Mass Haul Computation Details

Road Unit Costs

Mass Haul (site-based) considers two types of roads:

- Inter-zone roads: these are the roads used to transport material between two zones within the site. Inter-zone roads can be auto-created or explicit.
- Offsite roads: these are the roads used to transport material between an offsite zone and a zone in the site.

Inter-zone road unit cost

Inter zone road unit cost is the cost of moving a unit of material from zone *a* to zone *b*. This includes the cost of collecting, transporting, and dispersing the material. The actual cost of cutting and compacting is not considered in the computation. Mass haul (site-based) computes inter-zone unit costs using three components:

- Collection cost at the source (zone *a*): C_a
- Transportation cost from zone *a* to zone *b*: T_{ab}
- Dispersion cost at the target (zone *b*): D_b

Formula:

$$U_{ab} = C_a + T_{ab} + D_b$$

Offsite to zone unit cost

Offsite to zone unit cost is the cost of bringing a unit of material from the offsite zone to a zone within the site (borrow cost) and dispersing it in the zone. The borrow cost includes the cost of buying the material and transporting it to the site. Note that in the interest of keeping the Mass Haul (site-based) simple to use, the borrow cost is the same regardless of the destination zone in the site (i.e., the cost of bringing a unit of material from offsite is the same regardless of the destination zone). The actual cost of compacting is not considered in the computation. Mass haul (site-based) computes offsite-to-zone unit costs using two components:

- Borrow cost (from offsite zone *b*): $Borrow$
- Dispersion cost at the target (zone *b*): D_b

Formula:

$$U_{ob} = Borrow + D_b$$

Zone to offsite unit cost

Zone to offsite unit cost is the cost of collecting a unit of material within a zone in a site and bringing it from that zone to the offsite zone (waste cost). The waste cost includes the cost of transporting the material from site and dumping it offsite. Note that in the interest of keeping the Mass Haul (site-based) simple to use, the waste cost is the same regardless of the source zone in the site (i.e., the cost of bringing a unit of material to offsite is the same regardless of the source zone). The actual cost of cutting is not considered in the computation. Mass haul (site-based) computes zone-to-offsite unit costs using two components:

- Collection cost at the source (zone *a*): C_a
- Waste cost (from zone *a* to offsite): $Waste$

Formula:

$U_{ao} = C_a + Waste$

Transportation unit cost

Currently, Mass Haul (site-based) computes transportation depending on the type of road:

- Auto-created roads: Use the Default Unit Cost per Volume per Length (user input) and the road length (geometric centroid of zone *a* to geometric centroid of zone *b*).
- Mass Haul Roads: Use the parameters defined in that instance to compute the unit cost. Currently, each instance has a specific unit cost per volume per length. The unit cost is computed using this value and the length of the road.

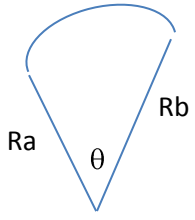
Collection and Dispersion Unit Costs

Collection and Dispersion unit costs are computed using the following simplifications:

- Each zone consists of a set of triangular arcs
- Material is uniformly distributed within each triangular arc
- Unit cost is computed by multiplying the average haul distance (computed) with the Default Unit Cost per Volume per Length (user input).

Average Haul Distance of a Triangular Arc

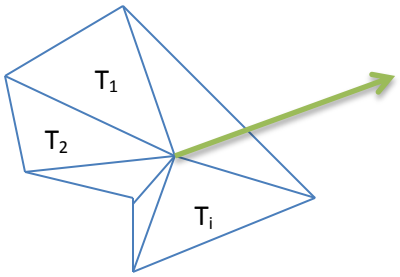
The following figure illustrates a triangular arc and the objective is to transport all the material (assumed to be uniformly distributed with thin the arc) to the vertex of the arc.



In this case, the average haul distance of a triangular arc (T_i):

$$\overline{d}_i = \frac{1}{2}\frac{(R_a^3 + R_a^2 R_b + R_a R_b^2 + R_b^3)}{(R_a^2 + R_a R_b + R_b^2)}$$

The average haul distance of a zone (polygonal shape) can be approximated as a set of triangular arcs (T_i), all sharing the same vertex: the extreme of the road.



The average haul distance is the weighted average of all the haul distances for each triangular arc:

$$\overline{d} = \frac{V_i \overline{d}_i}{V_i}$$

Where V_i is the volume of each triangular arc.

Note: the assumption that material is uniformly distributed makes the collection and distribution average haul distances equal in value.