, a series of alternative mitigation measures are available to City inspectors and the Contractors. Among the many next steps, City staff would review additional testing performed by the Contractor, by independent testing companies, and staff would also review the balance of any other observations performed during the work including the weather conditions. An extended period of warranty, monitoring and observation is not uncommon and may show in time that the road performance is acceptable.

- **Inspection and Testing procedures performed by staff have ensured the City received value for money spent on road projects.**

  While staff agrees that additional or modified testing procedures, as identified by the Auditor General, would be beneficial to mitigate the potential for unacceptable contract performance, staff is also confident that testing procedures performed to date have adequately protected the City's interests and valuable investment in the road system. Staff have also taken a number of initiatives not identified by the Auditor General to enhance our QA/QC procedures, such as the investment in a number of new nuclear density testing equipment, and will continue to make appropriate investments in this area in the future.

- **Innovation in road building technologies has and will continue to be a priority for staff to perform more road work with limited tax dollars.**

  Staff also recognizes that innovation in road building technologies will continue to provide opportunities for stretching limited tax dollars. Staff is proud of their contributions in the field of asphalt recycling and these contributions have been recognized by industry associations. The Auditor General has also acknowledged our contributions and complimented staff for our efforts in this area. We know that these efforts have realized substantial financial benefit to the City particularly with the investment in the reconstruction of roads under the ISF program. Staff chose to use CIREAM, an asphalt product comprised of recycled materials, in advance of a recognized standard for performance measurement. This investment saved significant costs in the unit price placement of the road asphalt structure and allowed approximately 30% more road to be constructed for equivalent dollars. Although conventional testing methods at the time would have suggested that the asphalt product was non-compliant, later testing methodologies have since proven staff made an acceptable decision. CIREAM is now an industry accepted product with many beneficial uses and will continue to be used on City projects. While we agree with the Auditor General's recommendation to comply with standard specifications, we also recommend that there are circumstances where full compliance is not necessary provided appropriate risk mitigation measures are taken into consideration.

- **Limited opportunities exist for obtaining the full value of grindings, and staff will endeavour to identify the best end use through the competitive tendering process.**

  The use of asphalt grindings will continue to be evaluated on future construction projects. We agree that the best end use should be an important consideration for the grindings. During the project execution of the ISF projects, City staff took a number of different approaches for the use of the grindings. Some of the grindings were used for maintenance projects, while other grindings were used by the contractors in the execution of their work. Due to the nature of the extraction process it is difficult to accurately measure the quantity of grindings removed, transported and re-used. Asphalt grindings have minimal value and can be considered a liability as the end use requires transporting the grindings by truck over any modest distance. To be of value, the grindings must be re-used in close proximity to the location of extraction.

  Consistent with the Auditor General's recommendation, it is the intentions of staff to allow the competitive tendering process determine the best end use of the asphalt grindings unless staff has identified a necessary need for the product at the time of construction. We agree that the stock piling of asphalt grindings is not an appropriate means to achieve the best end value, and this practice will only be used where the alternative represents an unacceptable liability to the City.

  In conclusion, staff appreciates the opportunity to work with the Auditor General on this important initiative and will continue to advance our road program to optimize value for the taxpayers.

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Management agreed to all of the recommendations of the Auditor General; however, several questions were raised regarding concerns and issues identified in the Auditor General's report and presentation that will be addressed in this report.

