

Dump Trailer Tip-Over Prevention

Hazards are ever-present in the steel plant environment, and a heightened awareness and emphasis on safety is a necessary priority for our industry. This monthly column, coordinated by members of the AIST Safety & Health Technology Committee, focuses on procedures and practices to promote a safe working environment for everyone.

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Steel Dynamics Inc. (SDI) has experienced several dump trailer tip-over incidents across the recycling and steel operations platforms and was looking for a way to mitigate this issue. Fortunately, these tip-over incidents have only resulted in near misses, property damage or minor injuries, but SDI understands and appreciates that many, if not all, of these incidents could have resulted in serious injury or fatality. As a result of these incidents, SDI formed a subject matter expert (SME) team with the support of the SDI Core Safety Group. This team was challenged with the task of identifying the best possible solution for the organization. As a result, an SME team of various transportation experts from both recycling and steel platforms assembled to help identify root causes

or contributing factors and develop best practices that can help reduce the likelihood of an end dump tip-over. The team began by meeting and reviewing past incidents and investigations from dump trailer tip-over incidents. During the incident review process, recurring root causes were identified as a common contributing factor to each incident (Fig. 1). After several conversations and iterations, a set of best practices was developed in order to provide all SDI locations with information to assist in preventing dump trailer tip-overs. The best practice documents were shared with third-party carriers and suppliers to be used in educating drivers of the contributing factors of a dump trailer tip-over incident. The following sections highlight some contributing

Figure 1

Equipment Damage	
Incident Title:	Outside Carrier Trailer Tip Over
Incident Date:	4/13/2016
Incident Description	
An outside carrier entered the facility with a load of cast iron borings and proceeded to the correct pile for unloading. The driver set up on a flat, firm spot at the pile and the material appeared to be level in the trailer from the perspective of the inspector on the ground. As the driver raised the trailer up to dump the material, the trailer shifted toward the passenger side and rolled over, coming to rest on an adjacent pile of material. The tractor stayed upright and the trailer remained engaged at the fifth wheel. The trailer sustained significant damage but there were no injuries.	
Root-Cause	
While it cannot be confirmed with certainty, it is believed that the wetness of the material caused some of it to get hung up in the trailer as the dumping process was initiated. This likely created the instability that caused the trailer to go over.	
Photos	
	
Safety Alert	

Example of a trailer tip-over incident report.

factors to tip-over incidents and best practices for their prevention.

Contributing Factor: Drivers Taking Known and Unnecessary Risks

This occurs when attempting to dump a load despite having some concern about the condition of the trailer/container, ground conditions, arrangement of material in the trailer/container, overweight load or by attempting to release wedged material by jerking trailer when elevated, attempting to dump with tractor not properly aligned with the trailer, etc.

Suggested Best Practice — Trailers should be weighed upon arrival to a facility and drivers are expected to ensure that any dump trailer that is overweight is not dumped. Drivers should request assistance with the offloading of material, rather than attempting to dump an overweight load. Drivers are expected to inspect their loads prior to dumping in order to ensure that the material didn't shift during transit and is safe to dump.

Contributing Factor: Uneven Surfaces/Soft or Unstable Ground/Downward Slope

Suggested Best Practice — Prior to dumping, ensure that all ground surfaces are level and solid. Drivers should not attempt to dump with the tractor facing down a steep slope, as the trailer may not raise high enough to allow material to flow/dump effectively. Signs are located in certain areas of SDI facilities to warn drivers of the risks associated with dumping on soft or uneven surfaces (Fig. 2).

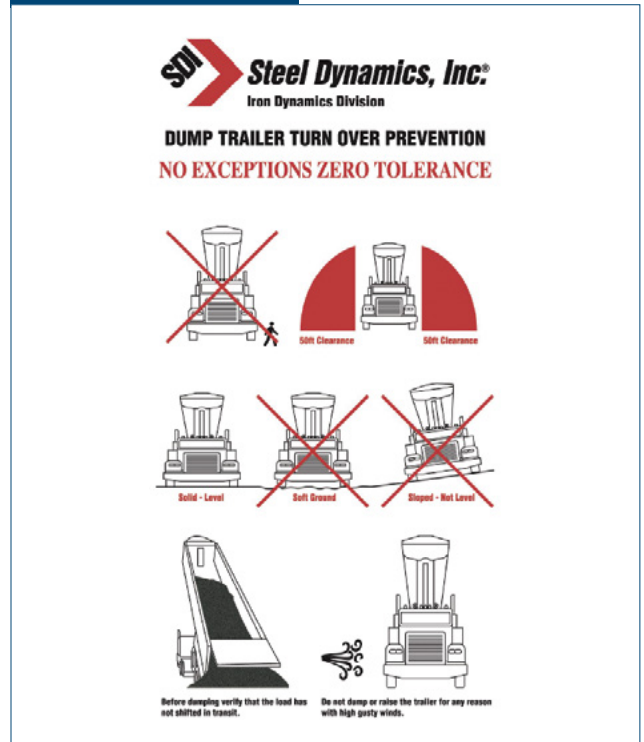
Contributing Factor: Poorly Maintained Equipment

Suggested Best Practice — Carriers and suppliers are expected to ensure that all delivery trailers/containers are properly maintained. (Visit the Appendix of the online edition of this month's *Iron & Steel Technology* to view a pamphlet of suggested preventive maintenance-related best practices that SDI believes to be necessary in order to ensure optimal condition of trailers/containers.)

