Adjusters’ Insight

Rolling Stock Claims – Keeping Matters on Track

By Andrew Hodkinson, Regional Head – Australia & New Zealand, Senior Engineering and Resources Adjuster and Omar Mostafa, Senior Engineering and Resources Adjuster

Within the Australian Mining and Freight Industries the need to move enormous volumes of ore to port, or cargo across the country, can be critical to production needs and customers’ supply chains. The most direct way of doing this is often via rail.

The equipment scale during transportation can be staggering with trains hauling hundreds of loaded wagons with combined weights reaching between 50,000 to almost 100,000 tonnes in the example of iron ore. Such trains form their own dynamics requiring careful design and monitoring, specific operator training and enormous power requirements. Track maintenance for heavily used rail can also be an important factor which drives availability.

Given the large upfront investment, such large rolling stock can be difficult to source on an urgent basis, very expensive to purchase, and if damaged, critical to repair quickly and cheaply such that business interruption to the mine is mitigated. Sadly from time to time these trains often find themselves involved in major incidents due to unexpected derailments and collisions resulting from operator error, mechanical or electrical failures, and floods that have affected the track. Each of these types of Insurance claims can come with their own adjusting challenges in terms of repair, replacement and/or rebuild.

In this article, we explore:
- the nature of the property involved and the incidents that can arise
- the various adjusting challenges involved with rolling stock derailments
- what the future risks might look like.
Involved Property

Most Rolling Stock and Track Infrastructure include a few common themes as follows:

- Large in scale;
- The combined weight of the locomotives and wagons (and their payloads) are in the hundreds of tonnes;
- The Original Equipment Manufacturers (OEM’s) often are involved in the maintenance under contract;
- Major components are expensive and take time to source [spares are not always on hand];
- Most ore carrying wagons utilise hydraulic systems for unloading and/or being ‘rotated’ to empty;
- Most require a highly qualified operator, and some are now autonomous (remote controlled).

Consequently, when things go wrong the damage can be substantial and difficult if not impossible to repair to operable standard and economically. The recovery of a stricken train can be an extensive operation, often required in a remote location, and track repairs will require a co-ordinated effort.

In this section we provide by way of background, an insight into the train property and static track involved.

Locomotives

Typically, the trains are powered by diesel electric locomotives due to their isolation and long journeys through remote country.

Diesel electric locomotives are equipped with electric drives in the form of traction motors that drive axles, and which are controlled electronically. Onboard the locomotives are various auxiliary systems for cooling, lighting, heating, braking etc. The large diesel engine is coupled to an alternator that produces the necessary electricity. Weighing many tonnes, the locomotives contain various systems as per Figure 1 overleaf.

Typical locomotives can today produce in excess of 4,500 kW, travel up to 120 k/hr, and can be located at the front, middle or rear of trains.

Worldwide there are in excess of 100 locomotive manufacturers, most of which reside in countries where rail is prevalent such as the UK, USA, Europe, India, Russia and Japan.

Some locomotives can be coupled to a “Control Car Remote Control Locomotive” or also known as “Dummy Locomotive”, which is a normal looking locomotive stripped from its typical systems and equipped with control equipment instead. This is done to be able to remotely control trains during loading and unloading of cargo. This is not to be confused with the fully automated trains which will be discussed in more detail later in this paper.
Wagons

The wagons are often custom-built subject to the bulk product or cargo contemplated, and these days, often sourced from Chinese fabricators. Wagons used for bulk commodities such as iron ore, grain, sand etc are usually custom made utilising a steel ‘bin’, which sits upon a base structure. The frame will typically attach two bogies that include two-wheel sets i.e. four wheelsets per wagon. Depending on the method of loading and unloading, the wagons may be equipped with various onboard hydraulic systems. Such wagons may have underside unloading gates or in fact can be physically lifted and rotated as part of their unloading. The system used is driven by the production levels.

In the case of classic sea-container cargo, these wagons will be simpler in design but perhaps longer in configuration. Such wagons tend to be flatbed structures that can be mixed and matched to create trains.