Update Response: Audit of Impact of Changes to Road Design			
Rec No	**Recommendation**	**Action Plan/ Time Frame August 2012**	**Action Plan/Time Frame Update December 2012**
1	The City should improve policies, procedures and reports supporting accountability for rejection of inferior products and enhanced follow-up on warranty issues.	Will formulate reporting procedure for test results. This can be completed within six months (March 2013).	Reporting procedure for test results in place as of September 2012.
2	The City should further investigate rejectable materials from previous and current projects, and establish appropriate remedies where warranty provisions allow.	Will monitor and continue to monitor areas already identified and determine corrective measures. This has been implemented.	Two areas have been identified and additional monitoring is being performed. One location has had asphalt replaced with new coat of asphalt.
3	The City should require asphalt suppliers to provide their quality control test results in accordance with OPS to Construction Services (as they become available) for all asphalt supplied to the City. Any deficiencies in the quality of the asphalt should be made known to management immediately so that corrective action can be taken if deemed necessary.	Asphalt suppliers will provide their quality controls results to Construction Services as per Ontario Provincial Standard Specification 310 Construction Specification for Hot Mix Asphalt Table 6 Sampling & Testing Frequency of Hot Mix Asphalt. This will be introduced starting January 1, 2013 and will become a standard for all future contracts. Contractors will be informed at the Annual Contractors Meeting.	City presently able to obtain quality control test results in accordance to Ontario Provincial Standard Specification. City will ask contractor for the quality control test results for our records.
4	The City lab should immediately begin testing gradation and asphalt cement content according to the job mix formula as specified under OPSS 310 – Construction Specification for Hot Mix Asphalt.	Our laboratory started testing the gradation and asphalt cement content of the job mix formula in June 2012.	As stated, this has been implemented in June 2012.

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5	Costs and quantities related to major items used in change orders should be identified and tracked separately under the change order item in progress payments.	This was performed in the past when requested by the Project Manager. To be consistent, this had been implemented as of July 2012.	As stated, this has been implemented in July 2012.
6	The City's current standard and tolerances to achieve a three percent cross fall on new construction, reconstruction or when grinding is done during a resurfacing or rehabilitation process, should be clearly stated in the contract.	Will state or indicate 3% crossfall and tolerances in standard drawings & specifications effective January 1, 2013. Contractors will also be made aware of this standard and tolerance at the Annual Contractors Meeting.	When required, will indicate in contract specifications on resurfacing contracts effective January 1, 2013. Construction projects always have 3% crossfall shown on construction drawings. Will also advise contractors at Annual Meeting in February 2013.
7	The City should improve policies, procedures and reports supporting accountability for rejection of incorrect cross fall as specified in the contract and/or drawings in order to comply with City standards.	Will research policies and procedures of the Ministry of Transportation and other municipalities in Ontario. Time frame may be 12 to 18 months.	Outstanding.
8	The City should communicate their willingness to accept RAP in the job mix formula for local roads in accordance with OPSS standards.	Will communicate our willingness and encouragement to local asphalt suppliers to use RAP in the production of hot mix asphalt. Will communicate this to contractors at the Annual Contractors Meeting.	At meeting held with local asphalt producers, made them aware of our willingness. Will also advise contractors at Annual Meeting in February 2013.
9	The City should communicate their willingness to accept RAP mixed with Granular A and Granular B Type I in accordance with OPSS standards.	Will communicate our willingness and encouragement to local aggregate suppliers to use RAP in the production of granular products. This will be communicated to contractors at the Annual Contractors Meeting.	Pending.

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10	The City should continue to identify further opportunities for cost savings where road work is planned so that the asphalt removed from one road can be used on other nearby City use(s). The objective is to minimize trucking costs while recycling the greatest volume of RAP possible (in its highest and best use) to the advantage of the City.	Have performed this recommendation in the past and will continue to do so. Will continue to monitor best practices and other uses. (i.e. shouldering around guiderails, washouts, etc.).	Have involved our Operations staff on the use of milled asphalt.
11	The City should continue to work with other interest groups and other Departments that could use the City's RAP in their nearby projects.	Have performed this recommendation in the past and will continue to do so. By January 2013, establish a request process where a master list will be created and maintained.	Pending.
12	Ownership and disposition of RAP should be clearly stated in the contract documents.	Will include appropriate clauses in contract specifications for all future contracts starting January 1, 2013.	Pending.
13	If alternate City uses are not identified for the RAP, they should be directed to go to the contractor.	Have performed this recommendation in the past and will continue to do so as contractors become better equipped to handle large volumes of RAP.	As stated, will continue to do this.

