0912 240897 Thesis

for Mike Shannon

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Can Velocity

Management be introduced

to the repair chain of a utilities

monopoly?

Abstract

Background The challenge of introducing Velocity Management which is a performance improvement technique may be too much for a repair chain of a regulated utility monopoly which provides one of the basic core needs of society. The need to increase repairs, water saved and income within existing staff numbers, whilst reducing repair backlogs and delivering high returns for shareholders and mitigating an increasing capital challenge of aging infrastructure does create a situation resulting in velocity management becoming a burden to the company. A three year study of whether Velocity Management could be successfully introduced into the repair chain of a utility monopoly is reported here.

Results Statistical analysis was used to determine if Velocity Managements introduction improved the repair chains performance against some Key Performance Indicators (KPI's). The KPI's were an increase in the number of repairs, Mega Litres a day saved, income, and a decrease in age of the backlog, average age of repairs and personnel all achieved the targets that were set at the beginning of the study. This showed that velocity management could be introduced to a utilities monopoly and markedly improved the repair chain performance of the organisation.

Conclusion A theoretical analysis supported by statistical results that are independently verified by the utilities regulator shows that Velocity Management can be introduced successfully into the repair chain of a utilities monopoly. Future research would be beneficial to assess which tools and techniques can be embedded into other utility organisations, when additional training is required and what is the value for money increase for the whole utility and not just the repair chain in areas such as customer complaints and repair rework.

Acknowledgements

I wish to acknowledge the support of my wife Kate Powney, whom without, I would have fallen short.

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Chapter 1 Overview

1.1 Introduction

The introduction summaries the position of the Utilities Monopoly, the challenges that they face due to their position, their drivers both from their shareholders and the regulator; and how performance improvement techniques can assist them in achieving these. A summary of Customer Side Leakage process within a water utility company and how this could be used to determine if Velocity Management could be introduced. The objectives that need to be answered to support the thesis and an over view of the breakdown of the chapters.

In the past monopolies (and regulated monopolies in particular) have been seen as not being terribly efficient or effective due to the protection that a monopoly situation affords them. They were state owned and had strong unions which made implementing change or transformation harder than similar sized privately owned organisations. Though these organisations are now privately owned a lot of practises and procedures still date back to the days when they were a nationalised industry. That said, they deliver a good profit to their shareholders, whilst not making spectacular returns and are seen as a safe low risk investment; hence why a lot of utility monopolies in the UK have pension funds as some of their main shareholders (Watts, N. 2008).

Utilities are government funded, and in the case of the Company which is a large water utility in the UK, provide one of the basic necessities of life to the population of Greater London. When these organisations were privatised, the new owners minimised the amount of money that was spent on maintaining the infrastructure in order to maximise their profits (MBD. 2009). This created a situation where there was a large backlog of capital works required to enable utilities organisations to stop their infrastructure from falling into disrepair. For the Company, an example of this was Victoria Mains; these water mains were among the oldest in the UK, with 44 per cent over 100 years old and they needed replacing (TWUL. 2010). These replacements were some of the works that were required to ensure that utilities were able to be sold on, or were required by the government as part of their management of the sector.

The challenge for the utilities was not only in the capital areas, but improving the operational processes and procedures to lean the organisation and trim the excesses that had occurred over the years of nationalisation. One of the operational areas that were looked at was the finding and repairing of leaks and the management of these repair teams. Consideration was given as to what could be trialled that would not have a significant impact on the Company as a whole, but if successful could be used in other parts of the organisation. Velocity Management was suggested to be trialled on Customer Side Leakage (CSL), to see if it could be successful and utilised across other parts of the business. This thesis tests the hypothesis of can the principles of Velocity Management be introduced to the repair chain of a utilities monopoly?

Velocity Management is one of many tools that make up business improvement suite of tools, which can be used on a business either by consultants or by internal staff to measure and improve business performance. Others such as Six Sigma, Lean, Theory of Constraints, and Activity Sampling are better known. Velocity Management focuses on speed of an activity, to move it through the process as quickly as possible, whilst still maintaining the required quality of the end product. It reviews each part of the process in a chain to create a benchmark and then accelerates or streamlines them, strengthens business units' process links and clearly communicates that message to all involved parties. Though Velocity Management assesses part of the process, it is focused on the strategic overview and questions the requirement for the process in the first place as well as the alignment of the processes with the goals of the business.

