

Safety Alert

PLANT ROLL-OVER RISKS DURING ROAD CONSTRUCTION

Recent Plant Roll-Over incidents demonstrate that an improvement opportunity is clearly presented to our industry to learn from previous incidents so that we do not continue to repeat them.

The causes of plant roll-overs are known but plant operators still repeat them so the message is clearly not being learnt at the operator level.

It can truly be said that it is better to learn from the mistakes of others than experience them yourself.

RECENT INCIDENT: Roll-Over of Belly Dumper Truck

A Belly Dumper Truck tipped-over onto its side after dumping wet soil.

Fortunately no one was injured but the dumper was damaged.

Dump Trucks of all types are subject to potential roll-over if material sticks to one side of the trailer or tray when material is dumped. For details of roll-over cause with conventional tipper type dump trucks refer to other incidents included with this Alert.

This is the first report of such an incident occurring with a Belly Dumper on a VicRoads project.

Investigation

The contractor investigated the incident and considers the essential contributing factor to have been the use of unsuitable 'sticky / wet' material being used in the Belly Dumper. A large amount of material was stuck on the inside left of the trailer hopper which caused the dumper to become unstable during travel.

As the dumper moved forward some of this loose material was fed under the right hand trailer wheels causing the vehicle to lean further to the left and eventually the trailer to tip over onto its side taking the prime mover with it.

Previously the material had been conditioned, in this instance it was not conditioned and was wet.

Corrective Action

The use of Belly Dumpers with this material has been discontinued on the project concerned.



Belly Dumper after the Incident

It is evident that our industry could benefit from a recirculation of previous Alerts so that contractors and plant operators can be reminded / made aware of the incidents and the essential contributing factors identified which lead to the roll-overs.

The Alerts on the following pages have been issued previously and are provided for your information and action as appropriate.

Hopefully this accumulated learning will prevent recurrences in similar circumstances.

PLEASE ENSURE THAT THEY ARE COMMUNICATED TO ALL PLANT OPERATORS AND ARE INCLUDED IN RELEVANT TOOL BOX MEETINGS.

Safety Alert

COMPACTION ROLLER RISKS NEAR EDGES OF EMBANKMENTS

Rollers continue to roll-over the edges of embankments during earthworks compaction on projects. Fortunately the embankments are often of a small height and the roller tips onto its side with minor injury (usually) to the plant operator. However, if a roll-over occurs on a high embankment it is likely the machine could roll from top to bottom with a real potential for serious injury to the operator.



Common Contributing Factors in Previous Incidents:

Investigations conducted into previous incidents have shown that common contributing factors include:

1. The roller operating close to the edge of the embankment
2. The roller quickly develops a lean toward the embankment due to collapse of soft poorly compacted soil close to the edge
3. The roller commences to slide down the embankment
4. The operator turns his machine away from the edge
5. The roller rolls over onto its side but could roll completely over and down the side of a steep embankment
6. The operator is usually inexperienced in this type of roller work
7. Compaction vibration rollers are usually involved

Reasons for Poor Compaction at edges of Fills:

The following reasons have been suggested by experienced operators and road construction engineers:

- (a) Poor Supervision
- (b) Inadequate direction / poor work methods
- (c) Lack of understanding by operators of consequences
- (d) Weak edges in underlying material due to:
 - Insufficient detail given in ensuring batter is constructed full width including over width from ground level up, i.e., lack of survey control, poor compaction and / or inconsistent compaction, the practice of cutting wet material over the batter face and leaving it as un-compacted material on the batter face.
- (e) The use of articulated rollers for compaction. Previously towed rollers and compactors were used and these were able to be reversed up to batter face.

Possible Reason for Incidents:

- (a) When the front roller drum begins to slip, an inexperienced operator's reflex action is to turn the drum of the roller sharply back onto the fill, which in turn articulates the roller with the wheels pointing towards the batters edge. As a consequence, if the machine is too close to the edge of the batter the outer wheel will drop over causing the roller to slip sideways. This seems to be happening of late.
- (b) Inadequate sized rollers for the work that is to be undertaken.

Recommended Methods for Preventing Roll Over of Compaction Plant:

- (a) Ensuring that all operators are appropriately trained and aware of the consequences.
- (b) Ensure close survey control in setting out of toe and in construction of batters.
- (c) Ensure fill batters are constructed over width from bottom layer up and trimmed back to the design width.
- (d) Ensure that any over wet material cut to the batter face is disposed of wide of the width of layer to be compacted and that the width of the layer being compacted is clearly distinguishable from the discarded material.
- (e) Outside edges of formation layers to be sloped towards the centre of fills such that rollers lean inwards. Middle areas of fill can be topped up after edges are compacted. (Refer pictures on following pages).
- (f) In confined areas such as fills at bridge abutments, keep outer edges of fill higher and roll at angle to the edge of fills (Refer pictures on following pages). Rolling slowly to the edges of fill, stop machine and vibration if there is any sign of instability and reverse away.
- (g) If batter widening is required, batters must be benched out from the bottom of the fill to suit the width of the machines then stepped into the existing embankment and maintain machine width until the desired height has been reached.