Quality Control (QC) and Quality Assurance (QA) of Hot Mix Asphalt

The Ontario Provincial Standard Specifications (OPSS) standardize the production of asphalt and the construction of hot mix asphalt throughout the Province. They are specified in City contracts. These standards are for both Quality Control (QC) and Quality Assurance (QA). The QC and QA specifications ensure that the client is receiving the product that has been specified in the contract documents. Quality Control is testing performed by the Contractor to ensure the quality of the materials meet specifications. Quality Assurance is testing performed by the Owner (the City) to ensure the quality of the materials meet specifications.

To ensure Quality Control, the local asphalt producers must have a certified laboratory and certified technicians. This certification process is very stringent where the laboratory equipment is checked and calibrated on a set schedule and the laboratory technicians have the necessary certification. This certification process is performed every year. All the local asphalt producers have certified laboratories and certified technicians.

The Canadian Council of Independent Laboratories (CCIL) represents the independent testing industry in Canada. There are over 330 member facilities across the country. CCIL has approved the laboratory of all three local asphalt producers.

The material specification and asphalt cement content for the mix design criteria are specified in OPSS 1150 Material Specification for Hot Mix Asphalt (see Exhibit 1 attached). These charts specify the allowable range for the gradation requirements for the various types of hot mix asphalt along with the asphalt cement content. From the specifications, the asphalt producers prepare a Job-Mix Formula which identifies the gradation and asphalt cement for each type of asphalt that will be produced at the plant. The Job-Mix Formula will be dependent on materials that are available at the plant or can be produced at the plant. The Job-Mix Formula for HL3 will be different for each asphalt supplier, and Sudbury will not be the same as North Bay or Barrie. OPSS 310 Construction Specifications for Hot Mix Asphalt (HMA) specifies tolerances for the Job-Mix Formula (see Exhibit 2 attached).

OPSS 310 also states the following:

"If the HMA is deemed borderline for aggregate gradation or asphalt cement content according to Table 7, the Contractor shall be notified in writing by the Contract Administrator and shall take the immediate corrective action through process control at the HMA plant. A total of three borderline test results for the same attributes representing up to 5,000 tonnes of HMA production shall result in the work deemed rejectable.

If the HMA is deemed rejectable according to Table 7, both the Contract Administrator and the Contractor shall review, agree, and identify the limits of rejected HMA that has been placed. Referee samples within the limits of the affected area shall be delivered by the Contractor to a mutually agreed upon third party referee laboratory to verify aggregate gradation or asphalt cement content or both. When the results from the referee samples area deemed rejectable according to Table 7, the HMA pavement shall be removed and replaced with acceptable HMA pavement. Alternatively, the Contract Administrator may accept a guaranteed maintenance bond, an increased maintenance period, or a negotiated price adjustment."

Asphalt samples are obtained in the field as the asphalt is being placed. These samples are taken back to our laboratory where the asphalt sample is checked for gradation and asphalt cement. Our laboratory had been testing the sample to gradation and asphalt cement content

to determine if OPSS 1150 was met; however, the Job-Mix Formula should have been checked in accordance to OPSS 310. In reviewing all the previous samples and comparing our results to OPSS 310, the predominant sieve that did not meet the gradation specification was primarily the 600um sieve (see Exhibit 3).

SIEVE	WEIGHT	% RET.	% PASS	SPEC.	
26.5					
19.0					
16.0				100	
13.2	32.0	1.5	98.5	98-100	
9.5	340.1	15.5	84.5	75-90	
4.75	834.3	38.1	61.9	52.5-67.5	
2.36	1067.5	48.7	51.3	36-60	
1.18	1325.8	60.5	39.5	25-58	
600	1697.6	77.5	22.5	23.4-33.4	out of spec 0.9 %
300	1916.4	87.5	12.5	7-26	
150	2035.1	92.9	7.1	3-10	
75	2116.2	96.6	3.4	1.7-7.7	
PAN	2191.0				
AC	5.67			4.7-5.7	

EXHIBIT #3

However, it is not the final decision on the rejection of the asphalt placed. Samples prior and preceding this sample would be examined to determine if a trend existed on the asphalt being delivered from the plant. Also, a request for the asphalt testing performed by the laboratory of the asphalt producers would be obtained in order to determine if we have obtained a sample that is not representative. Examining our test sample results with the asphalt producers' laboratory results will determine if additional testing would be required. Should additional testing be required, then a more comprehensive test of the sample's properties would be performed. This comprehensive test will determine rejection or acceptance. This comprehensive test will be performed by a certified third party referee laboratory. Depending on the results of the third party testing, then the necessary corrective action would be according to OPSS 310.

