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THE TALE OF TWO TRANSFERS

Phil Wowak, ASGCO, USA, discusses two case studies that look at improving engineering transfer points – the first involving multiple load points and the second concerning a complex stacker reclaim system with a reversing belt.

The successful operation of a conveyor system transfer point requires the material to be loaded properly onto the receiving belt so dusting and spillage are kept to a minimum and to comply with stringent environmental regulations. In today's world, where it is necessary to increase conveyor efficiencies, while reducing the operating cost, the conveyor transfer points must be properly engineered using the best designs and components in order to accomplish these goals.

The most common transfer point is a simple one conveyor to another in either a straight line or where the belts are oriented at a slight angle to each other, travelling in one direction. These types of single point transfer chutes are relatively easy to design.

Where it becomes a challenge is when there are multiple feed points on the system or when the receiving conveyor is a reversing belt. Engineering of these transfer points needs special considerations and components that are not normally incorporated in the more common examples given above.

Case study 1

This first case study involves a 350 ft long 54 in. wide incline conveyor travelling at 700 ft/min., which is loaded from two feeders under a rotary car dumper at a rate of 2000 tph of bituminous coal fines at a midwestern steel mill. To facilitate a blending requirement, a secondary load point was installed 130 ft downstream from the initial loading point.

Figure 1. Primary load point.

First challenge

Due to structural and elevation issues with the original design of the primary load zone, 20˚ troughing idlers had to be installed under the load chute impact area. The belt was then immediately transitioned to 35˚ troughing idler in less than 4 ft, while still in the skirt seal area. The width of the skirting load area also exceeded the recommended two thirds of the belt width. This type of idler transition is not recommended with such a short distance in the skirted loading area. This created a material leakage and dusting issue, as well as the need to adjust and replace the skirting seals due to flexing of the belt in this short transition. The belt was only supported with these 20˚ idlers on 24 in. centres under the loading point. Internal wear resistant skirt seal liners were not used in the load zone, which also contributed to the excessive leakage and the need for constant vacuum cleaning of the pit area under the railcar dumpers (Figure 1).

Figure 2. Secondary load point.

Second challenge

The secondary load point that was added to the system in order to blend product did not have a continuous skirt seal area from the primary loading point up stream, which caused the material on the belt to be ploughed off onto the ground when surge loading or belt mistracking occurred. The load profile on the belt was too wide due to the 20˚ idlers and loading chute that exceeded the maximum width at the first zone. These issues also created the need for weekly coal spillage clean up using costly vacuum trucks, as well as excessive air born dusting (Figure 2).

Figure 3. Secondary load point and full length skirt tunnel.

Solution

In order to correct these problems, it was necessary to redesign and retrofit both the primary and secondary load points, while still being limited with minimal headroom and structural obstructions in the primary transfer point.

The engineered solutions involved using the 20˚ troughing profile under the primary load point and then extending the transition distance over a longer distance before changing to the 35˚ idlers downstream. An intermediate 27.5˚ modular framed troughing idler was used in this transition, as well as modular impact and slider support beds to allow for a constant seal between the belt and skirting.

A skirting tunnel section that incorporated the externally mounted inner skirting wear liner was installed the full length between the first and second load zones. In addition, the second load point was retrofitted with modular impact load support beds and an extended exit skirting tunnel with several dust curtains throughout the full length. The externally mounted

Figure 4. Reclaim conveyor.

Figure 5. Off-centre loading onto yard belt.

internal wear liner protects the skirt seals and allows for easy maintenance and replacement from the catwalk, eliminating the need to remove the skirting covers or having to work from inside of the chute (Figure 3).

This engineered retrofit solved all of the spillage and dusting problems, while eliminating the costly need to completely redesign and replace the existing conveyor system.

Case study 2

The second case study involves a stacker reclaimer conveyor system at a major northeastern coal-fired power plant. It proved to be more complicated and required a more in-depth solution that included a 3-DEM material flow analysis to solve some of the problems. The chute was designed to transfer up to 1400 tph of bituminous coal from the 42 in. reclaim conveyor to the 60 in. reversing yard belt. The reclaim conveyor speed is 700 ft/min. with a capacity of 1400 tph during reclaim operation. The 60 in. reversing yard conveyor speed is 850 ft/min. and has a capacity of 3000 tph in stack out mode (Figure 4).