CSL repairs are broken down into detecting, proving, processing and repair; detection, processing and repair backlogs; revenue generated from repairs, relays and shared supply. Velocity Management was applied to the six parts of the Customer Side Leakage process: detecting, proving, processing, planning, leak repairs, and customer invoicing. The benchmark was taken from 12 months of data from April 2005 to March 2006 from the Companies corporate system that is used for reporting to the water regulator. This benchmark was compared to changes affected by Velocity Management in line with the Company's reporting to prove the hypothesis correct or not. Velocity Management was used within the Customer Side Leakage (CSL) Team in the reporting period of April 2006 to March 2007, which is the second year of the collected data. The third year of data from April 2007 to March 2008 was the year after Velocity Management was fully utilised within CSL, and would show the improvements or losses against the benchmark and how much impact Velocity Management had on the CSL repair chain in the long term.

1.2 Thesis Question

The thesis question is can Velocity Management be introduced to the repair chain of a utilities monopoly in order to produce a cost effective and efficient organisation now and into the future? Velocity Management was introduced into the Company during the 2006/07 regulatory year (April 2006 to March 2007) when Mike Shannon was the Manager of the Customer Side Leakage (CSL) Team. It will be compared to the benchmark data from the 2005/06 regulatory year which was before Velocity Management was introduced. 2007/08 was the 12 months after Velocity Management's introduction, but the key personnel involved had since left the Customer Side Leakage Team so any benefits realised were a legacy and a result of the changes remaining embedded within the organisation. The challenge for personnel remaining within the CSL Team was to continue to use the new processes and procedures and not revert to the old processes and the path of least resistance; which is the main factor why business improvements fails in the long term.

1.3 Key Objectives

In order to be able to answer the question, key objectives must be stated that can be proven to be true or false, and they must be broken down into parts that can be measured objectively. These six objectives and their performance targets underpin the success of the thesis, they are:

- Number of repairs being carried out by the CSL Team. Specifically an increase of those repairs that contribute to leakage and income generation. To support the thesis as being correct, leakage generating repairs would have to be improved by 20% and total repairs by 15%.
- Mega Litre per Day (MLD) saved. This saving is reported by the Company to OFWAT yearly and this is the key indicator that is used by OFWAT to place the utilities into a performance table. To support the thesis, there would have to be an increase of MLD of 20% against the baseline which was 19 MLD.
- Income: The Company would want to at least keep with parity to the benchmark of 2005/6 during the year that Velocity Management was introduced 2006/7. If the income generation could be increased, then this would be seen as a success as income generation is only second behind leakage repairs in the Company drivers for CSL. To support this thesis, there would have to be at least the same income generated or an increase. The target for income generation was set at 15%.
- The age of the backlog, specifically the management of those repairs over 365 days old, as this is an indicator that is assessed in the United Kingdom by the Economic Regulation for the Water and Sewerage Industry in England and Wales (OFWAT) during the yearly reports that are provided by the Company to the regulator. Linked to the backlog age is customer complaints - with the longer time taken to carry out the repairs, there is an increase in the amount of customer complaints received by the CSL Team. To support the thesis, the backlog of repairs of 365 days would have to reduce by over 50% during the period when Velocity Management is being used.

- The average age of all reportable repairs. This must be considered in conjunction with the average age of the backlogs, personnel manning with the CSL Team, and the amount of repairs being carried out in the period; as the less repairs that are carried out, the lowering of the average age as the repair turnaround time should be less. To support the thesis, the average age would have to be linked in to the amount of repairs carried out and be within 15% variation of the baseline once additional repairs were known.
- Personnel: That the personnel can manage the increase in work that is projected to occur and manage the possible reduction of numbers as part of the restructure. To support the thesis, the personnel would be able to manage an increase of repairs of 20% within the same or up to 10% reduction of staff.