Operators experienced in this type of work also recommend that windrows be constructed near the edges and that the rollers are operated so that they retain a slight lean towards the centre of the earthworks rather than roll with the machine in the vertical when near the edges. This approach will result in the roller leaning away from the edge of the embankment further reducing the likelihood the machine will roll over the edge and down the embankment.

RECOMMENDATIONS

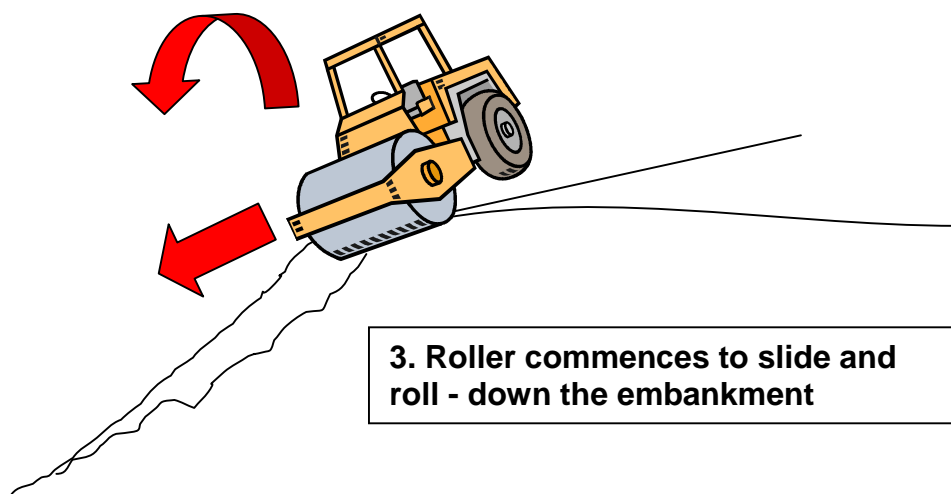
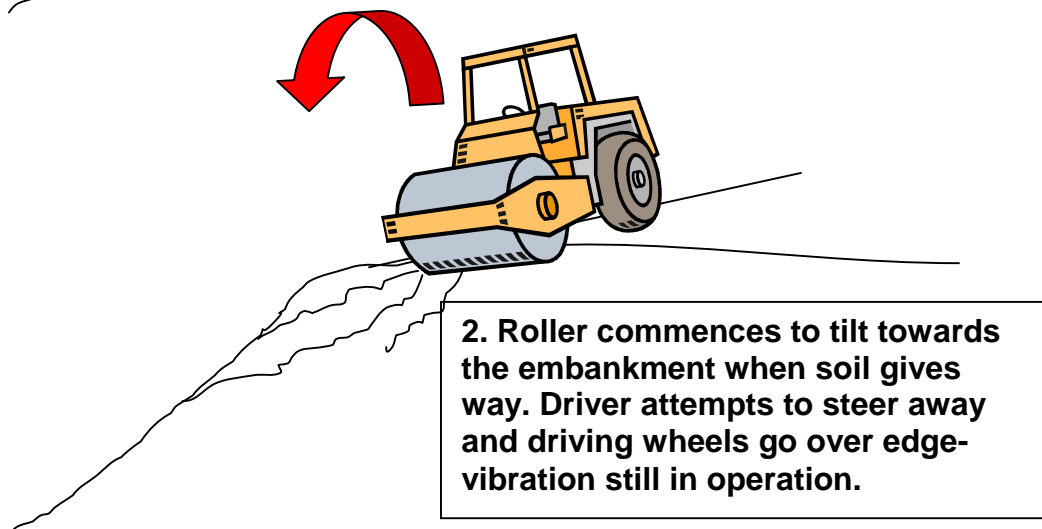
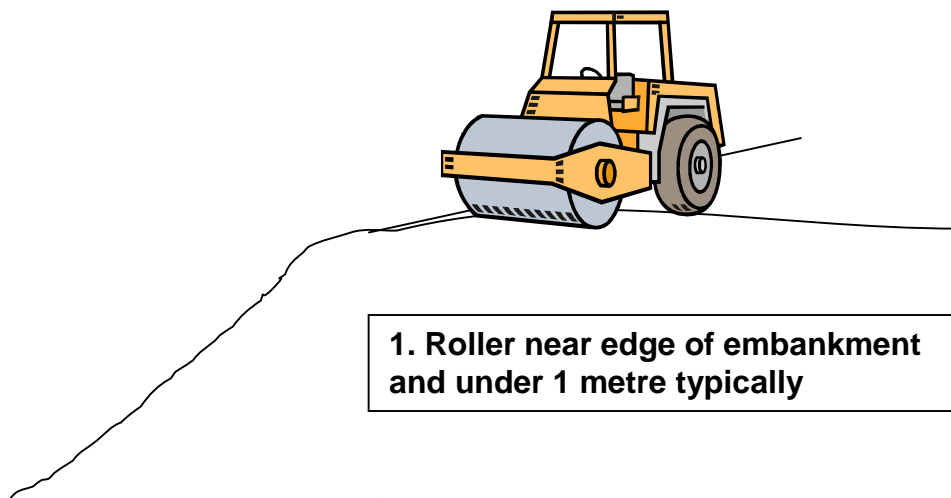
Contractors need to clearly identify the potential for rollers working near the edge of embankments to roll down the embankment as part of their documented Safe Work Method Statement (SWMS). The documented SWMS must include but is not limited to:

