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Performance Evaluation of TLS II CC 07 and CC 08 Load-out in July 2022 at PT. Bukit Asam Tbk, Tanjung Enim, South Sumatra

Muhammad Abbil Raihan [1], Adree Octova [1]
[1]Department of Mining Engineering, Universitas Negeri Padang, 25131, Indonesia.
*Corresponding author: albinto88.at@gmail.com Orcid ID:

ABSTRACT
Coal is one of the fuels sourced from solid hydrocarbons. Bataubara itself is formed from plants and microorganism that solidifies due to the influence of pressure. The use of coal as a fuel is widely used in large industries, such as the cement industry and in steam power plants. administratively the mining concession of PT. Bukit Asam, Tbk. is included in the Tanjung Enim City, South Sumatra Province. In July 2022, there was a torn Coal Conveyor-07 (CC-07) incident that disrupted productivity at TLS 2 (Train Loading Station) so that it could not deliver coal, causing losses to the company with a total of 42,562 tons. With a total loss of Rp. 28,372,329,681.
INDEX TERMS ***Coal, Belt, Sumatera.***

I. INTRODUCTION
Coal is a sedimentary rock which is chemically and physically heterogeneous containing the elements carbon, hydrogen and oxygen as the main component elements and sulfur and nitrogen as additional elements. Other substances, namely inorganic compounds forming ash (dust), are dispersed as separate mineral substance particles throughout the coal compound. In summary, coal can be defined as a carbonate rock in the form of solid, brittle, dark brown to black, flammable, which occurs as a result of chemical and physical plant changes. (Eliot, 1981)
Coal is also one of the natural resources which is quite abundant in Indonesia, based on data released by the Geological Agency, the potential for coal mines in Indonesia is 161 billion tons spread across Kalimantan Island (47%) and Sumatra Island (53%) one of the companies coal mining located in Sumatra, namely PT. Bukit Asam, Tbk.

PT. Bukit Asam, Tbk The Tanjung Enim Mining Unit is a company engaged in coal mining which has reserves of 3.33 billion tons and resources of 8.17 billion tons (PT. Bukit Asam, Tbk. 2020). Coal marketing PT. Bukit Asam, Tbk through Tarahan Harbor and Kertapati Pier. Mining activities carried out at the Air Laya Mine (TAL), Muara Tiga Besar (MTB) and Banko Barat (BB) sites. PT. Bukit Asam, Tbk gives a name or mine brand to the production results, namely AL (Air Laya), MT (Muara Tiga Besar) and BB (Banko Barat). From the production results produced by each mining site, then the most important thing that plays a role in determining the continuity of the mining business is the efficient management of coal that has been carried out by the Coal Handling and Transportation work unit (PAB). The unit is one of the determinants of the quality and quantity of products produced. Coal received from the mining front will enter the stockpile (load-in) and the loading of coal from the stockpile to put it into the railroad cars through the Train Loading Station (TLS) is called (load-out). PT. Bukit Asam, Tbk has loading coal using 5 (five) Train Loading Station (TLS) facilities that are already in operation, TLS 1 is used to load coal into railroad cars from stockpile 1 coal obtained from mining results from the Air Laya Mine (TAL), TLS 2 is used to load coal from stockpile 2 coal obtained from TAL and MTB (Muara Tiga Besar) mining, TLS 3,4 and 5 coal obtained from Banko Barat (BB) mining results. This observation focuses on the load-out process that occurs in TLS 2.

In July 2022 the coal delivery target is 610,000 tons. While the realization of coal shipments was 569,574 tons in July 2022, it is necessary to evaluate the TLS 2 load-out performance in July 2022.

II. STUDY LITERATURE AREA AND DATASETS
2.1. COMPANY PROFILE
PT. Bukit Asam, located in Tanjung Enim, Lawang Kidul District, Muara Enim Regency, South Sumatra Province with a distance of 186 km from the center of Palembang City and a distance of 779 km from the center of Padang City, West Sumatra.

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IUP area of PT. Bukit Asam Tbk. located at position 103˚ 45' E - 103˚50' E da 3˚42'30"S - 4˚47'30" or longitude 9,583,200 - 9,593,200 and latitude 360,600 – 367.00 in the international coordinate system .

Mining Business Permit Area (WIUP) PT. Bukit Asam Tbk. divides the mining area into two parts, namely the Air Laya Mine (TAL) and the Non Air Laya Mine (NAL). has an area of mining authorization can be seen in Table 1 below:

TABLE 1
AREA OF MINING BUSENISS PERMIT (WIUP)
PT.BUKIT ASAM TBK.