Of the six objectives that link into the thesis being proven, at least 4 or more would have to beat there indicators for the thesis question to be proven correct. The measure of MLD must be proven correct as this is the key that is measured by OFWAT.

1.4 Chapter Format

The format of the Chapters for the rest of the paper is broken down into the following:

- Chapter 1 is the introduction of the Monopoly challenge that Utilities have and their position between the shareholders and the regulator, Customer Side Leakage background, thesis question and the objectives to support the thesis.
- Chapter 2 is the industry background: what the Company is, how it is controlled, and the freedoms and constraints it has as an organisation. This includes what similar organisations there are and how are they regulated by government. The detail of the Customer Side Leakage organisational structure and processes and how it could be

improved by Velocity Management. The challenges for Velocity Management to be successful within a utilities monopoly.

- Chapter 3 is the Literature review which covers how Velocity Management has been used in utilities in the past and other similar industries that have used the practises.
- Chapter 4 is the methodology that was adopted by the Company to introduce Velocity Management. This includes the management of the data source, research methods, how Velocity Management was implemented, future processes that were adopted and what limitations there were to the study.
- Chapter 5 is the analysis and discuss of results. It compares the types and number of the repairs carried out in the three years of data; the amount of Mega litres per day (MLD) saved, the income generated from these repairs, back log of work, average age of repairs, breakdown of the repair types and the personnel who support the work over the three year period. The main types of repairs carried out by CSL are discussed, they are; relays, repairs, commercial, Meter Rear Replacement to Property Box (MRRPB): Outside Stop Valve to Boundary Box (OSVTBs), Section 75 (S75), and Miscellaneous repairs. It analysis the increases and decreases over the three yearly reporting periods and how Velocity Management assisted or hindered performance.
- Chapter 6 concludes the thesis and states if the thesis question of whether Velocity Management can be introduced to the repair chain of a utilities monopoly has been proven or disproven, when compared against the key objectives set in the introduction.

Chapter 2. Industry Background

2.1 Introduction

The industry background is broken into a number of parts, the Company and its position as a utility Monopoly; Velocity Management where it came from and what it focused on achieving; Customer Side Leakage both its Organisational Structure and the processes broken down to their component parts and the challenges that the Company and Customer Side Leakage were faced with to deliver business improvements.

The Company is a private utility company responsible for the public water supply and wastewater treatment in large parts of Greater London, the Thames Valley, Surrey, Gloucestershire, Wiltshire, and Kent. It is the UK's largest water and wastewater services company, and supplies 2.6 Gigalitres of drinking water per day. The Company is responsible for a range of water management infrastructure projects including the Company’s Ring Main around London and Europe's largest wastewater treatment works as reported by their website (Thames Water, n.d.).

The Company is a monopoly that has no competition, restricted growth because it operates in a specific geographical location, and is regulated in the United Kingdom by the Economic Regulation for the Water and Sewerage Industry in England and Wales (OFWAT) (‘OFWAT’, 2013), to stop it setting monopoly pricing, as it would if operating in an unregulated market (Sloman and Norris, 2005:369). The Company reports its annual performance to OFWAT where it is monitored against objectives that have been negotiated as part of its five year capital funding Asset Management Plan (AMP) (‘Environment Programme of the water industry: 2005 – 2010’; 2013).

The annual OFWAT report compares water companies against their historic performance and each other, with a failure to meet targets resulting in company penalties. The higher a company is on the OFWAT ranking table, the better funding they receive and the less financial undertakings or penalties they are likely to incur. Some water utilities have continually failed to meet their targets for up to five years, which makes it difficult to turn their performance around in the short term. This grading is used as the basis for funding negotiations for the next AMP period, protects customer service, measures and compares costs, and impacts on the pricing reviews as all water companies must have OFWAT approval to increase their customer pricing (‘Periodic Review 2009 - PR09’, 2013). Options for The Company to meet these regulatory goals and increase profitability are: to cut costs, upgrade the existing infrastructure in line with OFWAT requirements to avoid incurring penalties, improve internal processes and procedures, and increase the performance for detecting, proving and repairing leaks in order to maximise profit that can be sustained in both the short and long term.