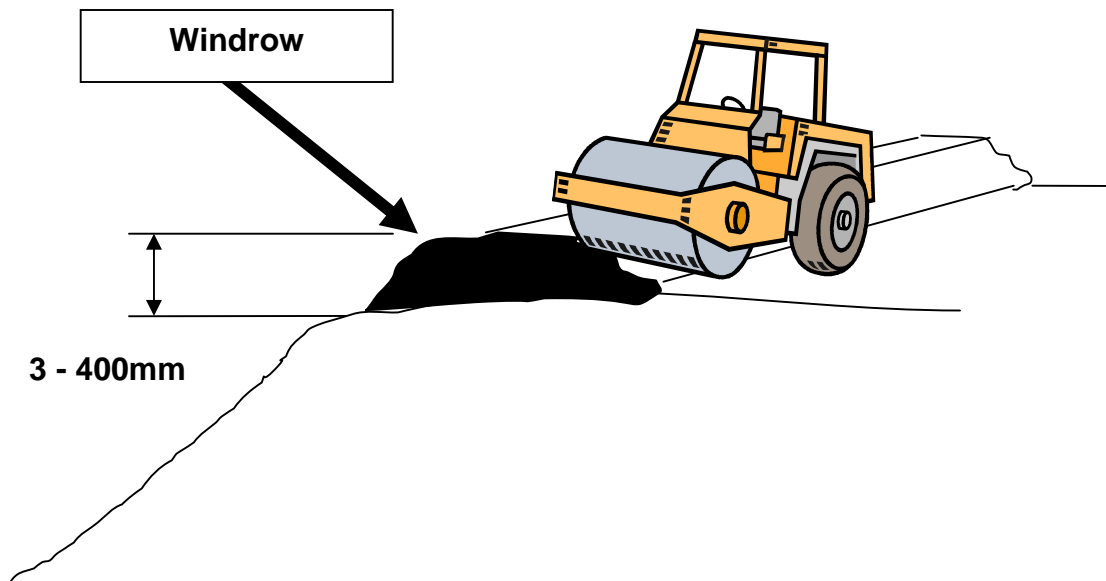
- An agreed method of construction which will control the risk of a roll-over taking into account the recommended methods for preventing roll-over of compaction plant. This must be conducted in consultation with plant operators.
- How the operator will be restrained within the roller cabin and protected against ejection should the machine roll down the embankment. Significant injuries are possible if unrestrained even if the operator is not ejected from the cabin and crushed by the rolling plant.

This Alert describes roller work practices which have proven successful in past years to prevent such roll-overs and contractors are encouraged to consider in consultation with their roller operators or provide an equal or better solution.

The earth compaction industry urgently requires a 'best practice' approach to rolling before someone is seriously injured.

THIS SAFETY ALERT SHOULD BE COMMUNICATED TO ALL RELEVANT CONTRACTORS





Proposed rolling with Windrow and Roller angled toward the centre of embankment.

Where it is necessary to roll closer than 1 metre to the edge the rolling should be conducted at an angle of about 45 degrees. This ensures the bulk of the roller is on firm compacted soil and the drive wheels are able to retain traction.



Rolling at angle when close to edge

Safety Alert

DOG TRAILER ROLL-OVERS

A number of Dog Trailers have been rolled over while dumping loads on site. There is potential for a far more serious incident if the tray were to fall onto other people in the area or an operational road.