The City's Quality Assurance (QA) reporting procedure for hot mix asphalt has changed as a result of the Auditor General's report. Any questionable testing results are now immediately brought to the attention of management and the Contractor for resolution/action.

The chart below illustrates the number of hot mix asphalt samples that did not meet OPSS 1150 (our testing procedures) and the number of samples that did not meet OPSS 310.

The last column shows the number of additional samples that were discovered by performing the additional test to OPSS 310.

# of Samples Not Meeting Specifications			
Asphalt Type	**OPSS 1150**	**OPSS 310**	**Additional**
HL3	24	24	0
HL8	4	4	0
HDBC	20	22	2

During the audit, only the Quality Assurance test results were reviewed. This only represents a portion of the actual material testing as the Contractor also performs testing as part of their Quality Control. Throughout the Province, both the Quality Assurance testing and the Quality Control testing are reviewed in the assessment of construction projects.

As stated in OPSS 310, there are several alternatives for the Contract Administrator to consider when assessing test results. These alternatives range from removal of the material, to an extended warranty, to a price adjustment on the contract.

Quality Assurance – Road Crossfall

In all our capital projects where a road is reconstructed, rehabilitated, or widened, the crossfall of 3% is illustrated in a typical section on the contract drawings. On a resurfacing contract, where the existing roadway is milled or the asphalt removed, the crossfall is reinstated at 3%. Although this is not stipulated in the contract specifications on resurfacing contracts, it was understood through the years of working with local contracts that our standard was 3% where achievable.

The Auditor General indicated that the crossfall was not indicated in our specification for resurfacing contracts. This recommendation on specifying the crossfall shall be included in all contracts going forward.

Although a 3% crossfall will be specified, it will be difficult to achieve this crossfall when the following situations arise:

- Road widening when widening may occur on one side or both sides.
- All approaches to intersections, where each leg must be examined for drainage.
- Where resurfacing is planned and existing conditions must be met for driveways and commercial entrances.
- The existing high point in the crossfall is offset to accommodate left, right, centre lanes or any combinations of the above.
- The rehabilitation treatment may not be able to make a grade correction.

The Ministry of Transportation (MTO) Construction and Inspection Task Manual states “Paving an incorrect super-elevation or cross-fall (tangent sections) or full super areas only is a major deviation”. Although this statement is self-explanatory, the length of reconstruction projects on provincial highways is more than in urban areas. MTO will tender contracts that are 10 kms in length where there are no driveways, no commercial entrance and very few signalized intersections. It is an easier task to lay hot mix asphalt on long stretches of new construction where a roadway did not previously exist versus placing hot mix asphalt on roadways where there are restraints in an urban environment.

On page 94 of the MTO Construction Task Manual, it also states in reference to Major or Minor Deviation:

"It should be used as a guide in deciding whether a deviation is Major or Minor in nature".

The City of Greater Sudbury has not adopted this manual.

Reclaimed Asphalt Pavement (RAP)

The material that is produced when the existing asphalt is milled from the roadway (removed by mechanical means) is known as milled asphalt or cold-planed asphalt or grindings. RAP is the end product that is achieved by removing foreign material from the milled asphalt, screening to achieve proper gradation, removing or crushing the large segments of asphalt and stockpiling for future use.

The value of RAP is dependent on the location of where the asphalt grindings are generated. The haul distance from the grinding operation, to the crushing/processing location, and to the final destination comes at a hauling cost. Often with projects at a large haul distance, the production of asphalt grindings becomes a liability for the owner. In past projects, the City has specified that the asphalt grindings be reused in a short haulage distance to minimize costs and maximize value.

