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The following levels of analyses should be undertaken to satisfy risk assessment criteria:

- (a) Simple analysis: this analysis is limited to a quasi-static case and does not allow calculating dynamic coupler forces through the train. The analysis should be performed in risk assessment cases when the train and track operational parameters are known but the train operational parameters are subject to insignificant changes in values.
- (b) Full analysis: this analysis considers the longitudinal behaviour of the train as a function of train control inputs from the locomotive, train brake inputs, track design characteristics and vehicle connection characteristics. In this analysis, the lateral and vertical movements of the vehicles are not considered. The analysis should be performed in major risk assessment cases and allows determining in-train forces and energy usage.
- (c) Advanced analysis: this type of analysis presents additional extensions to the full analysis that focus on the interaction of longitudinal train dynamics and lateral/vertical rail vehicle dynamics and it can be performed in longitudinal train dynamics simulators or multibody software packages. The longitudinal train dynamics and multibody simulation approaches can be combined to deliver comprehensive simulation results. This analysis should be performed for the following risk assessment scenarios:
  - i. Wheel unloading, wheel climb and rollover on curves due to lateral components of coupler forces;
  - ii. Rail vehicle body and bogie pitch due to coupler impact forces;
  - iii. Rail vehicle lift-off due to vertical components of coupler forces;
  - iv. Infrastructure damage.



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