The issue of monopolies is not just specific to the UK, but is an issue for a number of countries, including the United Stated of America (USA). A survey carried out by Black & Veatch identified that the USA are faced with similar issues to the UK. The survey confirmed that financial issues including capital investment and a rising cost base are of concern. (‘2012 strategic directions in the u.s. water utility industry’, 2012:8) The USA companies are faced with an aging water and sewer infrastructure which requires significant capital investment, rising energy costs, increasing or expanding regulation, treatment technology, aging work force and chemical costs were other issues that concerned them. (‘2012 strategic directions in the u.s. water utility industry’, 2012:9) Faced with these issues there was a requirement to reduce their cost base whilst carrying out significant change programmes. All these issues are similar to the ones faced within the UK industry. Asset Management and sustainability are other issues that the US market is dealing with. This is a direct reflection of the UKs challenges and shows that process improvement programme are critical not just for the UK, but for a number of countries that have an aging infrastructure and cost base.

The significant difference between the USA and the UK is that the UK water industry is privatised and the US industry is still largely owned by the municipalities. At the moment, in the United States, contracting out the utilities to a private provider is more common than selling their assets, with no major city having sold its assets in recent years ('Water Privatization, Policy Issued Package, 2004). This contracting out is for between 10 and 20 years and for both the operations and management of the facilities, which is seen as a way to keep the costs down for local government. ('Water Privatization, Policy Issued Package, 2004). The drawback of this has been that private companies increase the water bills to pay for resolving the aging infrastructure issues, and it is thought that they are increasing their profit margins, which is similar to the comments faced by privately owned water companies in the UK. There has been some selling off of smaller utilities, but it is not wide spread. With the recession that has affected the global economy for the last few years, it makes it harder for these municipalities to be able to release money to spend on their aging infrastructure. ('Water Privatization, Policy Issued Package, 2004).

Though publicity owned, most areas in the U.S. are regulated where the activities of obtaining water supplies, approving water rates are carried out by local government, and the treatment standards are in accordance with federal Acts. Therefore the control of water is very similar to the UK where OFWAT and the Environmental Agency are the monitors of the private companies. ('Water Privatization, Policy Issued Package, 2004).

The split between water utilities being privately and publicly owned is much the same in Europe as it is in the US, with most European water companies still owned by local government, with the major exceptions being France where there is only 25% council ownership and Spain which has 63% Council ownership. Other areas within the Europe where there is limited private ownership are Germany with 82% council owner ship and Finland with 90% council ownership. Other counties such as Belgium, Italy and Sweden have limited private ownership, but it is less than 5%. (Hall, 2009:4). When Governments in Europe have begun to privatise water companies due to debt, relieve themselves of the capital burden or try to deliver value, there has been fierce opposition to the sale by local unions as they fear a change of the way in which they are managed, and from locals who are concerned about an increase to the cost of the water provided, and about the perceived and at times real concern that this will lead to higher prices and financial exploitation of water. All these concerns resonate in both in the UK and the United States. Whether a water utility is private or public or where they are in the world, is another matter for discuss, the fact is that they are all monopolies, providing one of life’s essentials, and this will always make them an area of fierce debate. (Hayes, 2004:1).

Other similar industries in the UK such as power, gas and phone companies operating as monopolies or oligopolies have made significant profits for their shareholders over recent years even through the recession that has hit the UK. An example is British Airports Authority (BAA) which manages the majority of large airports across the UK. BAA was recently broken up as a monopoly by the government to bring some competition into the market. They are funded on a five year funding period called a quinquennium by the Civil Aviation Authority (CAA), with the majority of the same restrictions that the Company has with the regulator. BAA reported an increase in profits of 7.6% for 2010 even with the recession and the closing of the airports due to the volcanic eruptions. For 2011, BAA are forecasting Earnings before Interest, Taxes, Depreciation and Amortization (EBITDA) to rise

15.2% to £1.12bn as reported by the *Telegraph* ('BAA raises profit forecast on predictions of record-breaking year for Heathrow Airport', 2010).