No	Scope of Mining Area	Area (Ha)
1.	Laya Water	7,621
2.	Non Air Laya	
	a. The Big Three	3,300
	b. West Bangkok	4,500
	c. Bangko Tengah Block A	2.4323
	d. Bangko Tengah Block	22,937

TABLE 2
COORDINATES OF WIUP
PT BUKIT ASAM TBK.

X	Y
354095	9590030
354095	9525105
359873	9590037
359879	9585124
359821	9593690
359931	9582850
366821	9593727
366876	9582795
366877	9588814
366902	9579895
371789	9588839
371789	9579857

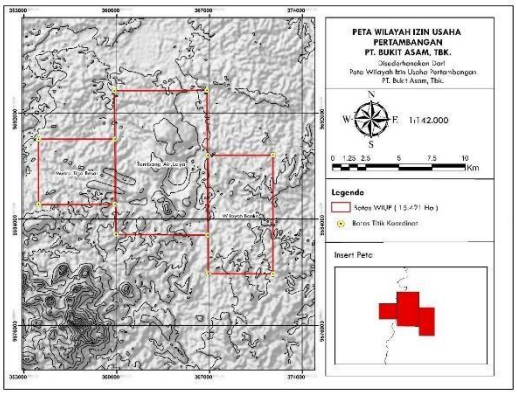

Figure 1. WIUP PT. Bukit Asam, Tbk

2.2. TYPES OF COAL

The coalification process is known for its impact on the movement of coal rank (Anggayana, Komang. 2005). Coal rank can be defined as the degree of formation. Changes in rank can occur due to "forced ripening" by intrusion which has an impact on variations in coal layering in the intrusive areas.

In general, coal rank consists of lignite with the lowest rank to anthracite for the highest rank. The heating value ranges from less than 7,000 Btu/lb in lignite to 15,00 Btu/lb in low-volatile bituminous to anthracite. Coal rank does not always vary within a coal basin. Changes in rank can result in changes in analytical parameters, such as volatile matter, fixed carbon, caloric value, moisture, and vitrinite reflectance.

2.3. COAL TRANSPORTATION

Transportation is part of the most important activities of coal. In general, coal mines that are located far from mining sites use transportation so that efficient coal transportation is needed (Muchjidin, 2006). In mining in Indonesia, transportation generally uses trains, trucks and barges while exporting coal is carried out using large-capacity ships.

PT. Bukit Asam, Tbk has Tarahan Port and Kertapati Dock to transport coal to consumers and for coal filling systems using Train Loading Stations (TLS). Currently the world's coal mining industry also uses TLS systems such as the United States, Australia and South Africa.

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TABLE 3
COAL CLASSIFICATION BASED ON ASTM (2005)

Kelas/Grup	Batas Karbon Tetap (%) (*Dry Mineral Matter Free*)		Batas Material Volatil (%) (*Dry Mineral Matter Free*)		Batas Nilai Kalor (Btu/lb / MJ/kg) (**Moist Mineral Matter Free*)		Karakter Aglomera
	= atau >	<	=	= atau <	= atau >	<	
Antrasit							
Meta-antrasit	98	-	-	2	-	-	Tidak beraglomer
Antrasit	92	98	2	8	-	-	
Semi-antrasit	86	92	8	14	-	-	
Bituminous							
Low volatile	78	86	14	22	-	-	Biasanya beraglomer
Medium volatile	69	78	22	31	-	-	(mungkin
High volatile A	-	69	31	-	14.000**/32,6	-	ada varieta
High volatile B	-	-	-	-	13.000**/30,2	14.000/32,6	yang tidal
High volatile C	-	-	-	-	11.500/26,7	13.000/30,2	beraglomer kecuali pa grup *high volatile C*
					10.500/24,4	11.500/26,7	Beraglomer
Subbituminous							
Subbituminous A	-	-	-	-	10.500/24,4	11.500/26,7	Tidak beraglomer
Subbituminous B	-	-	-	-	9.500/22,1	10.500/24,4	
Subbituminous C	-	-	-	-	8.300/19,3	9.500/22,1	
Lignit							
Lignit A	-	-	-	-	6.300/14,7	8.300/19,3	
Lignit B	-	-	-	-	-	6.300/14,7	

The types of coal based on formation can be divided into 5 levels based on the content in the coal.

