

## Incident Summary (Reference #5604819)

SUPPORTING INFORMATION	Incident Date		Sept 13 <sup>th</sup> 2016	
	Location		Vancouver. BC.	
	Regulated industry sector		Elevating Devices.(Escalator)	
	Impact	Injury	Qty injuries	0
			Injury description	No injuries.
			Injury rating	None.
	Damage	Damage description	There was no physical damage to the regulated product as a whole, however because of the failure of a system within the regulated product there existed the possibility of a release of a lethal amount of energy at the site of the installation.	
Damage rating			Moderate.	
Incident rating		Moderate.		
Incident overview		It was reported to BCSA that a down escalator at a busy downtown LRT (Skytrain) station had accelerated in an uncontrolled manner whilst fully loaded with passengers. The uncontrolled acceleration caused the passengers egressing the escalator to have to step off the unit in an uncontrolled and dangerous fashion. The incident overview can be seen in the attached video. The overview sequence is Normal operation-EPD trip-Uncontrolled acceleration-Chaotic egress of passengers-Reduction in load-Unit slowing and coming to a halt.		
INVESTIGATION CONCLUSIONS	Site, system and components		<i>This is an escalator located in an extremely busy downtown transit system subway station. The escalator is a unit with a moderate vertical rise and a step width of 40 inches. The unit is fitted with dual driving machines and therefore 2 sets of driving machine brakes. The escalator is fitted with a number of EPDs(Electrical Protective Devices) to act as safety shut-off switches that remove power from the driving machines and allow the driving machine brakes to apply in case of an emergency to retard, stop and hold the rated load of the escalator.</i>	
	Failure scenario(s)		<i>During the course of its service life this unit had brake maintenance and brake service performed on it by the Licensed Elevator Maintenance Contractor .During the servicing one of the driving machine brakes were fitted with replacement brake arms and linings. When the brake arms/linings were replaced the linings were never lapped to the brake drum.(Definition-LAPPED-to envelop entirely .LAPPING-to shape or fit by working 2 surfaces together with or without abrasives until a very close fit is produced.)The other braking unit had linings that were worn to the point that the rivets that attach the linings to the brake arms were contacting the brake drum before any lining material thus dramatically reducing any braking action generated by that driving machine brake. The escalator was travelling in the down direction with a full load of passengers ie .most steps had 2 people on them. At a point in time an EPD tripped .In this particular case it was a switch monitoring the Tension Carriage resulting in the power being removed from the driving motors and causing the driving machine brakes to apply .A combination of the linings that were not lapped and the linings that were worn down to the rivets meant that not enough braking force could be applied to retard, stop and hold the brake rated load (weight of the passengers)This resulted in an uncontrolled acceleration of the unit.</i>	
	Facts and evidence		<i>It is a B-44 code requirement that the driving machine brake(s) shall retard ,stop and hold the brake rated load for the escalator. In the presence of BCSA EDSOs the on- site mechanics from</i>	

