CONVEYOR ACCESSORIES
BELT FASTENERS & TOOLS

RIV-NAIL

Technical Bulletin

Bulletin # 1012

Belt Transition in a Troughing Application

Most bulk haulage utilizes troughing idlers to carry loads. Conveyor idlers support the belt as it conforms to the angle of the outside rolls. When the belt goes from "flat to troughed" or "troughed to flat", the geometric line of travel of the outer edges of the belt exceeds the central line of travel. As edge tensions of the belt are increased, the belt and belt fabric must either stretch or travel at a much higher speed to complete the transition.

This edge tension can be kept within safe limits if proper transitions are used with the conveyor systems. Both manufacturers of conveyor belting and conveyor idlers recommend and provide data to follow when designing conveying systems. Included in that data are recommendations for *Terminal Pulley Locations*, *Minimum Transition Distances*, and *Locations of Transition Idler Arrangements*. While the data and recommendations are provided, seldom are the reasons given to explain "why" the recommendation should be followed.

An example is the best way to illustrate the dynamics of a transition. First some assumptions:

Belt Speed	800 feet per minute
Belt Width	60"
Troughing Idler	35°
Transition	None, Full trough depth
Distance Idler to Terminal Pulley	5'

Under these conditions the center of the belt will travel at the rate of 800 feet/minute and the two outer edges will travel at the average rate of 968 feet/minute in the transition. The fact is that the belt cannot change from 800 to 968 instantly as it leaves the troughing idler. In a like manner, the belt edge must slow down as it reaches the terminal pulley.

Therefore, if the average speed is 968 feet per minute, as the speed increases from 800 fpm and slows to 800 fpm, the speed is significantly higher at the outer edges. The actual speed may be 1,000 fpm, or more. The total time to travel 5 feet is only .375 seconds.

The stress on the belt edge is huge. It is also true that the two points of the junction from flat to troughing are subject to stress and longitudinal flexure. The first condition contributes to intense elongation of the belt fabric. As the belt stretches and then returns to its original length, shear develops between the fabric and the rubber plies and covers. This will weaken the bond, if not totally destroy the bond. The result will be to have the belting fail within the splice.

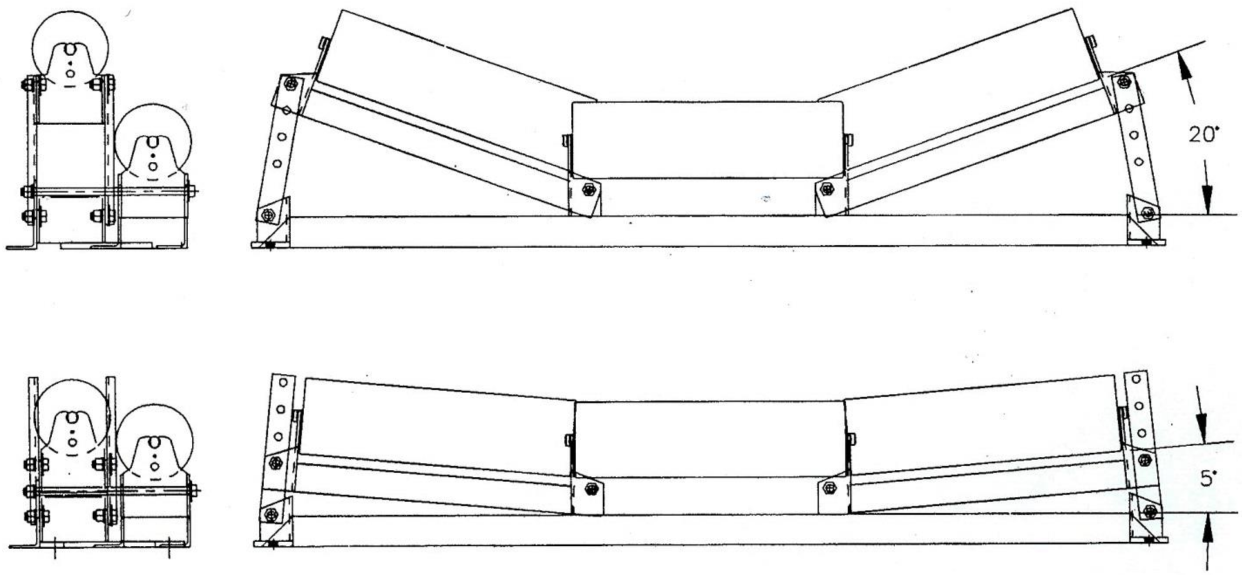
The second condition is idler junction fatigue or failure. The belt and or belt splice must flex both vertically and longitudinally simultaneously. The “whip-saw” action/reaction accelerates in very short transitions. If recommended transition distances are followed, the “whip-saw” phenomenon is minimized.