2.2.1 Peat (Peat)
In this evaporation phase it is still considered coal because the initial phase of coal formation still shows a high moisture content of > 75%.

2.2.2 Lignite (Brown Coal)
Coal in this phase has a water content of about 30%, while in the lignite phase it has a high volatility that can cause self-ignition.

2.2.3 Sub-bituminous
In this phase, coal has an average water content of 1530%, in a dry state, this type of coal can burn by itself and has a low level of sulfur content.

2.2.4 bituminous
In this phase it is often used in steam power plants because it contains 5,800-7,000 calories with volatile matter levels ranging from 50-54% .

2.2.5 Anthracite
In this last phase, the highest grade coal has a fixed carbon value of between 86-98% with a water content of around 3% and has low volatile matter .

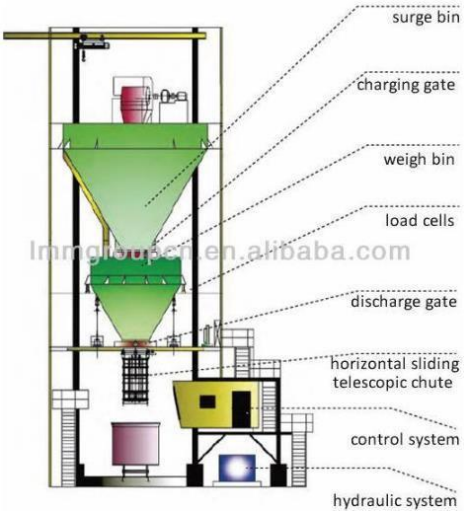

Figure 2. Part of TLS

2.4 Conveyor Belts
In an industry, sometimes there are heavy and dangerous materials that cannot even be carried or transported by humans, so transportation aids are needed to overcome these human limitations in terms of manpower to maintain the occupational safety and health of workers in the industry. For this reason, conveyor machines have been chosen as an effective and efficient means of conveying solid industrial materials. (Alfian, 2011)

Receiving coal by stockpile 2 is carried out using belt conveyors and dump trucks. belt conveyor whose material comes from the Muara Tiga Besar (MTB) pit and dump trucks whose material comes from the Air Laya Mine Pit (TAL).

Basically Belt Conveyor is quite simple equipment. The device consists of a belt which resists the transport of solid objects. The belt used in this conveyor belt can be made from various types of materials, for example from rubber, plastic, leather or metal depending on the type and nature of the material to be transported. To transport hot materials, the belt used is made of heatresistant metal. (Aris Wijaya, 2016)

The working principle of the Conveyor Belt is to move the material with the rotation of the motor, the main drive of the motor is connected to the pulley. The pulley is covered by a belt that is wide and long according to the carrying capacity and distance. (Zainuri, 2006). The advantages of transportation using a Conveyor Belt are that it works optimally, works automatically, is easy to start operations and continues to operate continuously. Conveyor belts have almost no pause to stop when operating, nor are they constrained by bad weather and belt conveyors also only require power less than other means of transport. (Hartman,

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1992)

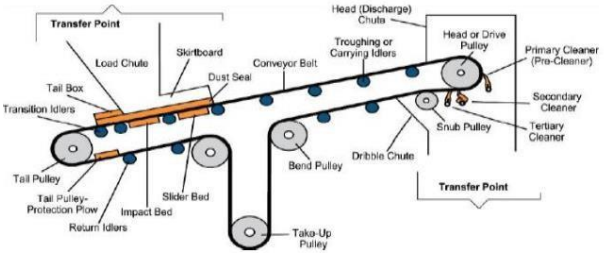

Figure 3. Conveyor Belt

According to the standards of the *Conveyor Equipment Manufactures Association* (CEMA), the basic construction of a conveyor generally consists of:

2.3.1 *Tail Pulley* (under certain conditions *Drive Pulley* with *Drive Unit* attached to it).
Tail Pulley serves to follow the direction of movement of the *belt* .

2.3.2 *Snub Pulley* (at *Head-End* and *Tail-End*).
The Snub Pulley serves to increase the angle of the *Belt winding* on the *Drive* .

2.3.3 *Internal Belt Cleaner (Internal Belt Scraper).*
Internal Belt Cleaner serves to clean the remaining material attached to the *Tail Pulley.*

2.3.4 *Impact Idlers (Impact Rollers).*
Impact Idlers function to support belts with empty loads and are located at the bottom of the *Carrying Idler* .