Aside from the above, if the cargo is chemical or fuel in nature, then bespoke pressure vessel wagons are manufactured to stringent codes.
Cargo

Cargos in the mining industry that are transported by rail are usually dry raw products that have undergone some screening and crushing, but rarely in Australia at least will have been refined. Thus, it is common to have open top wagons for iron ore or enclosed wagons for commodities like wheat, for example.

Cargos have many loading and unloading techniques depending on the product and the type of train used. By way of example, utilising the trains that are fitted with “Control Car Remote Control Locomotive”, train drivers can physically get out of the trains and remotely move it in line with loading/unloading chutes. This is done to save on operating costs (i.e. manpower).

As for domestic or commercial cargos, which are often loaded at a port for transport across the country, the cargo can be wide and varied in its nature. From cars to household contents, through to food products or other saleable goods. Most items can be transported by rail in sea containers.

From the standpoint of derailments, some of the more challenging items that can be transported by rail include dangerous goods, chemicals, and fuel.

Track Infrastructure

Track infrastructure will often include:

- Ballast (specified rock)
- Sleepers (usually concrete but older tracks may use wood)
- Rail (specified steel)
- Drainage (pipes, drains etc)
- Signalling (mechanical, lights, speed & route, safety systems etc)
- Bridges

Much care and design is taken with respect to rail infrastructure which is dependent on the intended rail use, anticipated loads and the environment being traversed.

Track gauge, which is the spacing between the two rails, varies commonly between narrow, standard and broad. This poses restrictions on the interchangeability of locomotives and wagons between the different tracks.

The rail will typically use Chinese or Japanese steel to precise specification, whilst the ballast and sleepers will be sourced locally within Australia. Often track operators will have strategic spare material for rapid response to derailments that will include replacement sleepers, rail and ballast.

The cost of installation is not insignificant as it will normally require heavy mobile plant for earthworks and cranes for installation, not to mention physical labour and transport to ensure that the materials can be located to site efficiently.
Track Maintenance

Due to heavy use, rail can over time lose its integrity. This can be either wear to the rail itself or movement of the ballast/support on which the rail sits due to vibration. Furthermore, the natural weather environment can also affect the rail overtime, particularly in areas where rainfall is prevalent. Another issue can be the fatigue of rail steel due to use and where a minor inclusion within the steel might cause a ‘stress raiser’.

Typical maintenance of track can include:

• Visual inspection and measurement
• Crack testing at rail joints
• Raking of ballast
• Rail grinding/profiling to ensure uniform rail cross-section
• Signal testing
• Sleeper replacement
• Lubricating switches
• Tightening components
• Herbicide treatment of vegetation

Fig. 4: Typical cross-section of track

Fig. 5: Rail grinding (Speno Rail Maintenance Australia Pty Ltd)
Incident Examples

The problem with derailments is the large amount of kinetic energy involved. A single loaded iron ore wagon weighing 100 tonnes travelling at 60 kph holds kinetic energy of \( \frac{1}{2} \times \text{mass} \times \text{speed}^2 \). So, if the train is 100 wagons long, regardless of the locomotive’s weight, the kinetic energy at this speed would be equivalent to a simultaneous car pile-up of 5,000 four-wheel drive vehicles (weighing 2 tonne each). Not a good outcome and this energy is usually dissipated through significant mechanical and structural damage.

There are various causes of derailments including but not limited to:

- Issues of operator error
- Mechanical failure
- Track wash-away/damage from weather events
- Level crossing collisions
- Signalling errors or failure

The following discussion outlines some more specific examples for ready reference. Charles Taylor Adjusting has handled several severe or total loss claims involving derailments of mining and freight trains over the years.

Operator Error

A recent derailment in Western Australia is shown below in Figure 6. This matter involved a combination of alleged operator error and braking issues during an inspection which resulted in the train ‘running away’ without a driver and requiring deliberate derailment.

