**Posting Title:** Cross Slope Tolerance Specification

**TCP #:** 000-0052

**Closing Date:** January 19, 2022

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| **Comment** | **Response** |
| Is the Ministry aware of the extra costs involved? This will also impact existing barrier walls structure crash systems, and storm drainage structures. | MTO understands that existing infrastructure may make it difficult to meet tolerances and this will be taken into consideration when excluding sections for cross slope tolerance requirements in the designer fill-in section. |
| Perhaps, these tolerances should have been determined following a prior industry discussion, or review of multiple projects to determine if they are realistic. Allowable tolerances for underlying pavement layers (e.g., granular base, concrete base, etc.) will affect the ability to achieve these very stringent cross-fall tolerances on asphalt layers. | It is the position of the ministry that additional trials would not be of any value. |
| The relaxed frequency of measurements has a significant impact on tolerances. | Lot and sublot system will capture a representative sample of cross slope. Consideration is being made for the use of continuous statistical measurement for acceptance using ARAN machines. Availability of machines is a limiting factor in this regard but is expected to improve in coming years. |
| Old pavements having cross slope issues require extensive repairs. Tolerances are extremely difficult to meet on a rehabilitation contract due to existing conditions (e.g., existing cross-falls, tying into existing components and features). | Option for relaxed cross slope acceptance based on allowable design tolerances added to the special provision for contracts involving lighter pavement treatments such as mill / pave. The use of this special provision is at the discretion of design staff who will exercise discretion when considering the ability of a contractor to meet its requirements, particularly when resurfacing existing pavements. |
| What milling specification will MTO be utilizing in conjunction with this specification? The current milling requirements typically instruct the contractor to mill the same depth across the pavement width. With the implementation of this spec, that will no longer coincide. Variable depth milling will need to be employed. | MTO is introducing a 3-D milling specification which will facilitate the use of this specification. As noted above, discretion will be used when including on contracts using existing removal specifications. |
| It clearly does not address measuring cross slopes in super elevated sections of the roadway. | SP applied equally to tangent and superelevated sections. Wording clarified to reflect this. |
| There is no dispute resolution clause either. A formal referee process has not been outlined. | This is not a complex enough requirement to warrant a dispute-resolution mechanism. |
| Is a measured cross slope that is say 0.3% higher than the design really a problem? It would seem that, the danger to safety is when the cross slope gets too shallow and slows the moisture run-off. Historically MTO has accepted 0.5 percent tolerance. | There have been no formal tolerances specified in construction contracts to date. Informal tolerances that may have been applied in the field by CA’s do not serve as a precedent. While cross slopes exceeding the upper limit of the range may not pose as much of a hydroplaning risk, the contractor is expected to demonstrate good quality control to achieve the proposed tolerances. Poorly constructed cross slope can manifest as exaggerated distortions as the road settles and is exposed to wheel loading over time. |
| 313.07.07.02.01 – having each course true to the cross slope seems excessive and impractical as we are staggering joints on the lower lift, having the lower or upper binder within 0.2% of the 2% design slope, where the crown is offset by 300mm does nothing for the performance of the final product. This should be a QC issue for the Contractor to manage. | Measurements are only required on binder courses to be opened to public traffic for a period of one month or longer. |
| 10. 313.08.01.08.01 – measuring the binder course for cross slope acceptance is excessive, its like measuring for smoothness acceptance on each lift… only the final course should be measured for acceptance. Same issue as above. | See above |
| 313.08.01.08.02 – Measurement should occur and documented prior to opening lanes to traffic. Contractors should not be held responsible for damages thereafter. | Wording changed to require measurements to be taken prior to opening lane to traffic. |
| 313.08.01.08.03 - the limit of 0.2% is too tight, the MTO has always accepted 0.5% as the tolerance – this should not change. The accuracy of a smart level is 0.1 degree, which is less accurate than 0.1%. Human error when using these devices is much larger i.e., the slope inadvertently not being measured perpendicular to centreline. The degree of accuracy in taking measurements is substantial compared to the tolerances to be achieved. Therefore, the acceptance tolerances of 0.2% and 0.35% are low and not constructible. We need to understand the MTO’s reasoning for setting such a tight acceptance limit and the risks of not having these limits met. Can MTO provide the data utilized to determine these “constructible” tolerances? | Disagree that a smart level is not appropriate. These are used in design to determine required cross slope correction for resurfacing and provide adequate accuracy. Tolerances were based on a jurisdictional scan of Canadian and American jurisdictions, several of whom use tolerances as stringent as 0.2%. Full scale field experimentation has proven that a high-quality electronic level placed on a 3m straight edge can reliably read percentage cross-slope values to within an error of 0.1 compared to digital level survey with millimetre accuracy. |