British Gas had record profits during the cold periods of 2008/9 and 2009/10, when many low socio economic households were struggling to keep warm and were dealing with increased levels of employment uncertainty due to the recession. British Gas made an increase in operating profits of 58% in 2009, which did lead to the announcement of a 7% decrease in the gas price to customers, but still achieved record profits because of the increase in gas usage and the growth in their customer base according to the BBC ('British Gas profits jump by 58% to record high', 2010). In the first half of 2010, British Gas recorded a 98% increase in operating profits, and after recording a 65% increase in profits for the whole of 2010, announced profits of £585 million according to the BBC (' British Gas sees profits rise 98% in first half of year', 2010).

18 months after the reduction in retail prices, British Gas announced that they would increase the retail price of gas as wholesale prices had risen (after almost halving during the recession from the peak in 2008). Furthermore there was a requirement to modernise its ageing infrastructure, and a drive to spend £1.2 billion a year on offshore wind projects and gas production as part of the government sustainability requirements. This caused fury among consumer groups that the biggest UK energy supplier had cashed in during the harshest winter in 30 years and should do more to help its 16 million customers by keeping bills low as reported by the BBC ('British Gas sees profits rise 98% in first half of year', 2010). These results show that there are strong returns for investment in utilities, with the challenge to ensure that utilities maintain their capital spend to keep their existing infrastructure modernised.

There are other monopolies not just within the utilities industry, BAE systems which are a multinational defence company, have been accused of being a monopoly in the past due to the UK government's decision to have a defence industry within the UK and not outsourcing this capability internationally. BAE strongly refuted claims that they were seeking to monopolise the industry by securing the Type 45 destroyer, future aircraft carrier and tanker aircraft contracts, over its main opposition Vosper Thornycroft (VT). VT had accused BAE of achieving the monopoly status in ship building if there won the contract to build the Type 45 destroyers ('BAE hits out at monopoly charge',2001). The key issue was that there was a reducing government work load and both companies had to win some government work in order to keep themselves afloat. The international market was tough and there was a high probability that they would lose money if they took too much risk in this area. This drove accusations of monopolies as both strove to win the critical government work.

Because of the UK Governments decision to keep a defense ship building capability within the UK, VT Group and BAE Systems become a joint shipbuilding venture, and VT left the market. The Government formed a monopoly to protect the national interest for defense, which is a decision made in the national interest. The JV become the UK government's strategic partner for the design, manufacture and support of future warships with the Ministry of Defense (MoD) and signed a non-binding Heads of Terms for a Terms of Business Agreement (ToBA) ('BAE and VT shipbuilding merger agreed', 2007). The details of the agreement was that the JV had to maintain a certain skill level within the organisation to enable ships and submarines to be built, even if there was a gap in ordering during some years.

The disadvantage of the TOBA was that it created a monopoly and BAE ceased to be in competition with other companies for ship building in the UK. In the past, BAE bid for international work and were efficient in this, but now that they had a fixed set of work from the UK MoD, then they stopped bidding internationally as this was not in their interests and introduced to much risk to the company. In effect, the monopoly position bred the wrong practices. BAE are challenged by the same situation in that they need to maintain efficient practices when they are a monopoly. They are managed by the MoD, but with the ability of the MoD to deliver cost effective programs somewhere limited, there is a challenge for both the tax payer and the company to justify their profits. ('BAE and VT shipbuilding merger agreed', 2007).

One of the ways utilities companies have made high short term profits is to restrict the amount of capital they invest in the business so that operating profits can be artificially maintained before the burden of replacing existing infrastructure is realised. When this occurs, the business is sold and the new owners deal with the regulatory requirement to invest capital, which occurred in 2007 when the Company was sold to McQuaries Bank. *Rheinisch-Westfälisches Elektrizitätswerk (*RWE) who owned the Company had been imposed with undertakings from OFWAT to upgrade their infrastructure which was starting to fail after having had minimal investment over a 10 to 15 year period. These undertakings would have a significant impact on RWE's profit margin for a number of years and the business was sold. During the due diligence carried out by McQuaries, a negotiation point was who would fund these undertakings as they were approx £1bn over a four year period, which affected the bottom line. If the OFWAT undertakings were not met, then they would be liable for significant fines. The funding responsibility was split between RWE and MacQuaries resulting in an upgrade of the water production and waste facilities, and replacement of the central London mains (which were laid in the Victorian period and had been rotting in the ground for a number of years causing significant leakage). This is an extreme example because the Company is the largest of the utilities companies within the UK, but does show the effect of lack of capital investment within a utility company.