The most common contributing factor is that the ground in the area is rough and uneven and has not been properly prepared for such an operation. It may only require one wheel set to drop lower and the roll-over will occur.

When the tray is elevated the trailers centre of gravity moves upward – if any of the load sticks high up in the tray than the potential for the trailer to roll-over becomes even greater. All it requires is uneven ground conditions to tilt the trailer sideways and an overturning moment is produced sufficient to roll the trailer over.

The same mechanism of roll-over is presented to ordinary tip trucks and dump trucks (articulated or otherwise).

If roll-overs continue to occur it is likely someone will be seriously injured.

The significant contributing factors vary but include:

- Reversing and dumping loads without supervision / spotter in place (note that radio control of dumping from associated FEL or similar plant used to level the ground has been observed on sites providing supervision, spotting and ground preparation).
- Truck arriving when site is unattended and attempting to dump in areas not properly prepared.
- Truck drivers not being aware of the risk presented by uneven ground and the need for site preparation.

RECOMMENDATIONS

The contractor in control of the site needs to ensure that:

1. A JSA or SWMS is available for this work and it identifies the need for the ground to be properly prepared (flat) to prevent roll-overs.
2. All drivers are site inducted and inducted into JSA or SWMS.
3. That the ground is prepared before each load is dumped.
4. That dumping is not permitted if the site is not supervised safely.
5. Pedestrians to be excluded from immediate dumping area.
6. Drivers wear seat belts.

**LETS NOT HAVE ANYMORE ROLL-OVERS
PLEASE COMMUNICATE THIS INFORMATION TO ALL RELEVANT
STAFF AND APPLICABLE CONTRACTORS**

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ARTICULATED DUMP TRUCK ROLL - OVER RISKS

Recent incidents involving Articulated Dump Truck roll - over have highlighted the need for this equipment to be driven within the manufacturers recommendations. Care needs to be taken in turns and reversing particularly when the wheels on one side of the tub (dumper trailer) are at a different height to those on the other side due to ground conditions.

A dump truck was performing a U-turn when its tub tipped onto its side whilst the cabin remained upright. The tray body was lowered and loaded at the time of the incident and during the turn the vehicle slid sideways resulting in the tub body sliding onto a slight downward slope and rolling over.

The following Alert issued by Mineral Resources New South Wales draws attention to other situations where this equipment has been shown susceptible to roll-over.

INCIDENT

In recent months there have been a number of incidents where articulated all terrain dump trucks have rolled over. All were near misses without significant injuries to operators.

CIRCUMSTANCES

In most incidents the circumstances were similar with the operator reversing the truck either up a windrow or a previously dumped load. This resulted in the rear of the truck (the tub) over balancing, rolling over and leaving the prime mover upright. In one incident the operator was driving down a properly constructed road which had just been watered down. He lost control and failed to negotiate a roundabout, rolling the prime mover and the tub.

INVESTIGATION

Investigation has identified that the incidents are related to the articulated all terrain dump truck style of vehicle and not specific to one brand of vehicle.

In most cases the driver reversed the truck to either dump a load or allow other vehicles to pass. The rear wheels on one side climbed up the windrow or the previously dumped load. In some circumstances a change in height of 60 to 70cm in one rear wheel set was sufficient for the tub to over balance and roll over (see photograph).

In the case where the driver failed to negotiate the roundabout, speed, driver inexperience and a wet road were major factors contributing to the incident.



RECOMMENDATION(S)

1. Carry out a site specific risk assessment to determine suitability of this style of vehicle for your mine site. The risk assessment should include but not be limited to the following:
 - Operating grades and slopes are within Original Equipment Manufacturers (OEM's) specifications
 - Operating speeds are within OEM's specifications
 - Adequacy of your road design.
 - Vehicles are not operated in an overloaded state.
 - Vehicles have not been altered from the OEM's specifications.
 - Vehicles are fit for purpose.
2. Review driver assessment and training for both experienced and inexperienced operators. Include situations which could lead to potential rollovers and identify appropriate corrective actions.
3. Raise driver awareness of potential roll over situations, through toolbox talks and/or driver retraining programs.
4. Review loading and tipping procedures to include centralisation of loads and safe tipping zones.
5. As part of your accident/incident investigation and reporting process formally notify the OEM or his representative in writing of any roll over incident and the circumstances leading to the roll over.