2.3.5 *Belts* serves to receive the transfer of motion energy from the rotating *Pulley , the Belt* will transport material from one end of a *Conveyor Belt construction* to the other end.

2.3.6 *Bend Pulleys* serves to bend or change the direction of the *belt* .

2.3.7 Take-Up Pulley functions to be able to move automatically to compensate for *the Conveyor Belt operation*

2.3.8 *Take-Up*
The unit functions to maintain *belt tension which offsets belt* stretching when hauling operations are being carried out.

2.3.9 *Carrying Idler* serves to support the *belt* that carries material loads.

2.3.10 *Pulley* Cleaners
serves to clean the remaining material attached to the *Pulley* due to friction with the *Belt.*

2.3.11 *External Belt Cleaner (External Belt Scraper)*
serves to clean the rest of the material on the *Head Pulley*

2.3.12 *Head Pulley* (as *Discharge Pulley* and also *Drive Pulley*)
serves to distribute rotary motion energy to the *belt* so that *the belt* moves. (CEMA, 2007).

Coal is grouped into a medium material group which has a different density from iron ore which is classified as a very heavy group. The following is a table of material groupings based on their specific gravity:

TABLE 3
MATERIAL DENSITY

Berat	Berat ton/m^3	Material
Ringan	Sampai 0,6	*Saw DIst, Peat, Coke*
Sedang	0,6 – 11	*Wheat, Coal, Slag*
Berat	1,2 – 2,0	*Sand, Gravel, Core, Raw mix*
Sangat berat	> 2,0	*Iron corem Cobbe Stone*

From the characteristic size of the material, it will form a surcharge angle or material pile angle at the top of the conveyor belt. This angle determines the area of the transport area. If the size of the material is in the form of small grains, it will experience abrasion and form a small surcharge angle, whereas if the transported material is in the form of large lumps, abrasion will not occur, so it will form a large surcharge angle.

Conveyor capacity for horizontal belt conveyors and diagonal conveyors or with an inclination angle, can be calculated using the equation. (Bhavan, 2010).

$$C = A \times v \times \gamma \times k \times 3600$$

note:
C = Total Transport Capacity (Tons/hour)
A = Material Cross-sectional Area (m ^{3})
Belt Speed (m/s) γ= *Bulk Density* (Tons/m ^{3}) k = Inclination Factor

In general, Conveyor Belts that are used as transportation for moving abrasive materials such as Coal, Ore and Concentrate use 3 Idlers. The cross-sectional area of the conveyor material using 3 idlers can be calculated using the equation. (Bhavan, 2010).

$$A = K\,(0{,}9b - 0{,}05)^2$$

note:
A = Material Cross-sectional Area (m ^{2})

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K = Coefficient of Cross-sectional Area
Belt Width (m)

The formula used to calculate the cross-sectional area value of the material that can be transported by *the Conveyor Belt* based on the number and size of the *idlers* . (Bhavan, 2010)

Idler with 3 Same Size *Rollers* A
$= K\,(0{,}9b - 0{,}05)^2$

$$h = \frac{b}{2} - \frac{t}{2}\sin\lambda + \left(\frac{t}{2} + (b-t)\right)\cos\lambda)\ tan\beta$$

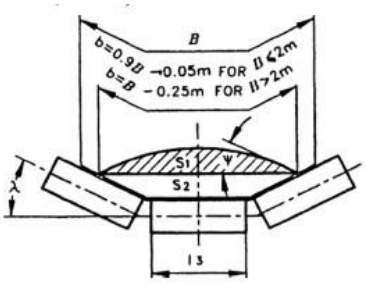

Figure 4.

III. METHODE

If you are using *Word*, use either the Microsoft Equation Editor or the *MathType* add-on (http://www.mathtype.com) for equations in your paper (Insert | Object | Create New | Microsoft Equation *or* MathType Equation). "Float over text" should *not* be selected.

In carrying out this activity there are several processes of implementing company activities that the author follows for data collection in the field. In July 2022 shipments that will be sent via TLS II, namely:

TABLE 4
JULY 2022
COAL RAIL SHIPMENTS

Bulan	Tujuan Pengiriman	Jumlah (Ton)
Juli	TE-TARAHAN	497.441
	TE-KERTAPATI	72.132

Source: PAB Work Unit PT. Bukit Asam, Tbk 2022

The mechanism for transporting coal begins with pushing coal using a *bulldozer* to the *vibrating feeder* from *stockpile* 2, then entering the *coal conveyor 07* (CC 07) after from CC 07 then bringing CC 08 to then filling the *surge bin* with a maximum capacity of 500 tons using 4 gates from the TLS 2 unit, the coal stored in the *surge bin* will then be spilled into the *wight bin* with a capacity that has been adjusted to the demand from consumers.