An exception to this type of income stream is BAA which is capitally funded through quinquenniums which are incorporated into the Regulated Asset Base (RAB) charged to the airlines as landing fees at 7%. To mitigate most utilities companies trying to spend as little as possible on their infrastructure, the regulatory bodies set tough measures linking capital investment into their funding cycle, so that a business' infrastructure is not so run down to make it unattractive for future buyers. The Company had not achieved its regulatory targets in the seven years to 2006 as stated by OFWAT (OFWAT, 2008), so the contribution of Velocity Management towards achieving this would be significant. During the introduction of Velocity Management there was continual refinement as knowledge increased and best practice deepened in the subject area (Dorling, Scott and Deakins, 2006:177). Once Velocity Management has shown success with increases in repairs and income, the intent was to embed this technique across the business.

The back ground of Velocity Management was during Operation Desert Storm in Iraq during 1990 and 1991, for the U.S. Army, there was a lot of waste of stores in terms of stock piles of supplies, which lead to the drive to improve and refine the logistics architecture required to support the military better. (Daniels, 2008:1) The so called Iron Mountain was created when stores arrived in bulk quantities, but no teams with the ability to organise and manage them, as they still had to deploy into theatre, this drove inefficiencies in the supply chain (Gardner, 2004:2). Wrong stocks were being available at the wrong time and the air and sea posts became clogged with equipment, food and ammunition. (Daniels, 2008:1-3). The army looked at other companies which moved stocks and other supplies over a long supply chain such as Ups and others to gauge how it could improve.   The existing Army Logistics procedures were found to be *"unreliable, inefficient, unresponsive to changing customer needs and expensive."* According to (Daniels, 2008:2).

The decision was made to replace mass with Velocity and by utilising Velocity Logistics, there was a sustained improvement with the costs of storage dropping and an increase in readiness levels and repairs times for the U.S. Army. VM enabled the US arm to focus and reduce its Customer Wait Time (CWT) for high priority material. This was because for the first time, the Army supply chain was viewed as a set of processes which interlinked. When each segment was analysed and optimised, substantial improvements were realised. (Gardner, 2004:1-2). This was shown to be a marked success and was introduced across the Army, but not into the Air force or the Marines. (Daniels, 2008:2).

Whilst Velocity Logistics was successful for the U.S. Army when they were in Garrison or in small scale conflicts, it was not as effective in large scale conflicts where the uncertainty of war, and the changing need for the combat soldier, resulted in Velocity Logistics struggling to be effective. (Daniels, 2008: 7-9). During Iraq, Velocity Management failed and ultimately the failure of logistics in Iraq was the same as the failures in the Gulf more than 10 years earlier. This was down to training, the large amount of stores being moved and the different operating principles between the Army, Marines and Air force, as well as not providing enough resources to clear bottlenecks when they were first identified.

Because all the services operated their logistics chains differently, there was not strategic distribution policy that linked them all together, which contributed to some of the failure. For Army specific supplies, Velocity Logistics was still effective, the issue was trying to move all the other services stores and equipment's when organisations were not structured the same way logistically. The U.S Marine Corps was still supply based rather than distribution based, which meant that even though they were disbursed across the battle field they were still supplied in bulk which required additional handing to breakdown the stock and delayed their delivery. In short though VM was used successfully to get the majority of stock to the Theatre for the U.S Army, the bulk of the issues occurred when it arrived in theatre and was combined with the other services supply chains. (Gardner, 2004:8-13). The result was that Velocity Logistics though failing in large theatres, could with buy in from other services still be a critical tool in managing logistics support across the battlefield for the U.S services not just the Army. For the use in Utility organisations, Velocity Logistics does meet their need, as Utilities are seldom faced with the fog of war.

