RISK AND THE VERTICAL TRANSPORTATION INDUSTRY

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ABSTRACT

Risk is a major concern for the public, scientists, engineers and policy makers alike. Yet there are major discrepancies between what the public fear and the magnitude of risks calculated by the "experts". This paper reviews current thinking on risk perception, communication, assessment and management. Examples are used to demonstrate the difficulties faced by industries who have mis-managed risk. In spite of a good passenger safety record, using lifts and escalators is frightening for some passengers, a fear sometimes amplified by media reporting. A pro-active risk management strategy for the vertical transportation industry is proposed and discussed.

1 INTRODUCTION

According to an *Equinox* documentary(1) one billion lift (elevator) journeys are made without hitch every day. An expert interviewed claimed that lifts are by far the safest means of transportation there is. In fact, *"...elevators are very, very safe. When was the last time you heard of anyone getting killed on an elevator? It just doesn't happen."* Similarly, a popular British science program, *How do they do that?*(2) told its viewers that they were statistically safer taking a lift than walking up the stairs. The expert interviewed said that, to the best of his knowledge, no one had ever being killed while travelling in a lift.

The (USA) Boston Sunday Globe(3) special report headline 4 December 1994 read, *"RISKY RIDE Millions of people ride the nation's 600,000 elevators and 30,000 escalators every day assuming that they are safe. But a four month Globe investigation has found that crippling accidents - even deaths - occur with alarming frequency."* The feature goes on to record, in graphic detail, deaths and injuries sustained by lift and escalator passengers. *"...horrified employees waiting for an elevator saw streams of blood flow down the closed elevator door."* The article blames the incestuous nature of the industry for poor maintenance, inadequate inspections and the poor take up of new safety devices. An industry expert is quoted as saying *"Our guarantee is that on a per capita basis, this is the safest form of transportation in the world."* In the context of the article, his words give little reassurance.

As an industry, we all know that travelling on escalators and in lifts is relatively safe. There are risks, but our experience tells us that they are minimal compared to others most of us encounter daily, such as travelling in a car. Some of us have overstated the safety of vertical transportation systems, which undermines our credibility when articles such as the one in the Boston Globe appear. The article is sensationalist, quite possibly inaccurate and certainly presents an unbalanced view. But it is also an effective challenge to the complacent.

In this paper we shall try to understand how the public perceives risk, and discuss better ways of communicating risk to the public. The process of risk assessment and management will be

outlined. Lift and escalator accident statistics will be presented, together with proposals for a pro-active risk management strategy for the vertical transportation industry.

2 RISK PERCEPTION

Risk is a major concern for the public, scientists, engineers and policy makers alike. Yet there are major discrepancies between what the public fear and the magnitude of risks calculated by the experts. This discrepancy has lead to the study of risk perception, which can help us to understand different attitudes to risk.

The public have to evaluate information they are supplied mainly by the media, including the opinions of scientists, engineers and policy makers. Experts often despair of the public who seem to ignore the "facts" they present showing something is safe. Yet the public have the difficult job of evaluating expert views, which are often contradictory or based on incomplete information from suspect sources.

2.1 Media

News media reflect a skewed representation of the risks of everyday life. For instance, an accident involving a school bus, killing say 10 children will receive more news coverage than hundreds of children killed in individual car accidents. Although sensationalism is irresponsible, it is inevitable that the media will present an unbalanced view of reality - a balanced prospective is, more often than not, boring and will not sell newspapers or attract television viewers. Media sensationalism, and the consequent disproportionate public concern and reaction, is sometimes known as the "social amplification of risk".

2.2 The Importance Of Trust

Trust is key element in the perception of risk. If someone responsible for a risk is trusted, then the risk is far more acceptable than a comparable risk in the hands of someone un-trusted. Slovic[4] cites the application of chemical and radiation technologies as an example of this phenomenon - although medicines and x-rays pose significant risk, we trust the medics who manage them and, in general, consider the risks acceptable. Industry, and government officials who oversee the management of nuclear power and non-medical chemicals are not trusted; so much so that it is apparent that public perceptions and acceptance of these risks is hardly influenced at all by technical risk assessments.