Challenge

This transfer point was a major problem area for the coal yard operators. While in reclaiming operation, the chute would build up and plug when running wet coal or during freezing conditions. Chute heaters, vibrators and internal baffles were added but the problem still remained. Due to the angle of discharge onto the 60 in. receiving conveyor, off-centre loading caused serious belt mistracking and constant spillage and clean up issues. Electric heat tracing of the chute was installed to help prevent freeze-up during winter operation, as well as several vibrators to try and keep the coal flowing. With all of these installed, they still experienced major coal buildup and plugging of the chute, which caused delays in sending coal to the power plant (Figure 5).

Solution

To solve some of these problems, various chute simulations were created and evaluated using 3 DEM™ chute design software. During the final review and approval of the chute design, a problem was discovered due to a frequently occurring operator error. During stack out at 3000 tph, the operator can cause the system to reclaim at the same time – going the wrong way on the belt. Thus this causes up to 1400 tph to go the wrong way on the yard belt. The only way to make it work would be to use a split chute design with a diverter gate and actuator. The coal yard supervisor was reluctant to incorporate a diverter gate into the new design because of the problem of the gate freezing up during winter operations.

How do you change the direction of the coal stream inside a transfer chute without using a diverter gate? The design engineers came up with a solution that used a movable deflector hood in the head discharge area to divert the coal stream into one of two outlet chutes. This design eliminated all of the buildup and freezing issues that occur when using an in line, swing blade diverter gate (Figure 6 and 7).

A new transfer chute was modelled and designed to allow the coal to be loaded onto the receiving belt, moving in the same direction, speed and in the centre. The new design also eliminated corner buildup and reduced wear due to impact and misdirection. The adjustable upper deflection hood was power actuated to prevent a chute overload when the upset condition (i.e. reclaiming while stacking out) was occurring. The hood was automatically positioned in the head chute to direct the coal during either stack out or reclaim. This prevents a chute overload during the upset condition.

Three different types of internal wear liners were used in different areas of the transfer chute, depending on what type of abrasion was occurring. A chromium carbide overlay plate was used in the high-velocity flow area and either UHMW or a hardened stainless steel liner was used in the splash and dribble chute areas.

The new transfer chute now operates without buildup and the coal flow is centre loaded onto the 60 in. receiving belt at the same speed and direction. This reduces wear and belt mistracking, as well as fugitive dusting and spillage clean-up. There is no longer a need for chute vibrators and the plant has still not re-installed the heaters.

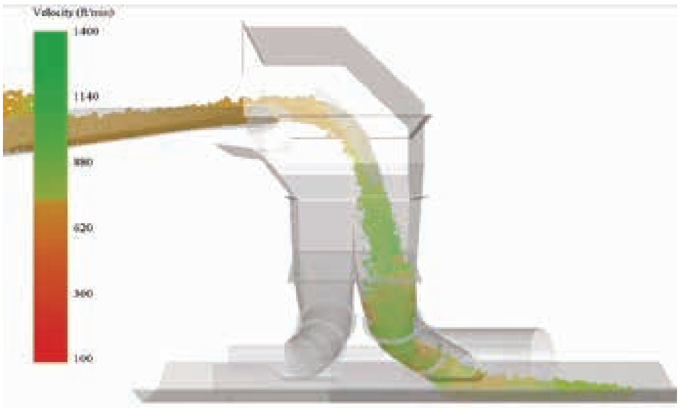

Figure 6. Hood in reclaim mode.

Figure 7. Hood in stack out mode.

Figure 8. Before (left) and after (right) installation of the new transfer chute with movable deflector gate in the head discharge area and two outlet chutes.

Conclusion

To create an efficient, safe and reliable transfer point, there are many essential products that eliminate spillage, control dust, support the belt and make the system more productive and safe. Several products have been discussed in this article; but not all. Effective belt cleaning systems, belt tracking devices, dust fogging systems and more are often necessary to reduce spillage and dusting, as well as operate in compliance with all of the current regulations that are now in place. WC