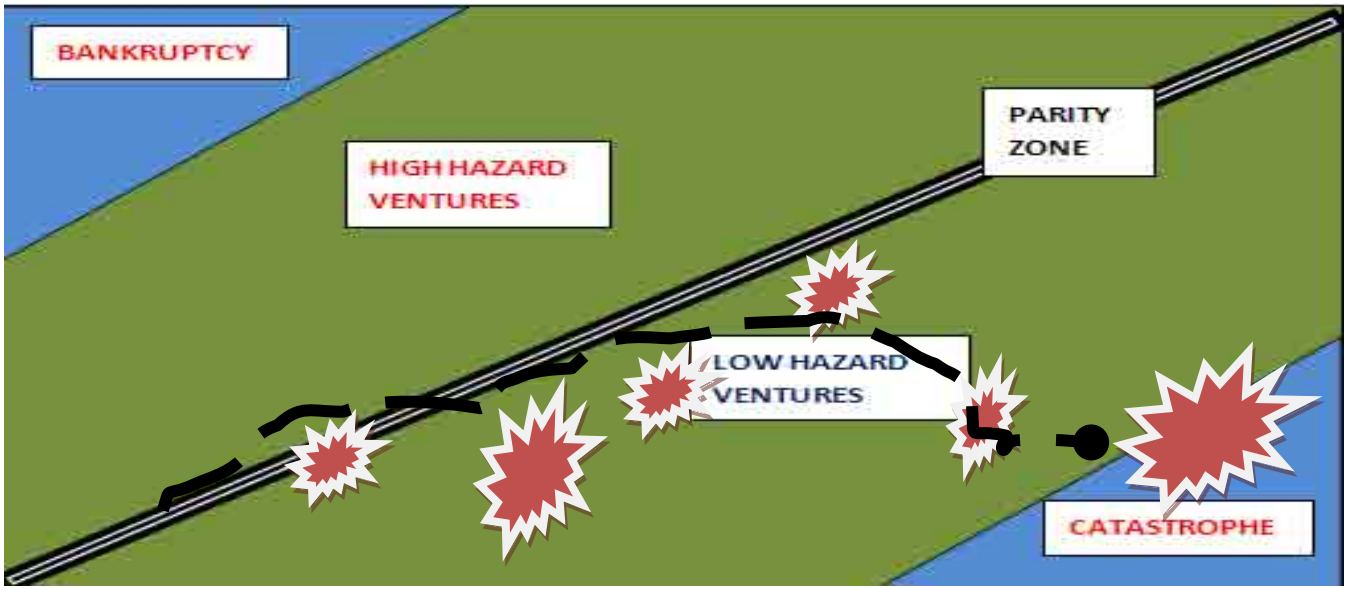
DISCUSS THE CLAIMS THAT HAVE BEEN MADE BY JAMES REASON THAT HUMAN FACTORS ACCOUNT FOR 80 TO 90% OF ALL ORGANISATIONAL INCIDENTS.

Background. Throughout history, disasters were often looked upon as acts of God, while nowadays it appears to be "fashionable to claim that human error is implicated in 80-90 percent of all major accidents" [12]. This latter statement may appeal to some, but hardly engenders confidence in management, the workforce and associated stakeholders.

How often in the workplace do we hear the words, "accidents are just waiting to happen"? This statement does not infer that management at the organisational level fails to take preventive action, but it does imply that, the lack of any proactive action, at any level does lead to active failures being created in the workplace.



Workplace Parity Zone

Management at the organisational level endeavour to sail through the "parity zone", [12]; between the parameters of high and low hazard ventures where deviation in either direction may lead to a catastrophe; but may be difficult to achieve every time when their objective is to meet production outcomes. (See above example [12])

Aim. The aim of this paper is to provide an alternative view to that of James Reason's claims of human error and will endeavour to demonstrate that most accidents are as a result of conditions arising from organisational levels of management and not that of human error.

Disclaimer. It is not within the scope of this paper to address all of James Reason's work, his models or theories, but primarily focus on the organisational element that inadvertently permits latent conditions to develop.

Considerations. During this paper, I shall introduce the relevant factors and terminologies that will enable the reader to understand how they relate to each other. I shall consider the Organisational, Technological, and Human Elements, the definitions of Line of Authority, Accident, Human Error, Error, and Confounding Factors, along with James Reason's Active Failures, Latent Conditions, Defence Barriers and his Accidental Trajectory Model [12]. Moreover I intend to provide examples that will highlight active failures and latent conditions at the organisational level.