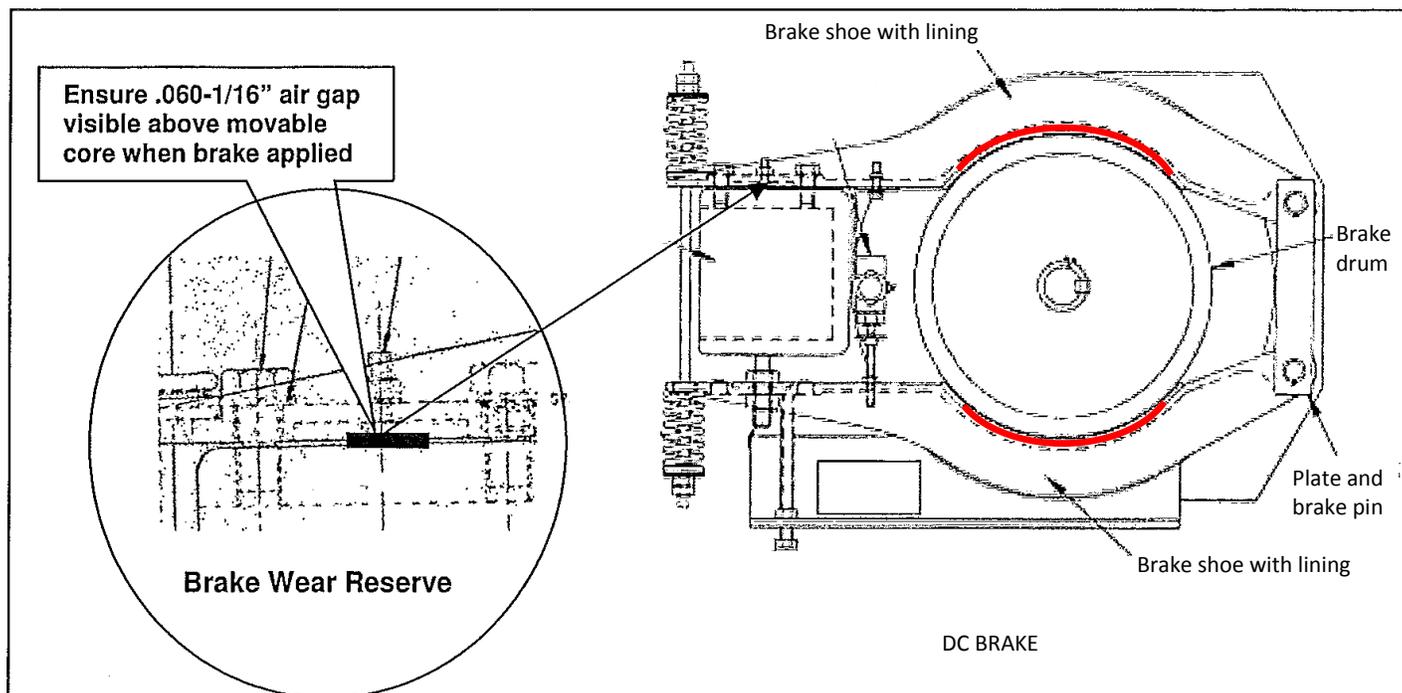
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	<p><i>the Licensed Elevator Contractor, dismantled both sets of brakes. On the first set of brake arms it was observed that in one of the shoes the lining material was worn away and on the other shoe of that set the lining was worn away to the point that rivets were contacting the drum therefore giving little braking action for that driving machine brake. The second set of brake arms had brake linings that had not been seated (LAPPED) at the time of their installation by the Licensed Elevator Contractor. The braking action of this set of brakes was severely reduced as a result of the linings not being lapped. The overall condition of the brake linings meant that the braking system of the escalator was producing far less braking force than required to make the unit code compliant. From on-site observations, discussions and conversations with the mechanics and supervisors it became apparent that both parties did not have an in-depth knowledge of the braking requirements for the escalator equipment that they were maintaining. Questions to both the mechanics and supervisors on-site demonstrated to us that there was a general lack of understanding of the driving machine brake system installed on this model of escalator.</i></p> <p><i>The fact that one set of brake arms had linings that were worn with rivets contacting the brake drum and the other set had been replaced and the linings not lapped greatly reduced the braking capability of the system. The general condition of the linings made any mechanical adjustments to the brake unable to meet OEM (ORIGINAL EQUIPMENT MANUFACTURER) specifications. OEM specifications for brake adjustment are predicated on the brake linings being within a certain thickness (specification) and said material having adequate contact with the brake drum. If this is not the case then the required adjustments cannot be made. Maintenance procedures should have identified these inconsistencies but they didn't. There appeared to be an overall lack of understanding of the braking system which contributed significantly to this incident.</i></p>
<p>Causes and contributing factors</p>	<p>The uncontrolled escalator acceleration was very likely the direct result of one of the sets of brake linings not being lapped during a service replacement and the other set of linings being worn to a point where rivets and not lining material were contacting the brake drum. None of these conditions were detected during routine maintenance procedures.</p> <p>It is very likely that the mechanics and supervisors employed by the Licensed Elevator Contractor did not fully understand all the requirements for the correct operation of this braking system relating to the service replacement of parts, maintenance procedures and testing.</p>