R Regan
ASSISTANT DIRECTOR SAFETY OPERATIONS

RECOMMENDATIONS

It is evident that this type of plant is likely to roll when reversing or lateral forces are applied to the tub when turning, particularly when the wheels on one side are at a different height. Wet slippery conditions and overloading will also be conducive to creating the dynamics for a roll-over to occur

Please advise relevant contractors of the recommendations above and of the need to operate these machines within the safe operating parameters advised by the suppliers of the plant.

Under the Plant Regulations Suppliers of Plant are required to provide details on hazards and risks associated with the equipment which is usually supplied in the form of user manuals and manufacturer's instructions.

Operators should also be reminded of the need to wear seat belts or similar restraint devices to ensure they are not ejected from the vehicle should a roll – over occur.

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PLANT & VEHICLE ROLLOVER SAFETY

In two separate recent incidents, a Roller (refer alert No 6) and a Water Truck have rolled over during road construction works on VicRoads projects. In both instances the vehicles left the constructed surface, slid down embankments and overturned onto their sides. The vehicles fell down embankments varying in height from 1.2 to 5 metres.

In both incidents the driver / operator was injured. If seatbelts are not worn, the driver is not restrained from ejection from the vehicle and significant and perhaps fatal injuries are possible during a rollover. A truck driver can fall at least 2.5 metres from their seat to the other side of the cabin and sustain significant injuries from being thrown around inside a rolling vehicle. Unsecured drivers may also be ejected from the cabin and crushed by the rolling vehicle.

MPD Management Responsibilities

Could all Contract Administrators and Surveillance Managers ensure Contractors conduct Risk Assessments for mobile plant and vehicle work near embankments and excavations, and that risk controls eliminate or substantially reduce the risk of a fall or roll over from height.

In compliance with Plant Regulations 711 (1) and 711 (2) and in addition to any controls to prevent a fall or roll over, all plant working near excavations, maintenance pits, verges, ramps or embankments shall be fitted with Roll Over Protection (ROP's) or Cabins and fitted with Seat Belts. **The wearing of seat belts should be mandatory** in this situation to prevent ejection and crushing of the operator by the plant during the rollover.

Under the Plant Regulations 106 (4), vehicles such as Trucks require the same consideration when being operated on a road construction project. In addition to the activity risk assessment considering the risk of a roll over, **the wearing of seat belts during the movement of all vehicles on site must be an essential consideration** to reduce injuries and prevent fatalities should any traffic incident occur on site. In effect, the rules should not differ from travel on a public road.

The wearing of Seat Belts during all plant and vehicle movements on road construction sites, in addition to speed restrictions, signage and the delineation of 'edges' so far as practicable, shall be included in activity risk assessments and are recommended for inclusion in site safety rules.

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TIPPER TRUCK MAINTENANCE AND OPERATION

Recently a Tipper Truck when discharging its load of asphalt experienced a failure of the tipper body. This resulted in the tipper tray and load breaking free of the truck chassis and collapsing to the side of the truck narrowly missing a worker who was standing near that side of the truck.

Investigations conducted by the contractor involved found that:

- **Loose bolts and cracking in welds and support rails were evident in the tipper body chassis connection that failed under tipping load conditions.**
- An estimated one tonne of cold asphalt had stuck to the floor of the truck body subsequently contributing to the tip body slewing to the right side.
- The floor of the truck body had not been cleaned prior to loading preventing the hot asphalt discharging and placing extra loading at the top end
- There had been no slip agent applied to the tipper body prior to loading.
- The Plant Daily Check Sheet indicated the truck as roadworthy when the tyres were later deemed unroadworthy



Tipper Body Frame Securing Bolts without Nuts

Recommendations by asphalt sub-contractor to prevent a recurrence include:

- Revising cartage contract specifications to require frame integrity inspection and roadworthy expectations, in addition to existing requirements for Plant to be maintained in accordance with the manufacturer specifications and Plant Regulation requirements.
- Appointing a qualified person to inspect cartage trucks on a regular basis
- Asphalt Depot Procedures to include requirement not to load trucks with excessive asphalt build-up in trays
- Ensure all truck bodies are cleaned out on a regular basis to prevent the build-up of material. Slip agent sprays fitted at loading points to spray truck bodies with 'Asfaltrent'.
- Implement a training session for drivers of asphalt cartage trucks.
- Ensure all personnel on site are made aware of the risks near operating plant and to keep clear

Management Responsibilities

All **Contract Administrators and Surveillance Managers** are requested to inform their contractors of this incident and determine what controls they have in place to prevent such an incident with their own or subcontractor's tipper trucks.

Specifically:

- Frame Integrity Inspections
- Roadworthy Requirements
- Inspections by Qualified person of cartage trucks on a regular basis
- Procedures for keeping pedestrians well clear of operating plant/trucks