To achieve an acceptable RAP, the following must be achieved:

1. Asphalt cement types should be stockpiled separately.
2. Crack sealing material should be minimal.
3. There should be no contaminated material in the mix.
4. QC and QA must be in place for the production.

Although OPSS permits the use of RAP, it may not be economically feasible to produce RAP if quantities required for the production of hot mix are not warranted. Although it is estimated that RAP could be sold, the local suppliers of hot mix asphalt have indicated that there is currently no demand for this product.

The competitive tendering process will determine the best end use of the asphalt grindings, unless the City specifies a specific high value use in the contract. The following uses of asphalt grindings are common on City projects:

1. Stabilization of road base – Some of the grindings on any particular contract remain on the project site and become part of the road base. This could be through a recycling technology, blending with aggregate, or to provide a temporary driving surface during construction staging. Asphalt grindings could also be used on shoulders, or other high maintenance areas, to minimize future maintenance costs.
2. Overbuild a nearby road – On recent contracts the City has used the asphalt grindings from one project to overbuild and strengthen a nearby road. This technique minimizes the handling/hauling of the asphalt grindings, and eliminates the problems with stockpiling.
3. Use for maintenance needs – Relatively small volumes of asphalt grindings can be used by City work crews to treat areas that are prone to erosion, such as shoulders and between guiderails.

There is limited use for RAP in hot mix asphalt since OPSS does not permit RAP in heavy duty binder course (HDBC), Superpave (SUper PERforming PAVEment) or HL3HS (hot laid type 3, high stability). However, OPSS does allow RAP to be blended with granular materials to produce various types of granulars (i.e. Gran A, modified B, etc.). As stated above, should it be economically feasible for the RAP to be blended to produce granular materials, then market forces will decide.

Cold In-Place Recycled Expanded Asphalt Mix (CIREAM)

CIREAM means the in-place mixture or plant mixture of existing reclaimed asphalt pavement (RAP), corrective aggregate or active filler or both if required and expanded asphalt. The design requirements of the mixture, materials, equipment, and placement of CIREAM follow OPSS 335 Construction Specification for Cold In-Place Recycled Expanded Asphalt Mix.

The CIREAM process and resurfacing will increase the overall strength of the roadway in comparison to the previous roadway structure. In addition to increasing the overall strength, the cost for the CIREAM process in comparison to hot mix asphalt is lower thus allowing more rehabilitation work to be performed at the same cost. For example, in the Radar Road contract, CIREAM was approximately 30% of the cost for the equivalent virgin hot mix asphalt. This resulted in a savings of approximately $640,000 for the contract.

There were problems with the Wet Tensile Strength and Dry Tensile Strength tests of CIREAM. This problem was not unique in the City as it occurred throughout the entire province. Although the tests failed, the material was not considered rejectable. The problem was that the sample tested at the laboratory was not representative of the material placed in the field. After much consultation with experts in the field of asphalt, a new specification was developed and the Ontario Provincial Standard Specification was revised.

As with any recycling technology, the quality of the end product is directly dependant on the quality of the material being recycled. This was the case with the Radar Road contract, when the testing for the CIREAM process identified that the asphalt cement in the existing asphalt was deficient. While specifications for strength could be met in a controlled laboratory setting, the City was advised that the field recycling process may not meet with the current specifications. In reviewing the options with the contractor and third party laboratory, the City accepted the risk and proceeded with the CIREAM process. The results of the QA/QC testing determined that the majority of the strength was achieved as well as the cost savings identified above.

Areas that do not meet the specification are being monitored during the warranty or extended warranty period. Should distresses in the asphalt be identified, additional field samples will be taken by a third party referee laboratory. Once results from these samples are received and reviewed, then a decision on the type of corrective action will be taken with consultation from the experts in the asphalt industry.

