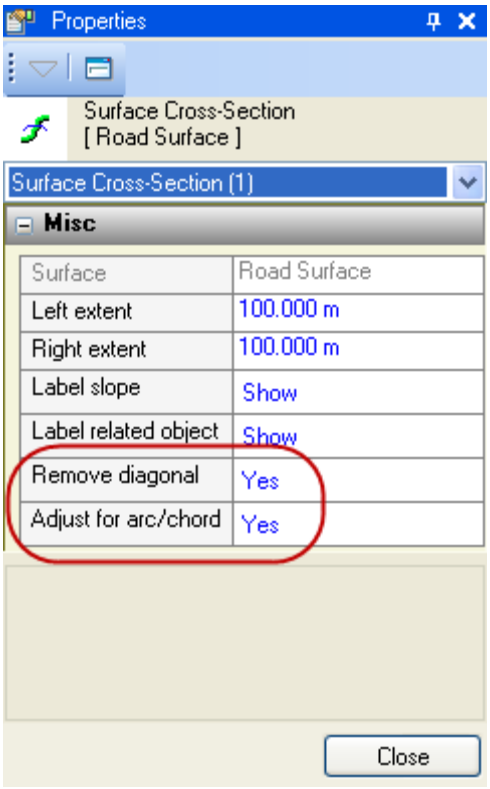
Potential Differences in Road Surface Model Interpretation between TBC-HCE, GCS900, and SCS900

In Trimble® Business Center - Heavy Construction Edition (TBC-HCE), you can create a road surface model using an alignment and a surface. You can then slice the road surface along the alignment to create cross-sections and display them in the **Cross-section View**. Two properties shared by all of the resulting cross-section objects affect how those cross-sections are generated and displayed. The properties are:



- **Remove diagonal** - This specifies whether a single diagonal triangle edge between two roadway feature breaklines is ignored when a surface is sliced to create a cross-section. By not slicing these diagonal edges, the warping effects of transitions, such as superelevations, can be properly reflected in the displayed cross-section, rather than simply reflecting the geometry of the TIN approximation.
- **Adjust for arc/chord** - This specifies whether a cross-section is adjusted laterally to follow the related horizontal alignment when the surface is sliced to create a cross-section. Again, this better represents the intended cross-sectional shape of the roadway, as opposed to its TIN approximation, which can differ significantly.

These settings are enabled (set to **Yes**) by default, but can be changed in the **Properties pane** associated with a displayed surface cross-section object by picking a cross-section, right-clicking and selecting **Properties**. These settings, even though established in the context of a particular cross-section's properties, are applied to all cross-sections associated with the specified surface and alignment.

It is important to note that these setting have no affect on the shape of the related surface. They only affect whether cross-sections of that surface, as associated with the subject alignment, faithfully represent the surface's shape, which is typically an approximation of the actual intended surface, or whether they reflect an interpretation of the intended shape of that surface.

Known issue:

When a road surface is exported from TBC-HCE to a grade control system (GCS), such as Trimble GCS900 or Caterpillar® AccuGrade™, the effects of the two cross-section properties described above are not reflected within the resulting SVD file, which faithfully represents the shape of the TBC-HCE surface. Therefore, when you export a road surface to GCS, you have no assurance that the cross-sections displayed in TBC-HCE, potentially as interpretations of the intended cross-sectional shape of the surface, exactly reflect that actual surface as used in GCS. Additionally, site controller software (SCS), such as SCS900, by default reflect these two cross-section properties, regardless of whether they are enabled in TBC-HCE. Consequently:

- The SVD file sent to GCS900 faithfully represents the related surface in TBC-HCE, which can optionally differ from the interpretation of that surface cross section's shape as seen in a cross-section view.
- Road surface cross-sections displayed in GCS may not match those displayed in TBC-HCE, unless you turn off these properties in TBC-HCE. If you instruct TBC-HCE to display uncorrected cross-sections, both TBC-HCE and GCS will reflect the road surface design as specifically indicated by the TIN-based approximation of the intended surface.

Note: GCS900 computes cross-section data along a machine's blade, not perpendicular to the centerline as in TBC-HCE; this is another source of differences between GCS900 and TBC-HCE computed cross-sections.

- Other than editing the related settings in the Terramodel .pro file that is output for use in SCS900, there is currently no way to make SCS900's interpretation of a TBC-HCE road surface model match that of GCS900's, and there is no warning about these discrepancies. Furthermore, what you see in TBC-HCE's cross-section view may not match what you see in either SCS900 or GCS900. The cross-sections and roadway feature locations that are staked and used for grade checking in SCS900 will likely far better approximate the design intent than the surface from which they were derived, in the same manner that the settings above enable TBC-HCE to interpret the surface's cross-sections.

Ramifications on grading a road:

Imported design roadway surface data may be a poor approximation of the intended roadway surface, depending on the density of the surface or stored cross-section data in the original engineering design data. Due to the known issue described above, the means by which TBC-HCE displays cross-sections may differ from those actual surfaces, which are used in GCS. Additionally, due to the fact that SCS and GCS applications employ different data formats, SCS900, by employing methods similar to those described above when displaying cross-section in TBC-HCE, may produce surface elevations at any given point, which differ from the approximations exhibited by the TIN based surface approximation. For bulk earthworks, the impact should be minimal, but for fine grading, the discrepancies may be significant. Grade checks may fail, due to the approximations inherent in a machine's road surface model, since SCS900 will typically be basing its analysis on the above described interpretation of the intended roadway cross-section at any given location.

What you can do:

Although many roadways have been successfully constructed despite this limitation of cross-sectionally defined and TIN-based roadway models, to mitigate the potential differences in road surface model interpretation between TBC-HCE, GCS900, and SCS900, you should always use the most densely-triangulated surfaces that you can. **In addition, you should always check your final design data to confirm that it fits your required level of accuracy before you begin earthwork operations.**