Trust is fragile, taking a long time to build, and an instant to destroy. Abraham Lincoln one wrote *"if you once forfeit the confidence of your fellow citizens, you can never regain their respect and esteem"*. Slovic[4] demonstrated the fact that trust is easier to destroy than to create in a study where he asked college students to rate the impact of trust on 45 hypothetical news events relating to the management of a large nuclear power plan in their community. His results are shown graphically in Figure 1.

2.3 Issues Arising From The Importance Of Trust

- People are prone to over-confidence in their own judgements. Unfortunately this applies to experts as well as to the general public. Slovic et al.[5] give examples of a Reactor Safety Study and the 1976 collapse of the Teton Dam where the experts were shown to

have greatly underestimated possible failures in their risk assessments. Over confident scientists, subsequently shown to be wrong, undermine the public's trust.

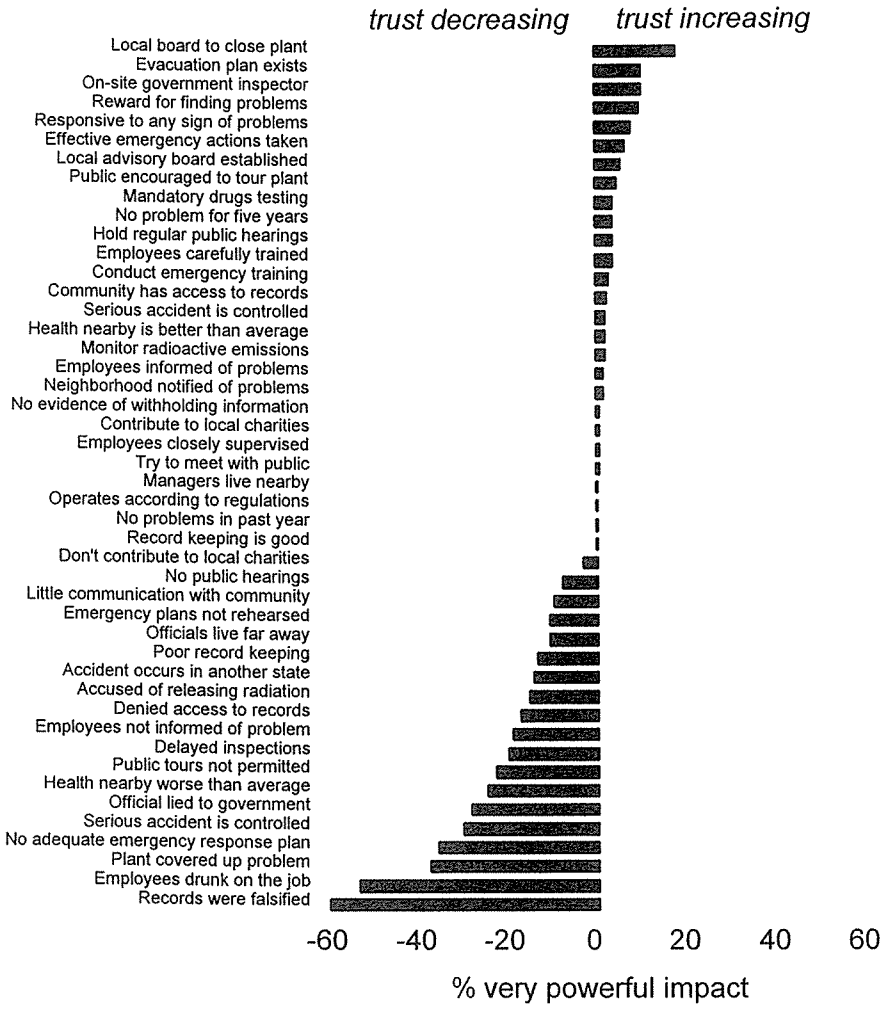

Figure 1 Differential Impact Of Trust-Increasing And Trust-Decreasing Events Relating To The Management Of A Nuclear Power Plant

- A trait of the media is to find experts with opposing views on the same subject; it makes for lively discussions, even if one view is totally unreasonable. The disagreement of experts often undermines trust in both parties, casting doubt on both sides of the argument.