Organisational Element. The meaning of organisational element within this paper refers to employer and senior management, not middle or lower echelons of the workforce. Nor do I assume human error is at the heart of all accidents; but will concede that they do contribute to active failures. The organisational element is responsible for decision making, planning and allocation of resources. Having said this, one may be tempted to draw a conclusion that this element is immune from any errors due to the very nature of its status.

Technology Element. Assuming that technology is only as good as its creator and is subject to design error; then, is it not possible that designers are inadvertently creating flaws by programming technology to have less reliance on the human element? That if technology is not monitored by humans; design faults, poor planning, inferior materials, shelf life, maintenance, emergency recovery procedures, and communication may be factors that could create an environment where active failures and latent conditions accumulate.

Human Element. Reason is of the opinion that human beings control their actions by two modes, automatic and conscious and goes on further to explain the positive and negative aspects of the two [12]. It is my view that the human element is able to make independent decisions based on the level of knowledge, skills, education and training but are also prone to and can become distracted, bored, make mistakes, emotional, and lose focus if their needs are not met or sufficiently challenged.

Line of Authority. Based on life experiences and anecdotal evidence, the line of authority with any organisation depends upon the hierarchy, culture and communication to meet outcomes. Within this paper the line of authority will refer to the level of "employer responsibility in accordance with the Victorian OHS Act 2004" [8]. This is important as responsibility within an organisation cannot be delegated and must remain the domain of the organisational element.

Accident. Wagenaar & Groeneweg, in their review of shipping accidents concluded that "accidents appear to be the result of highly complex coincidences which could rarely be foreseen by the people involved" [15]. On the other hand we have an extract from the British Medical Journal which states that: "an accident is often understood to be unpredictable - a chance occurrence or an act of God - and therefore unavoidable" [3].

Human Error. Human error traditionally has been associated with negativity, which may have prevented other factors from being considered in an accident investigation, thus clouding the investigator‘s mind from being objective during the process. Reason is of the opinion that “Human error can be defined as the failure of planned actions to achieve their desired ends - without the intervention of some foreseeable event” [12]. This may not be a new phenomenon as Turner states that “the idea of personal responsibility is deeply rooted in western cultures [14]; and Reason goes on to say that “the occurrence of a man made disaster leads inevitably to a search for human culprits” [11].

The alternative point of view is that of McDonald who believes that; “the widespread (false) knowledge that the majority of accidents (85/90%) are caused by human error (formerly unsafe acts), this belief or false knowledge can also help us derail our thinking” [7]. When faced with the above points of view, it is of no surprise to find that investigators in the past have taken the human error approach during accident investigations.

Error. According the Penguin English Dictionary, an “error is a mistake, action, behaviour, an act that fails to achieve what was intended, the difference between an observed or calculated value, [9]. Reason on the other hand is of the opinion that “errors take different forms, have different psychological origins, occur in different parts of the system and require different methods of management” [12]. If both descriptions of error are deemed correct, then both can be used to describe active failures.

Confounding Factors. The second item of James Reason’s work that I find difficulty with, is his simplistic view of confounding factors, and that he does not consider other additional factors such as political, machine fatigue, climate, organisational pressures, health, poor technical and equipment designs, workplace cultures, codes of practice, human knowledge, technological limitations, to name but a few. In fact I will be so bold as to say that Reason appears influenced by “false knowledge” as described by McDonald [7].

Active Failures. It is my opinion that active failures are a conglomeration of poor judgment, errors, misinformation, poor decisions, inadequate design, lack of knowledge, conducted voluntary, involuntary, inadvertently or deliberately. Active failures may occur at the technological, organisational and/or human element levels that may or may not lead to accidents.

Latent conditions. Reason coined the term latent conditions to identify why a combination of active failures lead to accidents. If this is true, why are active failures permitted to accumulate in the first place and not addressed before they trigger an accident? The question remains when and how to identify such triggers before a catastrophe occurs. Two recent examples with histories of latent conditions are the 9/11 attacks in the USA in 2001 and the current Global Financial Crisis (GFC).

Defence Barriers. Hudson is of the belief that "Controls can and will fail, defences will be breached" [6]. Are we then led to believe that that no matter what defence and safety barriers are installed, they are bound to fail at least once during the planned operational lifetime of the enterprise? If true, then I believe that the more complex technology becomes the less reliance on the human element. Therefore the removal of the human element from the decision making process will create an environment for active failures.