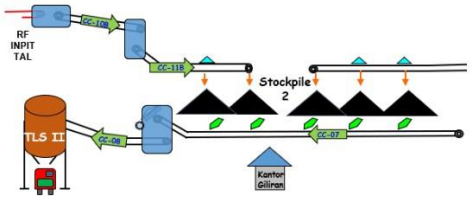

Figure 5. Coal Transport Mechanism

In the data collection process at PT. Bukit Asam, Tbk the author does this by taking secondary data. Secondary data is data or information that already exists indirectly through intermediary media. The data are as follows:
3.1 TLS realization time data 2
3.2 TLS downtime data 2
3.3 TLS barrier type data 2
3.4 TLS load time data 2

IV. RESULTS AND DISCUSSION

Based on the results of observations made during the Industrial Field Practice (PLI) activities, the data obtained during the loading and transportation of coal at OPB 2 work unit Penbara West Block with a delivery target of 610,000 tons in July 2022. The actual achievement of actual deliveries on the field is currently 722,544 tons. , secondary data results that the author got from PT. Bukit Asam, Tbk, namely: TLS II Load-Out activity data in July 2022

Load-Out crash hour data in July 2022

TABLE 5
TARGETS AND ACHIEVEMENTS
OF JULY 2022 COAL SHIPMENTS

Rekap Load-out TLS II				
Bulan	Tahun	Target(Ton)	Realisasi (Ton)	Realisasi (%)
Juli	2022	610.000	569.574	93%

Source: PAB Work Unit PT. Bukit Asam, Tbk 202

In July 2022 TLS 2 shipped coal by rail with a delivery target of 610,000 tons, but that was realized that month as much as 569,574 tons of the delivery target or around 93% of the target.

TABLE 6
LIST OF OBSTACLES IN TLS II

Bulan	Jenis Halangan	Total Halangan (Menit)
Juli	Mekanik	480
	Terencana	375
	Operasional	1.105
	Sistem Tambang	90
Jumlah		2.050

Source: PAB Work Unit PT. Bukit Asam, Tbk 2022

The failure to achieve the delivery target in July 2022 at TLS 2 could be due to obstacles when shipping coal. Obstacles

that occurred in TLS 2 in July 2022 were grouped into 4 obstacles, namely mechanical obstacles of 480 minutes (24%), Planned 375 minutes (18%), Operational 1,105 minutes (54%), System.

Mine is 90 minutes (4%) and total blocking hours are 2,050 minutes .

Figure 7. Percentage of TLS II Blockage Hours

TABLE 7
JULY 2022 TIME

Bulan	Jam Tersedia Kalender (Menit)	Jam Jalan (Menit)	Jam Halangan (Menit)	Jam Standby (Menit)
	44.640	24.105	2.050	18.845
Juli	100 %	54.00%	4.59%	41.1%

Source: PAB Work Unit PT. Bukit Asam, Tbk 2022

So in July 2022 the activity time in TLS II is Calendar Available Hours 44,460 minutes, Running Hours 24,105 minutes (54%), Barrier Hours 2,050 minutes (4.59%), and *Standby Hours* (41.1%).

Figure 8. Percentage of TLS II Activity Time
Source: PAB Work Unit PT. Bukit Asam, Tbk

The filling time for the Tarahan train in TLS 2 is with a series of 60 cars with a load of 50 tons per car. The fastest charging time for a series of Tarahan trains is 62 minutes with a Tarahan charging SOP time of 115 minutes and the longest charging time is 514 minutes due to a power outage while charging.

TABLE 8
LOADING TIME FOR TARAHAN TRAINS

Uraian	Waktu (Menit)	Nomor KA	Keterangan Hambatan
Tercepat	62	TE-THN 61-40	Tidak ada Hambatan
Terlama	514	TE-THN 57-40	Listrik Padam

Source: PAB Work Unit PT. Bukit Asam, Tbk 2022

While the filling time for the Kertapati train in TLS 2 by filling the carriages is the fastest with a time of 38 minutes with a series of 37 cars with a SOP filling time of 60 minutes for Kertapati and the longest filling time with a time of 92 minutes with a series of 33 cars due to thin material barriers/long pushes and unstable loco.