Contributing Factor: Improperly Loaded Material

Unevenly distributed material can cause a dump trailer to be unstable. Trailers that are loaded with a loader can be loaded heavy to one side and material can shift in transit, causing uneven distribution.

Figure 2



Warning sign about dumping risks present in some Steel Dynamics Inc. facilities.

Additionally, certain loads can contain a variety of materials and if heavier/more dense items are loaded to one side, the load will be unstable when attempting to dump.

Suggested Best Practice — Drivers are expected to inspect their loads prior to dumping in order to ensure that the material didn't shift during transit and is safe to dump. Certain SDI facilities place signs warning drivers of the risks associated with dumping loads that are unevenly distributed or have shifted in transit (Fig. 2). Suppliers are responsible for properly loading material into dump trailers in order to ensure that it can be dumped safely upon arrival at a facility. (See the Appendix of the online edition of this month's *Iron & Steel Technology* to view a pamphlet of suggested best practices for loading material in dump trailers/containers to minimize the potential for material to be loaded unevenly or heavy to one side.)

Contributing Factor: Frozen Loads

Suggested Best Practice — Same-day deliveries are required during the winter months in order to minimize the opportunity for material to freeze within the trailer/container. Suppliers/carriers should consider the use of an appropriate releasing agent, which can be applied to trailers/containers prior to loading in

order to prevent or minimize the potential for material to freeze to the floor/walls of trailer/container (e.g., calcium chloride, salt, plum juice). Consult the plant representative for suggestions on an acceptable releasing agent that will not cause a loss of material quality or other complications.

Contributing Factor: High Winds

Suggested Best Practice— Drivers should not attempt to dump material during inclement weather conditions.

Additional Factors to Consider

- Drivers should remain in the cab and wear their seat belts when dumping, unless the dump trailer/container requires the use of outside-the-cab controls.
- Drivers should ensure a safe distance is maintained as trucks are performing dumping activities.
- Drivers should establish an appropriate distance between trailers to create a safe zone. In the event of a tip-over incident, this will prevent other personnel or equipment in the area from being affected.
- Carriers/suppliers/drivers should avoid using “flip gate-style” dump trailers to dump scrap metal. Material may not flow efficiently, as the flip gate is

likely to cause material to get hung up. Once hung up, the material is likely to shift or become wedged, resulting in an imbalanced load.

With safety as the No. 1 core value at SDI, a commitment was made to send everyone who enters its gates home safely at the end of the day. As a part of the dump trailer tip-over prevention initiative, SDI has sent a letter containing the end dump tip-over prevention best practices to all of its suppliers and third-party carriers. SDI has strongly encouraged each company to share and review the best practices with all employees and implement any and all elements of this program. ♦

Disclaimer

SDI is offering these suggested best practice tips in the hope that by focusing on safety concerns and following such best practices, incidents of dump trailer tip-overs will be reduced or eliminated. SDI does not, however, warrant that such best practices will, in fact, achieve such results, or will prevent a dump trailer tip-over. These suggestions are not all inclusive and it is wise to have multiple people examine a load of material before dumping to consider all safety concerns present with each load. The choice of whether to follow such best practices shall be entirely that of the owner/operator of the dump trailer and SDI disclaims any and all responsibility or liability for personal injury or property damage that may occur as the result of a dump trailer tip-over.

Did You Know?

Pioneering Research Enriches Our Mechanistic Understanding of the Unique Role Niobium Plays in Improving the Properties of Commercial Steels

A research team led by the Nippon Steel and Sumitomo Corp. has won the 2017 Charles Hatchett Award. The award is made annually to the best research paper on the science and technology of niobium and its alloys. This year's paper explains how detailed atom probe tomography studies have been used to clarify the mechanism through which niobium improves the high-temperature properties of a ferritic stainless steel, widely used for automotive exhaust manifolds. This research has a much broader application to our understanding of the role played by niobium across the full range of commercial steels where niobium is added to enhance their properties.

This Institute of Materials, Minerals and Mining (IOM3) annual award, now in its 39th year, is sponsored by Companhia Brasileira de Metalurgia e Mineração (CBMM) and makes an important contribution to the company's activities that recognize excellence in research on niobium and its applications. The award winners were presented with their medals at the IOM3 dinner held in London on 11 July.

It has been widely speculated that niobium atoms, in solution, segregate to grain boundaries and dislocations, initially within the gamma matrix, and that such interactions contribute to the retardation of recovery of dislocation substructures, which then has a subsequent, important impact on the final properties of the transformed steel. This is a mechanism unique to the element niobium.

This work, using the atom probe tomography technique, has for the first time clearly established that niobium does indeed segregate powerfully to dislocations, and the authors have described the phenomenon as the Niobium-Cottrell atmosphere. They have sought to explain its manifestation by suggesting that the size of the niobium atom plays an important role in the segregation of the element to available substitutional sites in the distorted matrix in the vicinity of dislocations.

This observation contributes to our current knowledge of the role, which niobium plays in the retardation of recrystallization and thus to its ability to influence the development of enhanced mechanical properties. This mechanism is of particular importance in the processing of ferritic stainless steel that operates at high temperatures where enhanced thermal fatigue properties are required.