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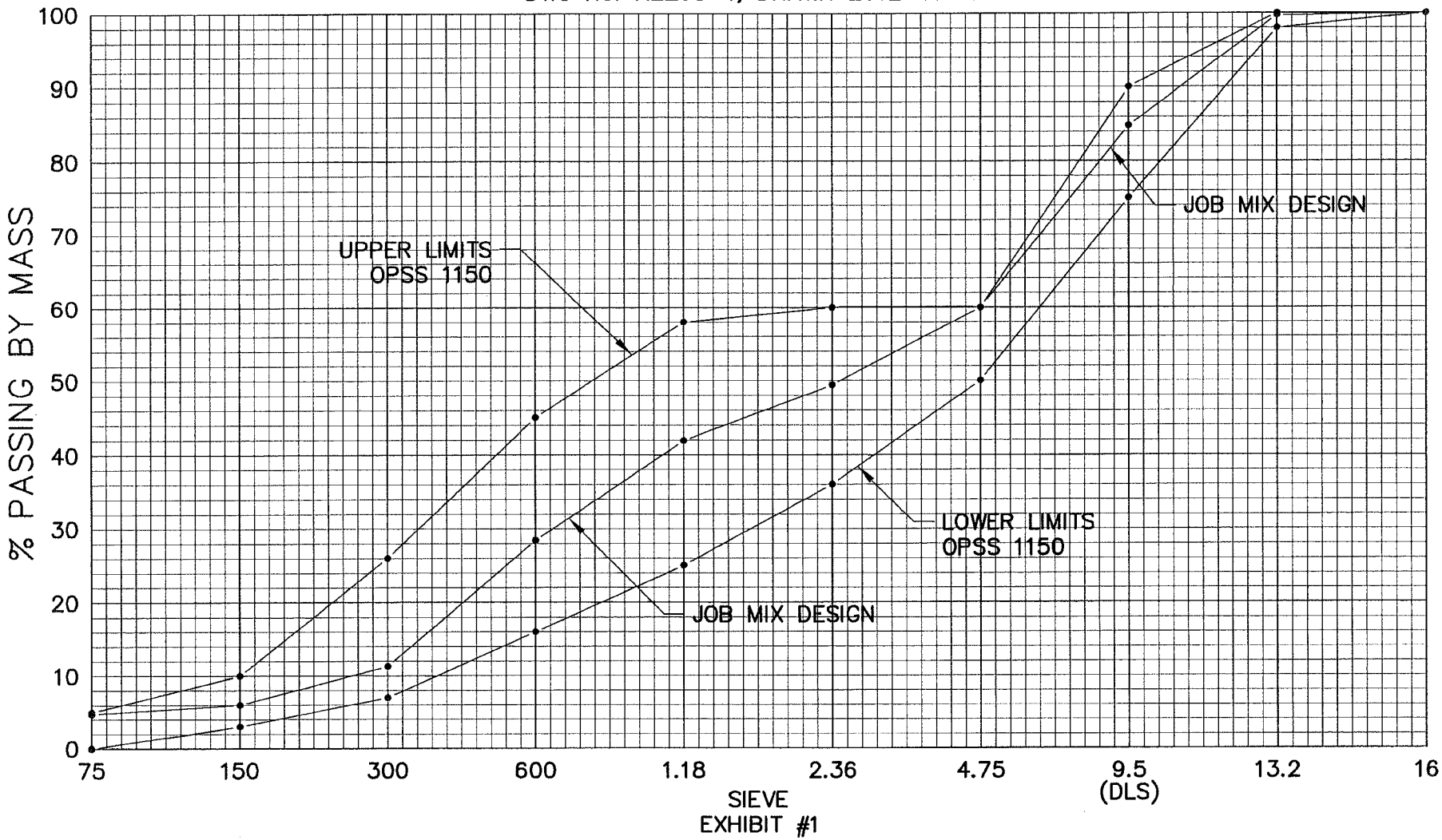
JOB FORMULA – MIX DESIGN, HL–3 SURFACE ASPHALT
GRADATION REQUIREMENTS – OPSS 1150

DWG No. A2268–1, DRAWN 2012–11–23



TOLERANCES FOR JOB FORMULA – MIX DESIGN, HL–3 SURFACE ASPHALT
GRADATION REQUIREMENTS – OPSS 310

DWG No. A2268–5, DRAWN 2012–11–26