- Evidence suggests[4] that sources of bad (trust-destroying) news tend to be seen as more credible than sources of good news. For example, regulators and the public express considerable confidence in the relevance to human health of studies showing that certain substances are carcinogenic in animals. Evidence to the contrary carries little weight. This emphasis on bad, trust-destroying news is again reflected in the media.

- People with vested interests are less likely to be trusted than those with nothing to lose or gain from stating their case.

- New evidence that something is safe, presented by a person or group that is not trusted, has little impact.

2.4 Other Hypothesis On The Public Perception Of Risk

- People are reluctant to let others expose them to risk; yet they freely choose to expose themselves to comparable risks. In other words, "voluntary" risks are more acceptable than "involuntary" risks. One study[6] suggests that people will accept a risk 1000 greater if it chosen than if it is imposed by others.

- People accept man-made risks (such as Chemical plants) less than natural risks. The US Environmental Protection Agency estimates between 5,000 and 20,000 lung cancer deaths in US homes per year are caused by radon, which occurs naturally in the environment. And yet there is public apathy about this risk[7].

- Unlikely, but potentially catastrophic disasters are feared disproportionately relative to the calculated or historic risk[5]. This is considered a factor in the discrepancy between perceived risk and the frequency of death values for Nuclear power.

- Familiar risks are more acceptable than unfamiliar risks. We are naturally afraid of the unknown.

- There is a need for certainty[8], *"Is it safe, yes or no?"*. A response to questions of risk, *"The risk is minimal to the best of current knowledge"*, promotes fear.

3 RISK COMMUNICATION

Lofstedt[9] defines risk communication as *"the process by which authorities or experts convey to the members of the public the nature and extent of risks to which they are subject"*. The study of risk communication has arisen out of the need to gain public acceptance for sightings of chemical plants, hazardous waste facilities, etc. Some findings are specific to this type of scenario. But others can be generalised and applied to other industries.

Approaches to risk communication can be divided broadly into two categories:

- "top down" or "source to target"
- engaging in dialogue and inviting public participation

The top down approach is based on the premiss that the expert is knowledgeable and the public needs to be educated. The dialogue approach provides information, but encourages the public to air their fears and concerns, addressing the issues raised to the extent of incorporating changes in the experts' design or viewpoint. This second approach is sometimes know as reciprocal risk communication, and is favoured by researchers.

3.1 Hypotheses And Recommendations Relating To Risk Communication

The following hypotheses and recommendations are based on generalisation of Sandman's proposals in *Getting to Maybe: Some Communications Aspects of Siting Hazardous Waste Facilities*[8]:

- As trust is an important factor in public risk perception, it is also fundamental for positive risk communication.

- Greater media coverage of a safety issue tends to lead to increased public concern about a risk; media coverage should not be courted. On the other hand, setting out to conceal risk from the media and public would be short sighted as this is likely to lead to media sensationalism and to a breakdown in trust.

- Inconsistency in stance can lead to a loss of credibility and a crisis of confidence. The effect of this principle is frequently demonstrated in the political arena.

- The public can underestimate their own influence. Suspecting that their fears will not be addressed, they tend to judge that they cannot afford to listen to the experts, so their only option is absolute opposition. Acknowledging the public's influence is positive step.

- Avoid suggestions that public fears are irrational or selfish. It is rational to distrust experts, who often have a stake in providing reassurance that fears are unfounded. All coherent positions require respectful response; dismissing them outright is strategically unwise.