| 313.08.01.08.05 - We strongly suggest MTO implements an exemption list consistent with section 8.01.02 of SP 103F31 excluding item (h) related to the 400 m lane length. In addition, substituting item (i) with: transition areas into and out of superelevated sections of roadway irrespective of curve radius. Sections with curbs should also be exempt. | Not necessary to list exceptions to the same level of detail as SP 103F31. Transition areas from tangent to superelevation will be exempt from the requirements of the special provision. Locations where elevation matching is required such as curbs, barriers, existing pavements, etc are also exempt. |
| What types of contracts does the MTO intend to implement this specification on? i.e., freeways, 2 lane highway, etc. Are there any exemptions on locations to be tested? Intersections, turn lanes, bridge decks? | Use is at the discretion of the regional Project Delivery, Geotechnical and QA sections who will evaluate the appropriateness and practicality of the use of the SP. |
| Will there be any extra allowance for the time required to complete this testing? Paving windows only seem to be getting shorter and shorter. | Project managers will need to consider the critical path impacts when considering the use of this SP. |
| The specification is basically saying that, any electronic level purchased at the hardware store with an accuracy of =or- .1 degree is a suitable measuring device. These “electronic” levels are rarely accurate. | The use of a smart level is consistent with other jurisdictions and is used for determining existing cross slope during design. |
| The accuracy of + or - .1 degree is equivalent to + or - .17% slope, so the tolerance equals the acceptance (+-.2%). Acceptance tolerances of 0.2% and 0.35% are seemingly low. Based on our historical profiling data, a tolerance of 0.5% - 1%, or greater would be more reasonable criteria. | Tolerances revised to 0.3% for a lot and 0.4% for an individual sublot |
| No QC/QA carries a 3-meter straight edge, which means they are going to take the 1.22 meter “electronic” level and set it on top of the paving crews 3-meter straight edge; when is the last time you have seen a straight edge that stays straight? | 3m straight edge is required for QA measurement of surface tolerance in OPSS 313.08.01.03 and should be available on site. |
| 90% of the slope issues we deal with involves disagreements with QC/QA/inspectors/foremen using “electronic levels”, and taking the reading of a $200.00 level against the accuracy of a $40,000 slope system on a paver or mill. | Noted |
| Our experience suggests that, the maximum tolerance of a paver is 1/8” in 10 feet, or .1% slope. | Noted |
| HMA tender items measured by square metres should be exempt as the operationally guiding parameter is lift thickness for these items. Would a payment adjustment processed be considered to deal with cross-fall issues? If so, we suggest payment by the tonne of mix when utilizing this specification. | Specification may be used on contracts with asphalt paid for either by tonnage or square metres. If crossfall correction is required, the contract will be structured accordingly. Otherwise, the contractor will be required to control their operations as appropriate. |
| Warrant - Tolerances are extremely difficult to meet on a rehabilitation contract due to existing conditions (e.g., existing cross-falls, tying into existing components and features). MTO should consider omitting this specification from rehabilitation contracts. When the contract prescribes partial road width paving, this specification should not apply. | See response to 4th comment |
| Has the MTO considered technology similar to the high-speed profiler that can measure continuous crossfall for the roadway? All locations could be evaluated simultaneously and a simple payment system could be applied. Such technology may/may not exist. However, it does seem like this is a step backwards. | See response to 3rd comment |
| These electronic levels are not exactly reliable, and should not be utilized in construction, and the amendment to the specification really does not make sense. | Electronic levels are adequate for their proposed use in this specification. Reliability has been demonstrated in full-scale field experimentation. |
| We would still like to ask the Ministry how they came about their suggested tolerances? The required accuracy measurements may require expensive survey equipment to measure points and calculate the slopes. How is MTO performing pre-engineering to ensure the contractor can achieve cross slope, HMA lift thickness, elevation, smoothness, and compaction? These criteria cannot be considered in isolation; they need to be considered together. Variability of the underlying pavement treatments a (e.g., Hwy. 404 – Fast Track patches at Owner specified areas, Hwy. 401 – concrete bases, FT patches, rout and seal of existing base) affect the ability to achieve tolerances. | Based on jurisdictional scan of Canadian and American road authorities and verified in field experimentation. As noted above, application of this SP will be judicious based on achievability. |
| We strongly suggest MTO to provide existing and final elevation profile data to determine cross falls for the subject contract for information purposes only when this specification is utilized in order for the contractor to determine the necessary corrections. It is necessary for the Ministry to provide this data at the bid stage to enable Contractors to allocate resources and determine material quantities and costs (grinding, additional survey, etc.). | Elevation data will be provided when the 3-D milling specification is used. Otherwise contracts will be screened to ensure cross slope tolerances are achievable. |
| We also want to emphasize that, this specification might be better developed through cooperation with the industry, and are suggesting a task group approach. This is an important issue that we need to stay in front of and work with MTO for a better version of this SP. We propose delaying the implementation of this specification for one year until data can be collected to determine constructible tolerances. When the specification is implemented, we suggest a TODRF for the first two years. | See response to 2nd comment |