

Find 4 examples of failure due to creep that are relevant to the transport indust...



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Failure due to Creep Relevant to the Transport Industries Creep failures result when solid materials or plastically deform or move gradually under the influence of stress usually subjected over long periods of time and high temperatures relative to the material's melting point (French 1991). Creep failure can occur to different materials under loads including plastics, metals and composites. The following examples outline the effects of creep in the transport industry.

1. Sagging of leaf Spring A composite leaf spring made of plastic material (Polyethylene terephthalate) used in the rear suspension sags after a several years of working. The spring was subjected to the vehicle's weight and initially underwent plastic deformation as the strain became higher. The strain rate reduces with time and levels out. Under effects of its operating environment (on average  $480^{\circ}\text{K}$ ), the strain rate increased exponentially leading the spring to fracture. The spring actually failed at the third stage of creep failure. The melting point of the material is  $265^{\circ}\text{C}$  ( $538^{\circ}\text{K}$ ) as noted by Turner (2001) and McCrum, Buckley, and Bucknall (2003). The ratio of operating temperature to melting point is 0. 89.
2. Steam Pipe Failure The steam pipe of a locomotive failed as a result of creep in Uganda. The material used for making the steam pipes was austenitic steel. The working temperature of the tubes was set at about  $600^{\circ}\text{C}$  ( $873^{\circ}\text{K}$ ) and was subjected to high pressures, about 24. 1MPa. The steam pipe burst as a result of creep failure leading to the emission of steam in the environment. Given that working temperature at time of burst was about  $830^{\circ}\text{K}$ , the ratio of operating temperature to melting point is 0. 95.
3. Aero Engine Turbine Blade Failure The turbine blade for a fighter plane was fractured as a result of creep failure (Tauqir & Khan 2002). Metallurgical studies showed that the blade that got fractured was subjected to extremely

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high stresses as the plane flew at high speeds and rapid maneuvers. The working environment of the blade was that of very high temperatures (1670°K). The material's melting point was noted to be 1800°K. From the calculations the ratio of operating temperature to melting temperature comes to 0.92.

4. Big Dig Ceiling Collapse in Boston Big Dig Ceiling Collapse involved the collapsing of a ceiling panel in the Fort Point Channel Tunnel, Boston (Murphy & Scott 2006). In July, 2006, the event occurred when a 3-tonne ceiling panel fell on a vehicle injuring the driver and leading to the death of one person. The ceiling was always subjected heavy loads including vehicles and trucks. The ceiling subjected to direct heat of the sun always reached high temperatures, sometimes 350C (308°K). The failure occurred mainly as a result of the long duration it was subjected to heavy loads.

References French D. (1991) Creep and Creep Failures. Retrieved 19th February, 2011 <http://www.nationalboard.org/index.aspx?pageID=164&ID=181>

McCrum, N., Buckley, C., & Bucknall, C. (2003). Principles of Polymer Engineering. Oxford Publishing.

Meyers A. and Chawla K. (1999). Mechanical Behavior of Materials. Cambridge University Press.

Murphy, P. & Scott A. (2006). Workmanship and design of tunnel are called into question. The Boston Globe.

Tauqir S, & Khan Q. (2002) Creep-fatigue failure of an aero engine turbine blades. Retrieved 19th February, 2011 [http://www.sciencedirect.com/science?\\_ob=ArticleURL&\\_udi=B6V2X-454RWH9-9&\\_user=10&\\_coverDate=06%2F30%2F2002&\\_rdoc=1&\\_fmt=high&\\_orig=search&\\_origin=search&\\_sort=d&\\_docanchor=&view=c&\\_searchStrId=1647973115&\\_rerunOrigin=google&\\_acct=C000050221&\\_version=1&\\_urlVersion=0&\\_userid=10&md5=](http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V2X-454RWH9-9&_user=10&_coverDate=06%2F30%2F2002&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_searchStrId=1647973115&_rerunOrigin=google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=)

6f436cde42bb2b44207cc5eba22c795f&searchtype= a Turner, S (2001).

Creep of Polymeric Materials. Oxford: Elsevier Science Ltd.