Accidental Trajectory. Figure 1 below, illustrates how active failures have lined up with latent conditions to create a window of opportunity for the accidental trajectory to become a reality. Such windows of opportunity are considered rare in large organisations, but when they do occur it is with a great loss in life and material. This model is an excellent tool in identifying and anticipating potential Active Failures and Latent Conditions prior to any accident [12].

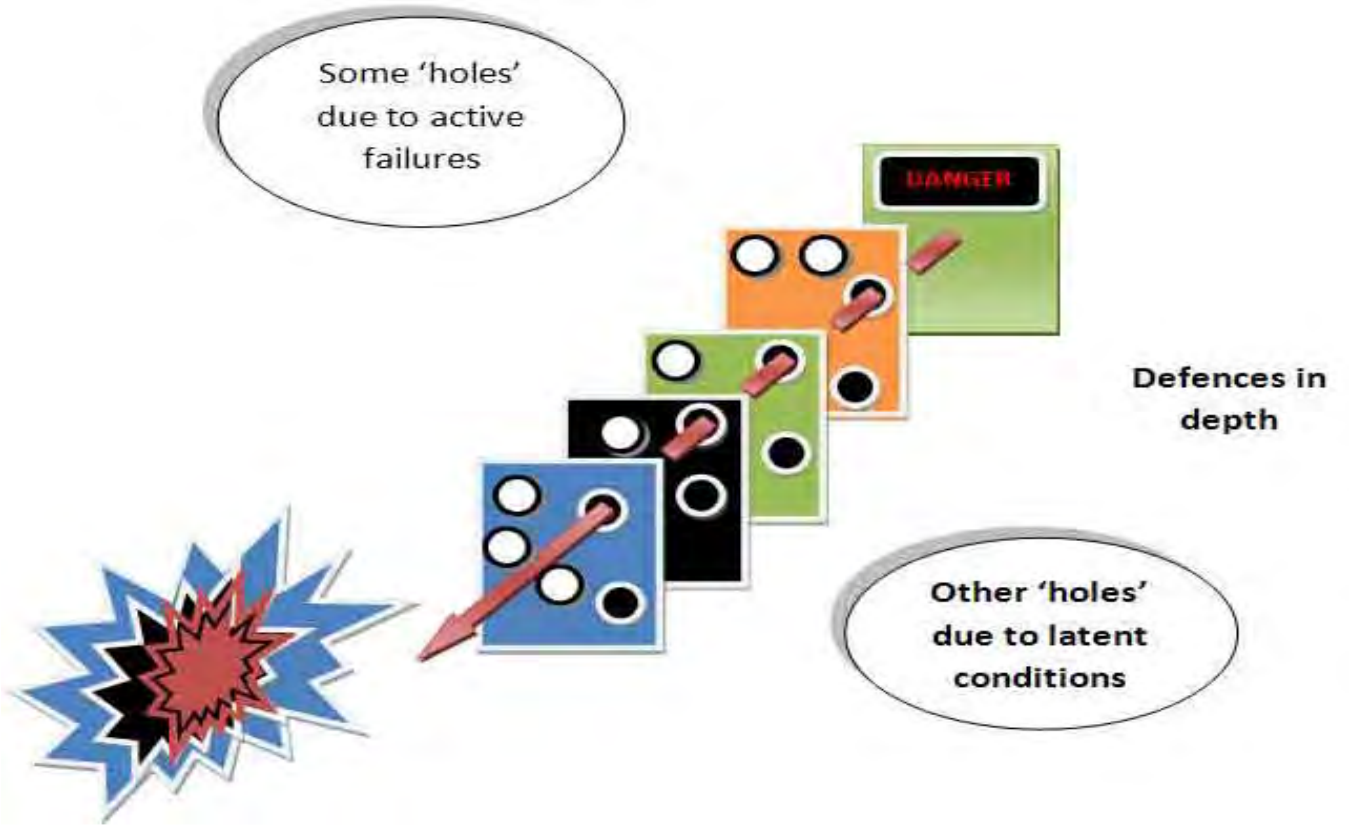


Figure 1. James Reason's Accidental Trajectory

Disaster Examples. The intention of the three accident examples is to demonstrate the contribution of active failures, latent conditions, and the role of the three elements; including "Reason's Six Kinds of Rule-Related Behaviour", "Accidental Trajectory" and "Windows of Opportunity" [12]. The three examples are: the Westgate Bridge collapse in Melbourne, Australia; the Piper Alpha oil rig explosion in Britain and the Chernobyl Nuclear Power (plant) Fallout in the Soviet Union.