Fig. 6: Iron Ore derailment (The West Australian)
Mechanical / Electronic Failure

With such large distances travelled, the bearings within the wheelsets can be susceptible to failure. The term ‘screwed journal’ is widely understood throughout the rail industry to describe the failure of a Packaged Unit Bearing (PUB) and the subsequent separation from the wheel set of the axle portion upon which the PUB was assembled.

The PUB is seated over a portion of the axle referred to as the ‘journal’.

Screwed journals can be caused by a multitude of factors including poor manufacturing, poor storage, poor handling or assembly, poor maintenance, overloading, foreign material etc. These factors can lead to the PUB becoming exceedingly hot and the journal is in effect ‘turned’ or ‘lathed’ off the axle. Once this occurs, the bogie can derail leading to the whole wagon or other wagons following off the track. Below in Figure 7 is an image of the bogie assembly where the PUB is located.

Another issue that could lead to derailment is the electronic failure of automated/semi-automated trains. Below in Figure 8, a freight train fitted with “Control Car Remote Control Locomotive” was deliberately derailed after it travelled tens of kilometres with no driver. The driver was outside the train remotely loading it when it stopped responding and “ran away”.

Fig. 7: Typical bogie assembly complete with two wheelsets

Fig. 8: Run Away train deliberately derailed in Tasmania [The Guardian]
Track wash away

By far one of the more common issues leading to derailments is interference with the track from unexpected pooling water that can erode the rail ballast. Even the slightest change in track support can lead to uneven loading and motion of laden or empty wagons, such that the wheels ‘jump the tracks’. This can lead to catastrophic damage as per Figure 9.

It can also be very slight damage to track that can lead to a wheelset ‘jumping’ the track, but not necessarily derailing the train or consist. In these situations, the wheels will impact and damage the concrete sleepers for several kilometres until discovered by the operator. Such damage may look superficial, but in fact will require sleeper replacement and is likely to cause some interruption to the mine.

Level Crossings

Whilst most level crossings have automated boom gates these days, it is still not uncommon for a member of the public to ‘race’ a train in their car or truck and think that they can beat it, only in fact to get in its way. Such incidents are difficult to avoid for the train operators and can lead to derailment.

A less common problem is when the rail expands in extreme heat and buckles or interferes with adjacent rail at a level crossing. Once such incident occurred during summer in Australia and led to a significant freight train derailment at a level crossing as evidenced in Figure 10.

Figure 11 is an image of locomotives which have collided with a truck at a level crossing.
Signalling

Whilst rare, in the event of a signal failure, it is possible for a train to derail, particularly if it is traversing a section of track which holds a railroad switch that has failed in the incorrect position for the train speed. Most train derailments take place at the point when it goes from one track to another track. A loose set up is a guarantee of making a train jump off the track; a disaster.

Reinstatement Challenges

Locomotives

There are two key challenges with locomotive repairs:

1) Firstly, the exercise of physically relocating a derailed locomotive to a suitable repair yard. Given the size and weight of this property (potentially 200 tonne in weight per loco), it can take some effort to locate suitable cranes, and then create access to the derailment site such that the locomotives can be either righted or loaded onto transport. Figure 12 is an image from Guay Inc in Canada lifting a locomotive.

2) The second issue relates particularly to undercarriage repairs. Given the extended use and distances involved with locomotive operations, they can be susceptible to fatigue crack issues. Therefore, the regulators will insist on replacing more items than repairing them, such that equipment integrity, and in turn safety is ensured. This can be an expensive exercise, even in the smallest of incidents. And at instances where there is no apparent damage to the undercarriage equipment (traction motors, bogies, etc.), costs will still be incurred to verify the equipment is sound. These costs will be the result of sending the equipment to their OEMs, fully stripping and testing them, replacing parts that will be compromised during disassembly (i.e. bearings, seals, etc.) and reassembling them.

Fig. 11: This truck was able to derail two locomotives at a level crossing

Fig. 12: Crane lift of a locomotive
Wagons

Whilst wagons involved in derailments also require careful repairs to satisfy rail safety regulators etc, there are a couple of issues which present when repairs are considered, which may lead to an increase or decrease in repair costs.