The example used is found in typical applications, creating excessive wear and tear on hinge pins and belt fasteners. Hinge pin failure at the idler junction is common. Fastener failure is also common at the idler junction and conveyor belt outer edges.

The best remedy is to follow the recommended guidelines of transitions. In this case, the recommendation would have had a transition of 15–16 feet with reduced angle idlers. The result would be the edge and center would both travel at essentially the same speed, minimizing stress at the idler junctions and belt edges.

precision idler

SELECTION OF TRANSITION IDLERS



Transition idlers are used to support the belt between a terminal pulley and the first standard idler. PRECISION transition idlers are available in two models: Model 20TET provides a variable trough angle from 5° to 20°, and the Model 35TET provides a variable trough angle from 20° to 35°. Standard idlers work well as transition idlers in most situations as shown in table 3.3.

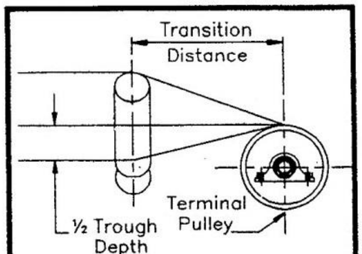


TABLE 3.1 b=Belt Width

PULLEY AT ½ TROUGH DEPTH

Idler Angle	% Rated Tension	Fabric Belts	Steel Cable
20°	Over 90	0.9b	2.0b
	60 to 90	0.8b	1.6b
	< than 60	0.6b	1.0b
35°	Over 90	1.6b	3.4b
	60 to 90	1.3b	2.6b
	< than 60	1.0b	1.8b
45°	Over 90	2.0b	4.0b
	60 to 90	1.6b	3.2b
	< than 60	1.3b	2.3b

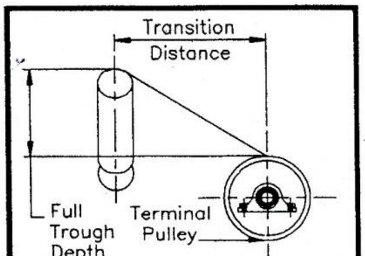


TABLE 3.2 b=Belt Width

PULLEY AT TROUGH DEPTH

Idler Angle	% Rated Tension	Fabric Belts	Steel Cable
20°	Over 90	1.8b	4.0b
	60 to 90	1.6b	3.2b
	< than 60	1.2b	2.8b
35°	Over 90	3.2b	6.8b
	60 to 90	2.4b	5.2b
	< than 60	1.8b	3.6b
45°	Over 90	4.0b	8.0b
	60 to 90	3.2b	6.4b
	< than 60	2.4b	4.4b

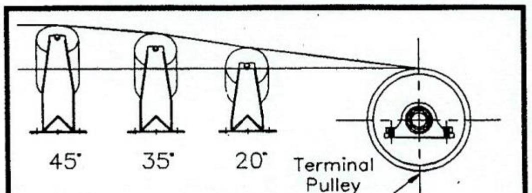


TABLE 3.3

TRANSITION IDLERS

Idler Angle	MINIMUM DISTANCE SUGGESTED TO IDLER	TRANSITION ARRANGEMENT
20°	1.0 x Belt Width	-------
35	1.5 x Belt Width	35° – 20°
45	2.0 x Belt Width	45°–35°–20°

If distance to the first standard idler is greater than the suggested spacing in tables 3.1 and 3.2, the use of transition idlers is recommended.