Westgate Bridge - The author serviced lift on the right during 1970 [13]

Westgate Bridge Disaster. In 1970, the Westgate Bridge in the western suburbs of Melbourne collapsed bringing 35 men to their deaths. The Royal Commission in its findings looked carefully at all the roles and concluded that: “the disaster which occurred… and the tragedy of the 35 deaths were utterly unnecessary. That it should have been allowed to happen was inexcusable. There was no onslaught of natural forces, no unexpected failures of new or untested material. The reasons for the collapse are to be found in the acts and omissions of those entrusted with building a bridge of a new and highly sophisticated design” [12].

A perusal of documentation relating to the accident indicated that there were errors of judgment at the organisational level, variations within the workplace, lack of safety procedures, active errors, a poor understanding of the new technologies and inexperienced senior management [13]. The actions, elements, latent conditions, active errors and Reason’s Accidental Trajectory in table 1 below demonstrate how the conditions at the organisational level contributed to the Westgate Bridge collapse. In hindsight, had the organisational element taken appropriate actions to arrest these active failures from occurring, the disaster could have been avoided and lives saved.

NO	ACTION	ELEMENT	CONDITION
1	Labor problems	*Organisational*	Active Failure
2	Change of contractors	*Organisational*	Active Failure
3	Inexperienced engineering staff	*Organisational*	Active Failure
4	No support from management	*Organisational*	Active Failure
5	Poor morale	*Organisational*	Active Failure
6	No leadership and coordination	*Organisational*	Active Failure
7	Incorrect procedures	*Organisational*	Active Failure
8	Incorrect decisions	*Organisational*	Active Failure
9	Ripple appears on bridge	*Organisational*	Active Failure
10	Concrete Blocks to reduce ripple	*Organisational*	Active Failure
11	Bolts removed	Human	Active Failure Trigger
12	Ripple spreads	*Technological*	Active Failure
13	Riggers unable to reinsert bolts	Human	Active Failure
14	Bridge spans begin to collapse	*Technological*	Active Failure
15	Bridge span folds and collapses	*Technological*	Active Failure