1) The first is whether the wagon frame is twisted and can be returned to its normal profile. Often the answer will be ‘NO’, as it becomes an uneconomic exercise to try and cut up and heat treat a frame. Thus, a twisted frame can often lead to the wagon being written off. Such wagons can vary in value from AUD30,000 for cargo wagons, through to AUD180,000 for bulk ore wagons. There will be occasions when second-hand wagons can be considered for replacement as a short-term solution to minimise business interruption; nevertheless, the available wagon’s gauge will need to be regarded against the track gauge used by the Operator.

2) The second issue is whether the wheel sets can be recovered. If the wheels hold impact damage, then they may be recovered if the age of the wheels and use is limited. This is because the wheels can be ‘turned’ or ground back. This can be an alternative to simply replacing wheelsets. (Note: depending on duty, wheel sets might be ‘turned’ up to three times during their normal life). If turning the wheels is practical, then this will represent some ‘loss of useful life’ and this can be quantified into dollars. Figure 13 is typical of the condition wheelsets might be found in post derailment.

CTA utilises specialist rolling stock consultants to assist their engineering adjusters in the reinstatement assessments often required in insurance claims, as well as liaising with industry experts to assist clients in sourcing replacement property to minimise the business interruption.

Cargo

Given the release of energy involved in a derailment, it is often the case that most cargo is destroyed. Often it is a very manual exercise to separate out undamaged cargo from damaged cargo.

Where bulk stock such as consumables for supermarkets are involved or electrical goods, it is often the case that such property will cost money to dispose of, rather than yielding any salvage value. Cargo cannot simply be buried local to the derailment site, these days with stringent environmental legislation being active; it is nearly always required that debris is removed and disposed of at the local tip. Chemicals, in particular, represent significant environmental headaches if they are lost in a derailment. Chemicals which can cause pollution to local water courses or the water table can require a considerable clean-up response.

Fig. 13: Separated bogie and wheelset equipment
**Rail Infrastructure**

Restoration of rail as quickly as possible is often the priority post derailment. On many occasions the derailed train will simply be lifted / pushed to one side, such that the track reinstatement can proceed immediately. The reason for this is normally because miners will operate multiple trains to port and must minimise the interruption to their ship loading.

For the very large miners an outage can cost millions of dollars per day. Because of this, track reinstatement equipment and procedures are very efficient, and materials are usually readily available at strategic locations along the rail route so that a derailment can be responded to quickly.

The assessment of business interruption that emanates from derailments will require review of the whole operation and include forensic accounting assistance. CTA will form an Adjusting Team for such assessments.

An example of ‘ready to go’ track sections is provided in Figure 14.

Track reinstatement is often on a like for like basis. There is normally no salvage available and most efforts are around trying to complete the work without impacting the environment in proximity to the derailment locus.

---

Fig. 14: Pre-made sections of rail and sleepers ready for installation

Fig. 15: Often significant earthworks are required to prepare for ballast installation
Environmental considerations

Given that derailments are normally in remote areas, the response time can be delayed, and this may allow for chemicals, particularly in liquid form, to enter the environment and cause contamination.

The clean-up that follows will likely involve removal of all contaminated soil, and this can be taken for disposal at specialist waste disposal facilities or similar. It is not common that soil can be treated at the location of derailment because this is on third party property. Chemical treatments may be required, and the environmental regulator will no doubt send out inspectors to monitor the clean-up progress. This can be a costly exercise for the track and/or train operators. Figure 16 is indicative of the potential for environmental contamination from a derailment. CTA Adjusters are experienced in the environmental requirements and potential liabilities that need to be managed in such situations.

Cause Investigations

Whilst some derailments may be quite straightforward in their cause – for example, a motor vehicle was impacted by a train at a level crossing – in some cases the damage is so great that the cause of the derailment may be difficult to ascertain.

Indeed, some derailments require forensic engineers to assist in the investigation and there can be multiple contributing factors at play.