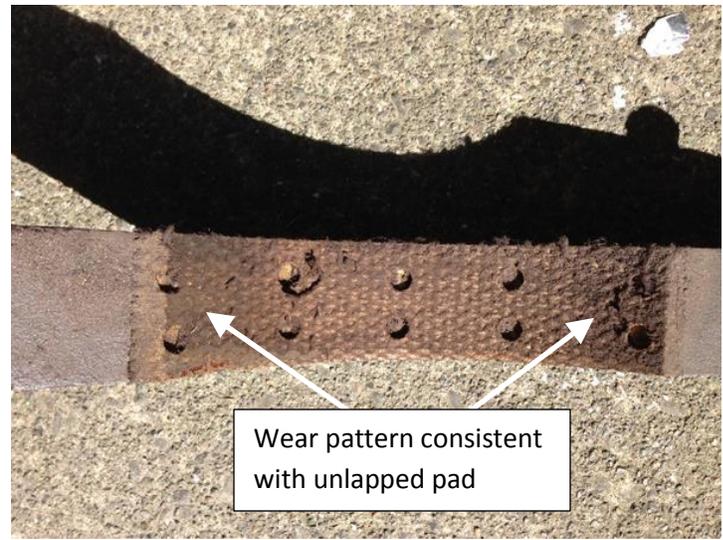
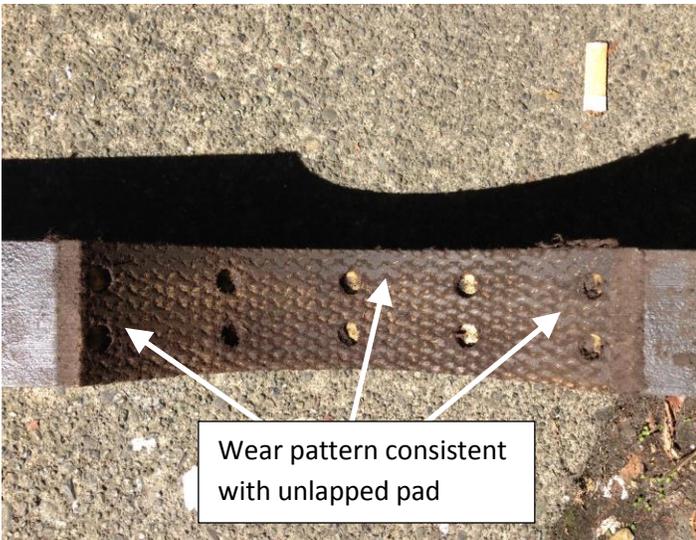
**Video 1:** Escalator Brake Failure – Uncontrolled Acceleration

Clicking the image above will open the video in a browser. Alternately, [this link](#) will lead to the same video.

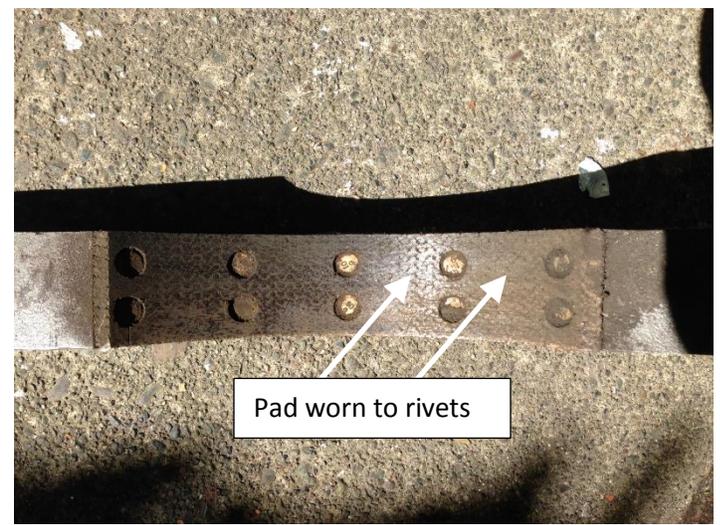


### End View of DC Shoe Brake

**Figure 1:** Escalator Brake Arrangement: Two brake assemblies installed on escalator



**Figures 3 and 4:** Brake Pad from one brake assembly – Brake pads not lapped on installation as evidenced by the inconsistent wear patterns resulting with ineffective brake force.



**Figures 5 and 6:** Brake Pad from second brake assembly – Brake pads worn to rivets resulting with ineffective brake force.