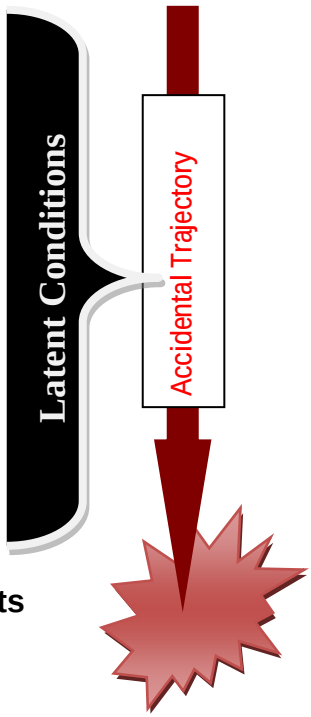
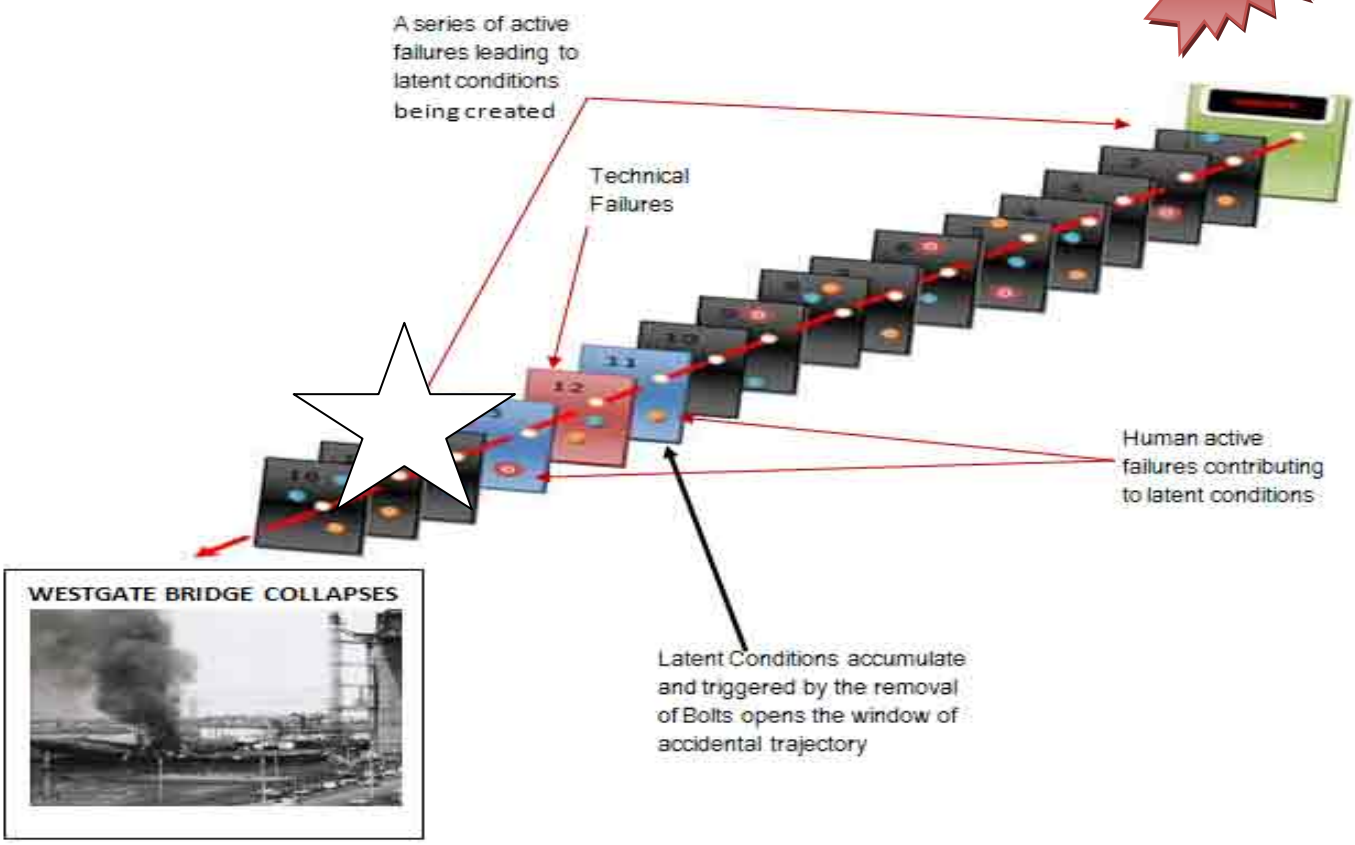


Table 1. Westgate Bridge Collapse sequence of events



Westgate Bridge Accidental Trajectory

The Piper Alpha at sea prior to the explosion [10]

Piper Alpha Disaster. In 1988, disaster struck the Piper Alpha oil production platform which was located in the North Sea, off the coast of Britain [12]. Hudson's description of those who work in the oil and gas industries as "hard men who took risks" [5] is of little consolation to the families of the 165 men who lost their lives.

My prime objective in selecting this unfortunate accident is to illustrate that the human element is quite capable of making informed and independent decisions and secondly to illustrate that under adverse conditions in the absence of any information, and relying on senses and life experience alone, can survive. In this event I identified the actions of the diving superintendent as "Successful Improvisation" [12]. I note that he was about to follow normal safety procedures, when he realised that what he was faced with did not fit in with his training and made an informed appreciation of his circumstances and took corrective action that saved his life.

Post Chernobyl Nuclear Reactor 1987 [2]

Chernobyl Accident. In 1987, the area around the Chernobyl nuclear power plant in the Ukraine (formerly under the USSR), was evacuated and depopulated. The nuclear reactor had malfunctioned, releasing radiation into the atmosphere causing long term health problems still felt to this day. If we are to believe Reasons claim that the, "Chernobyl was an accident initiated almost entirely by Misvention" [12], does it absolve the actions of the organisational element? I think not. The influence of the human element pales in comparison when compared against the technological elements as the main contributor to this preventable and unfortunate catastrophe.

I am therefore not convinced that Misvention is the correct term in this case and would prefer that of Mispliance as more fitting as to what led to the accident. Post accidents reflections are not always indicative of safety cultures and statements such as "It was a direct consequence of Cold War isolation and the resulting lack of any safety culture", [4] must be treated with caution. After all, while violations and erosion of safety procedures occurred at other nuclear plants around the globe [12], isolation from the western world does not mean that violations were endemic in the Soviet Union.