The parties involved in such investigations have different agendas and approaches, and below are some examples.

Regulators

Regulators will investigate for several reasons including:

- To determine if the track or train operator have breached any relevant legislation
- To determine if licenses are to be maintained
- To ascertain details to prevent re-occurrence and to stipulate future actions
- For safety lessons

Track Operators

Track operators will investigate to determine if they hold any liability for the incident or whether the derailment was triggered by external issues or onboard the train consist itself?

Train Operators

Like the track operators, train operators will investigate to determine if they hold any liability for the incident or whether the derailment arose from external issues or an issue with the track itself.

Insurers

Insurers will be interested in all of the above. Only once the root cause is known can policy trigger be confirmed, and response determined. For example, if for some reason the train operator failed the mandatory drug testing post-derailment, then this could lead to potential policy issues.

Furthermore, Insurers always have one eye on potential recovery prospects once they have indemnified and paid an Insured. The quality of the cause investigation can be very important to the success or otherwise of a recovery action.
New Technologies and Emerging Risks

As with most things these days, the digital revolution continues to change how businesses operate. The rail industry is no different, and in fact the Miners have embraced new technology quickly. Some examples of emerging risks that may impact rail haulage are discussed below.

Automated Trains

Rio Tinto as an example, has recently spent some AUD940m automating approximately 200 locomotives, which operate across hundreds of kilometres of track every year. This not only saves on operating costs but is expected to yield certain safety advantages. These new systems named under the umbrella AutoHaul™ include:

• Collision Detection Systems
• Automatic Train Protection technology controls train speed to ensure adherence to speed limits
• An on-board video camera to record the front view of the train

The average return distance of these trains is about 800 kilometres with the average journey cycle—including loading and dumping—taking about 40 hours. Locomotives carrying AutoHaul™ software are fitted with on-board cameras allowing for constant monitoring from the Operations Centre in Perth, some 1500km away. All public rail crossings on the network are fitted with CCTV cameras and have been upgraded to the highest safety standards.

The only aspects of the above which may lead to an interesting future is the ‘unknown’ risks that digitising may bring and the external threat of cyber hackers.

Maintenance systems

Improvements in track inspection and maintenance itself will also follow with technology improvements. ‘Big data’ in respect to defects recording, maintenance history etc will all feed into the preventative maintenance systems.

The intent with all these improvements is to improve reliability and reduce overall costs.

Conclusion

Charles Taylor Adjusting has been involved with many derailments over the years involving large mining consists or freight haulage. Early appointment of engineering adjusters to be involved in the cause investigation, repair scope and reinstatement monitoring can be useful in reducing the overall loss quantum.

CTA’s previous experience with complex wagon reinstatement, environmental clean-up and ensuing business interruption losses means that we are very well placed to handle the most complex and challenging of losses.
About Charles Taylor Adjusting

Charles Taylor Adjusting (CTA) is one of the leading loss adjusting businesses in the market. We focus on commercial losses and claims in the aviation, marine, natural resources property, casualty, technical and special risks markets, many of which are large and complex in nature. CTA is a business of Charles Taylor plc which is quoted on the London Stock Exchange.

Charles Taylor plc is a leading provider of insurance-related professional services and technological solutions to clients across the global insurance market. The Group has been providing services since 1884 and today employs over 3,000 staff in 120 locations spread across more than 30 countries in the UK, the Americas, Asia Pacific, Europe, the Middle East and Africa.

Our Expertise

Charles Taylor Adjusting has qualified engineers on staff throughout all Australian offices with diverse backgrounds ranging from “big picture” Project Engineering/Construction right through to detailed design work. Our Engineering Adjusters hold Adjusting qualifications and are members of the Australasian Institute of Chartered Loss Adjusters (AICLA), the Australian & New Zealand Institute of Insurance and Finance (ANZIIF), or other UK-based professional bodies of equivalent or higher standards.

We ensure outcomes are concisely reported to Insurers to match their requirements in documenting the circumstances of the loss in a clear and logical manner, allowing them to reach a conclusion in respect to policy response.