- Establish an open information policy on safety issues. But, where possible, enable the public to rely on its own, and independent sources rather than asking for trust. This may involve contributing to the funding of the independent sources.

- Adopt a communications strategy that recognises the public's fear of risk does not correspond to accident statistics, but is subject to issues of control, familiarity, etc. Do not try to approve or disapprove of these truths, but understand why they are true and adapt accordingly.

4 RISK ASSESSMENT AND MANAGEMENT

Risk assessment is the forming of a judgement about a risk based on the information available at any one time. Risk management involves using this assessment as a means to take decisions about a risk. The decisions may balance the benefits associated with accepting the risk and issues such as the cost of reducing or removing the risk all together.

Risk assessment and management has a long history[10]. There is evidence to suggest that the Aspipus people in the Tigritis-Euphraties valley were carrying out a form of risk assessment in around 3200 BC. Risk management in the construction industry had already been established in Babylonian times; the Code of Hammurabi required that if a building collapsed on completion, the architect responsible for designing it was to be executed.

The assessment and management of risk has been formalised and adopted in modern law, e.g. the European Community directives for safety on construction sites have been implemented in the UK through the *Construction Design and Management Regulations* (CDM). Another example of the application of risk assessment and management in the UK is the *Control of Substances Hazardous to Health Regulations* (COSHH).

Figure 2 identifies usual stages in risk assessment and management. Each stage is discussed below. The UK beef BSE (mad cow disease) scare is topical at the time of writing and has been used as an example.

- The description of intention is the place, product or process we are assessing, e.g. the safety of eating British beef.
- The hazard identification is the process of identifying what could reasonably be expected to cause harm, e.g. BSE in cows may cause Creutzfeldt-Jakob Disease (CJD) in humans who eat infected beef products.
- The identification of consequences is the damage or injury that will be caused if the hazard is realised, e.g. CJD is a fatal disease.
- The estimation of the magnitude of the consequences is an assessment of whether the damage will be negligible, minor, moderate or severe, e.g. if the link between BSE and CJD turns out to be true, will CJD kill a few unlucky people, or will thousands die?
- The estimation of probability of consequences is an assessment of the likelihood of the risk occurring, e.g. at the time of writing, the experts assign a high probability to their being a link between BSE in cows and CJD in humans.
- At this stage it is necessary to estimate and evaluate the risk. This can be done "scientifically" using probability event trees, quantified risk analysis, etc. But it should also take into account the lessons learnt from risk perception, e.g. the "calculated" risk of humans contracting BSE is currently considered to be very small, yet there is widespread fear and confusion amongst the public. There are issues of trust (changes of stance from politicians/experts), media sensationalism, fear of the unknown, etc. all impacting on public perception of this risk.

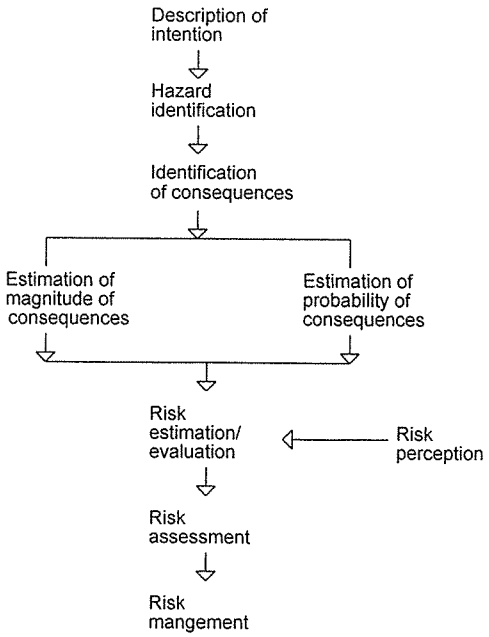

Figure 2 Intention To Risk Management

Evaluation of the risks may change as more information becomes available, so a risk assessment should generally be kept under review. In time, monitoring of the risk and its effects improve the accuracy of the risk assessment. Provided that effects of a risk are measured accurately, statistics become the most authoritative technical measure of the risk (providing the source of the risk remains unchanged). Relying on future statistics for an assessment of new risks is know as retroactive (as opposed to pro-active) risk management; this is a dangerous policy.