ACTION	ELEMENTS	ELEMENT
Routine reactor shut-down	*Organisational*	Active Failure
Reactor prepare for test	Human	Active Failure
Series of operator actions	Human	Active Failure
Disabling of automatic shutdown	**Human**	**Active Failure**
Flow of coolant water diminished	*Technological*	Active Failure
Power output increased	*Technological*	Active Failure
Operator moves to shut down reactor	Human	Active Failure
Power surge result from previous errors	*Technological*	Active Failure
Fuel elements ruptured	*Technological*	Active Failure
Explosion lifts reactor plate	*Technological*	Active Failure
Fission released into atmosphere	*Technological*	Active Failure

Table 2. Chernobyl Reactor sequence of events

Review and Analysis. In two of the examples, the human element plays a definite and decisive role as triggering the accidents; however, latent conditions at the organisational and technological levels are in significant more numbers than the human element. This leads me to presume that the Human element is but a tool, often used as a convenient scapegoat by investigators as the catalyst for accidents for not adhering to the embedded "In Depth Defences" [12] of the organisational Safety Management System, (SMS). This also raises the spectre whether there was a commitment at the organisational level towards the Safety Management and Recovery System. In the overall analysis, I feel that technology must never outstrip the knowledge of its human element, and that humans must always be in control of the decision making process to deal with emergencies.

Conclusion. During this paper I have endeavoured to demonstrate by examples, diagrams, tables, other authors and my thoughts, an alternative point of view to that of James Reason. It would also be unjust on my part to claim in the space of this paper that I have all the answers and humbly beg forgiveness for my ignorance on the subject. Finally, in summing up, I believe that James Reason's neglect of additional confounding factors, focus on human error and the influence of global "false knowledge" [7], inadvertently misled him to conclude that human error to be principal architect of accidents. We should therefore leave the door open for new knowledge, and review whether the organisational element is the cause of accidents and not that of human error.

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ATTACHMENT 1

Authors Additional Supporting Notes

1. Recommendations. As a result of this paper, I recommend that: greater interaction between man and machine, replace Human error with latency error, conduct regular Strategic Incident Appreciations (SIA), consider a global definition of the word accident, accept that accidents are a fact of life and identify the active failures that trigger accidents.

2. I am of the belief that seeking a human scapegoat to bear the blame after the accident has occurred is not conducive to good working relationships and that the organisational element that should shoulder the responsibility. Furthermore the organisational element is entrusted with providing an environment, free of hazards as required by the Victorian OHS Act 2004 [8].

3. Unpublished - Personal memories of The Westgate Bridge Disaster (1970). I was an apprentice electrician for a firm called J PARK Electrics, operating out of Brighton. I remember well the days when John Baker (Foreman) and I would visit the bridge to undertake maintenance and repairs on the lift that took the workers to the summit of the bridge. We would drive to the eastern side of the Yarra and take a boat across to the western side. The bulge (ripple) on the bridge would stretch across the width of it, appearing some four centimetres high. The rumblings and jerks often heard and felt occasionally were laughed at by those working on the bridge and considered it part of the job. Tough blokes they were, that's for sure.

Two weeks before the disaster, I visited the bridge to undertake lift maintenance as per our work maintenance schedule. On completion I went to obtain a work docket signature from the young engineer, (Bill Stacey) and in doing so, I asked him about the ripple and the reason for the concrete blocks. Bill's answer was that the concrete blocks had been put placed on top to remove the ripple from the bridge. I made a joke about the bridge falling around his ears and we both just laughed. On reflection my prophetic remark of that day has haunted me ever since and I feel a sense of loss and sadness. Bill unfortunately died some weeks later after suffering massive internal injuries. He was a real good bloke.

In fact on the day of the disaster, John Baker and I were scheduled to work at the bridge that morning; but for some unexplained reason John decided to change the shift from the bridge to maintenance on the city construction lifts. Subsequently at 12.00 am whilst on the top floor of Marlin House in Bourke Street we heard of the Westgate Bridge disaster. Using the surveyor's theodolite we looked in the direction of Williamstown to locate the Westgate Bridge and found that one of the pillars supporting the western end of the bridge was missing along with the span. John Bakers decision saved both our lives on that day. My brother, who worked in the bank near the disaster, stopped work and raced over to see whether I was among the dead.