TABLE 8
LOADING TIME FOR TARAHAN TRAINS

Uraian	Waktu (Menit)	Nomor KA	Keterangan Hambatan
Tercepat	38	TE-KPT 17-02	Tidak ada Hambatan
Terlama	92	TE-KPT 15-00	Material tipis/dorongan jauh

Source: PAB Work Unit PT. Bukit Asam, Tbk 2022

From the investigation results of the K3 work unit PT. Bukit Asam, Tbk obtained the result that the CC 07 *belt was torn through with a long size. The belt was* torn 6 meters long and 66.5 cm wide. The *belt* was torn from the right of the road band and torn 53 cm from the left of the road band.

TABLE 8
TORN BELT EVENT SAMPLE DATA

Uraian	Tahun 2022	
	Nilai	Satuan
Waktu Perbaikan	28	Jam
Rata-rata Permuatan CHF 2 Load Out Periode Juli 2022	1.520	tph
Harga rata-rata Penjualan Dosmetik (KPTI & TRHN)	Rp. 1.433.239	Rp/ton
Harga rata-rata Pokok Penjualan (KPTI & TRHN)	Rp. 766.631	Rp/ton

Source: PAB Work Unit PT. Bukit Asam, Tbk 2022

When the *belt was* torn, PT. Bukit Asam, Tbk experienced coal delivery time at TLS 2, so that PT. Bukit Asam, Tbk lost profits that should have been able to ship coal.

$$\textit{Loss Production Opprtunity}$$
$$= \text{Rata} - \text{rata pemuatan} \times \text{Waktu Perbaikan}$$
$$= 1.520\ \textit{ton} \times 28\ \text{Jam}$$
$$= \mathbf{42.562\ \textit{ton}/\text{Kejadian}}$$

$$\text{Profit Margin} = \text{Harga Penjualan Domestik} - \text{Harga Pokok Penjualan}$$
$$= \text{Rp. } 1.433.239 - \text{Rp. } 766.631$$
$$= \mathbf{\text{Rp. } 666.608/\text{ton}}$$

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TABLE 8
PROFIT AND LOSS OF TORN BELT INCIDENTS

Waktu Perbaikan (Jam)	TPH/Bulan (ton/jam)	Profit Margin	Loss Production Opportunity (ton)	Kehilangan Laba
28	1.520,08	Rp. 666.608	42.562	Rp. 28.372.169.696

Source: PAB Work Unit PT. Bukit Asam, Tbk 2022

In July 2022 there was an incident where *Coal Conveyor-07 (CC-07) was torn* which disrupted productivity at TLS 2 (*Train Loading Station)* so that it was unable to carry out coal shipments, causing losses to the company totaling 42,562 tonnes. With a total loss of Rp. 28,372,329,68

V. CONCLUSION

In carrying out Industrial Field Practice activities the author gained a lot of knowledge both in the academic field and directly in the field, which can later be applied after graduating from college.

Based on the description in the report on Industrial Field Practice activities, it can be concluded that in the world of work requires a great responsibility, high accuracy and patience for all the work done and discipline in following work regulations and time discipline is our responsibility so that the tasks given can be carried out completed properly and on time. Based on the results of the discussion in accordance with the title proposed by the author, the writer can draw the conclusion that:

1. In July 2022 at TLS 2 (Train Loading Station) it is planned to ship 610,000 tons of coal by rail. However, 497,441 tons of coal shipments were realized by rail to Tarahan Port, Lampung and 72,132 tons to Palembang's Kertapati Pier for a total of 569,574 tons in July 2022.
2. In July 2022 there was an incident where the Coal Conveyor-07 (CC-07) was torn which disrupted productivity at TLS 2 (Train Loading Station) so that coal could not be shipped, causing a total loss of 42,562 tons to the company. With a total loss of Rp. 28,372,329,681.

From the investigation results of the K3 work unit PT. Bukit Asam, Tbk obtained the result that the CC 07 belt was torn through with a length of 6 meters and a width of torn belt

The belt was torn 66.5 cm from the right of the road band and 53 cm torn from the left of the road band.

ACKNOWLEDGEMENTS
Based on the results of the conclusions that have been described, the authors would like to provide some suggestions to support the future Industrial Field Practice (PLI). The suggestions to be conveyed are:

1. Supervise the running of the load-out process and analyze any errors in the load-out process
It is necessary to have a crusher before sending coal using a dump truck , the coal that will be sent to stockpile 2 must be crushed so that the size of the coal to be dumped using a dump truck is in accordance with the size it should be.

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