Those responsible for managing the risk have to take into account the risk assessment in deciding what measures, if any, are appropriate in order to reduce the risk. The cost versus benefit of each risk-reduction option must be considered. In industry impacting on the environment, this compromise is reflected in the BATNEEC (best available technology not entailing excessive cost) principle, which is widely applied.

In the British BSE scare, the evidence remains under review. Public perception of the risk makes a drastic risk management policy (mass slaughter of cows) a likley course of action, not because the experts think it necessary, but to restore public confidence.

5 LIFTS AND ESCALATORS ACCIDENT STATISTICS

5.1 United Kingdom

In the UK, RIDDOR[11] regulations dictate that lift and escalator accidents in the work-place resulting in major injuries are reported either to the local authority, or to the Health and Safety Executive (HSE) according to where the accident happened. Accidents outside the work-place, e.g. a domestic lift accident, are not reportable. Local Authority statistics are forwarded to the HSE for collation and publication. HSE acknowledge that, although they get to know about most work-place fatalities, only about 41% of other injuries are reported. The results are published annually, recent figures are reproduced in Table 1. The HSE databases hold very general information. They will investigate more specific queries but, as only 6-8% of reported accidents are investigated, there limited scope for using there data to identify how lift and escalator safety can be improved.

Year	Group	Fatal	Major	Over 3 Day	Total
1992/93	Employees	1	3	21	25
	Members of public	-	2	-	2
1993/94	Employees	-	4	18	22
	Members of public	-	2		2

Table 1 Injuries To Employees And Members Of The Public Involving Lift And Escalators (Excluding Construction Hoists) Reported To HSE 1992/93, 1993/94.

The Department of Trade and Industry (DTI) also maintain a database of accident statistics, extrapolated from a sample of 18 hospital accident and emergency departments throughout the UK. The database is designed to provide information for the consumer, but includes work related incidents as all major injuries are treated in hospital accident and emergency departments. The DTI database is more detailed then HSE's, and is broken down into categories of accident. A summary of their results for lift and escalator accidents in 1994 is given in Table 2.

5.2 Other European Data

Lenskens presented data on lift accidents for Belgium, West Germany and The Netherlands in his ELEVCON '94 paper, *Lift Safety in the Netherlands*[12], which is reproduced in Table 3. A breakdown is given of the accidents in Netherlands; around two thirds of the accidents

involve users as opposed to lift company employees. Belgium's relatively poor results are ascribed to less strict regulations.

Age group	Mechanism Category Fall	Striking contact	Crushing/ piercing	Bite /sting	acute over exertion	other/ un-specified	Row Totals
Escalator Accidents							
0-4	162	81	0	0	0	0	244
5-14	203	81	41	0	41	0	365
15-44	487	365	0	0	41	41	934
45-64	365	81	0	0	41	0	487
65-74	731	41	0	0	0	0	771
75+	1056	162	41	0	0	41	1299
Lift Accidents							
0-4	41	122	162	0	0	0	325
5-14	20	20	0	20	0	0	61
15-14	0	102	81	0	0	41	223
45-64	41	20	41	20	0	0	122
65-74	41	41	20	0	0	20	122
75+	142	102	81	0	0	20	345
unknown	0	0	20	0	0	0	20
Column Totals	3289	1218	487	41	122	162	5319

Table 2 DTI Accident Statistics For UK Lifts And Escalators In 1994 Based On Extrapolation From The Records Of 18 Hospital Accident And Emergency Departments

	Belgium (1975-1984)	West Germany (1981)	The Netherlands (1975-1984)
Deaths per year per 10 000 lifts	0.8 - 1	0.14	0.1 to 0.2
Serious accidents per year per 10 000 lifts	15	1.4	2

Table 3 Comparison Of Lift Accident Statistics For Belgium, West Germany And The Netherlands

5.3 Relative Safety Of Lifts Compared With Other Means Of Transport

Using an average of Lenskens' data, it is reasonable to estimate that there are approximately 0.27 passenger deaths per year per 10,000 lifts. According to Boston Globe's sources, 600,000 lifts correspond to 55 million lift trips per day. If you assume (this is a major generalisation) that both Lenskens' and the Boston Globe's figures[3] are typical internationally, you can calculate that every time someone travels in a lift, they risk death at a probability of 8.1×10^{-10}. To put this risk in context, it has been included in Table 4, together with other transport risks taken from the paper, *Analysis of the Daily Risks of Life*[13] by R Wilson. Wilson uses the measure, risks that increase the chances of death by one in a million.

Risks which increase chances of death by one in a million
Travelling 7 minutes by canoe
Travelling 10 miles by bicycle
Travelling 300 miles by car
Travelling 1000 miles by jet
Taking 1240 lift trips

Table 4 Comparable Risks Of Death Using Different Types Of Transportation

6 A STRATEGY FOR THE VERTICAL TRANSPORTATION INDUSTRY

Compared with some of the industries referred to in this paper, the vertical transportation industry is managing relatively minor risks. Yet every accident is one too many, and we (the industry) are called to account when notable incidents occur.

One major, emotive accident (say 10 children fall to their death in a lift) could initiate media focus leading to a loss of public confidence in the vertical transportation industry, and a disproportionate concern over one particular safety issue. The authors suggest the vertical transportation industry should learn from the mistakes of other industries by adopting a pro-active risk strategy. Some suggestions follow:

- Understand how and why public risk perception differs from statistical evidence and adopt an appropriate risk communication strategy. Most of the findings discussed in sections 2 and 3 of this paper can be applied directly. The most important issue in dealing with public fears is to maintain trust. Every interaction, especially with the media, should be reviewed in the context of whether that interaction could undermine trust, either now or in the future.

- Press for (and if necessary subsidise) mandatory reporting of accidents to independent bodies, and for the preparation of detailed statistics. Identify common causes of accidents and address them, e.g. Barney states[14] that if statistics were properly available deflector brushes would be fitted to all escalators.

  The Boston Globe[3] criticised the USA industry Safe-T Rider campaign stating "With no requirement to compile accident statistics, the industry has funded a publicity campaign that blames accidents not on unsafe equipment, but careless riders." This is an unfair criticism of a well-motivated campaign. However, the best response to this type of criticism is to be in a position where its claims are insupportable. Are they?

- Avoid complacency! The lift industry knows that a partly loaded traction lift can fall up rather than down because of its counterweight. And yet lift safety gear can stop a lift falling down but not up. Modern technology can provide numerous ways of overcoming this design limitation (the much heralded rope break is only one of them). Yet most lift companies provide (and lift consultants accept) safety gear that provides no protection from a possible direction of falling which is not even protected by a buffer. This issue needs to be addressed. Are there others?

- Apply risk assessment for new technologies. Consider how public confidence may require additional safety measures to be taken above those dictated by technical risk assessment, e.g. we should be able to make ropeless lifts, electronic safety gear, etc. technically safe, but will additional measures be required to ensure public confidence?

7 CONCLUSIONS

Public perception of risk is a function of many variables, of which accident statistics play only a small part. It is important that we, as an industry, maintain public confidence in vertical transportation systems. Lessons learnt from other industries' mistakes can be applied.

Maintaining the public's trust is paramount. Poor communication of risk associated with vertical transportation will undermine public confidence. Out of the public spotlight, we must strive for ever better safety standards. On occasions when we are thrown to the lions in the media arena, only the Christians (i.e. the conscientious) will be saved.

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