2.2 Customer Side Leakage Organisational Structure

CSL is the part of the Companies repair chain which finds and repairs leaks on the customers' side of the water network in order to meet leakage targets; and is a revenue stream. CSL comprises 20% of the repair chain and changes to it are able to show significant gains for the Company, but it is a separate enough entity to allow changes to be made in isolation without affecting the whole repair process (Shannon, 2006:4). If the CSL repair chain was optimised, the Company would be better placed to meet its regulatory leakage targets and secure improved long term funding from OFWAT (Shannon, 2006:2). This streamlining has a significant impact on the company, its performance in the eyes of the regulator, and its long term profit-making success (Shannon, 2006:5).

During the gathering of data, CSL went through a reorganisation as part of an organisational transformation to streamline the business and reduce operating costs. This occurred in September 2006. Figure 2.01 illustrates the structure before the reorganisation with 25 direct reports, and the rest of the personnel involved in the CSL repair process are contractors. The positions identified to be cut as part of the restructure were: the Leakage Manager, the London Domestic Manager, and one of the Planning Staff. It was recommended that these positions be removed from CSL.

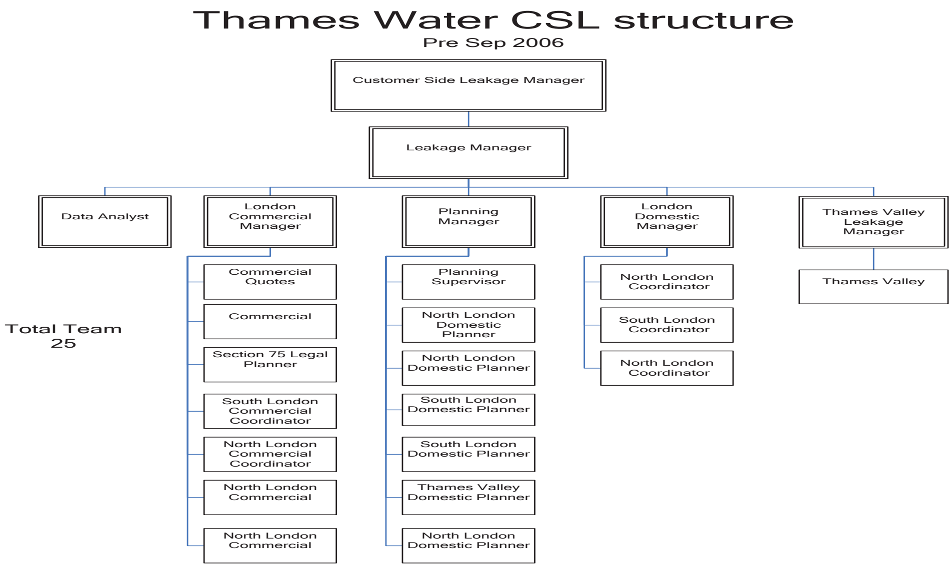

Figure 2.01: Customer Side Leakage Organisational Structure Pre September 2006

Figure 2.02 shows the reorganised CSL structure post September 2006, which has 22 permanent staff positions, and the rest of the team are contractors. Velocity Management was introduced to CSL in the 2006/7 reporting year which runs from April 2006 to March 2007. Losing three staff whilst introducing Velocity Management brought additional challenges (in terms of staff management) that had to be overcome for Velocity Management to be successful. The removal of the Leakage Manager position streamlined the reporting between the CSL Manager and the rest of the CSL Team. The removal of the London Domestic Manager position enabled London to be managed as one area for CSL, which resulted in an improved ability to move resources across London to deal with CSL issues. The North London Domestic Planner position was assessed as having the lightest workload across the Planners, but there was concern that the loss of the position would have an impact on the workload and backlogs for the rest of the planning team. This was continually assessed during the introduction of Velocity Management, to make sure that the rest of the team managed the additional work.

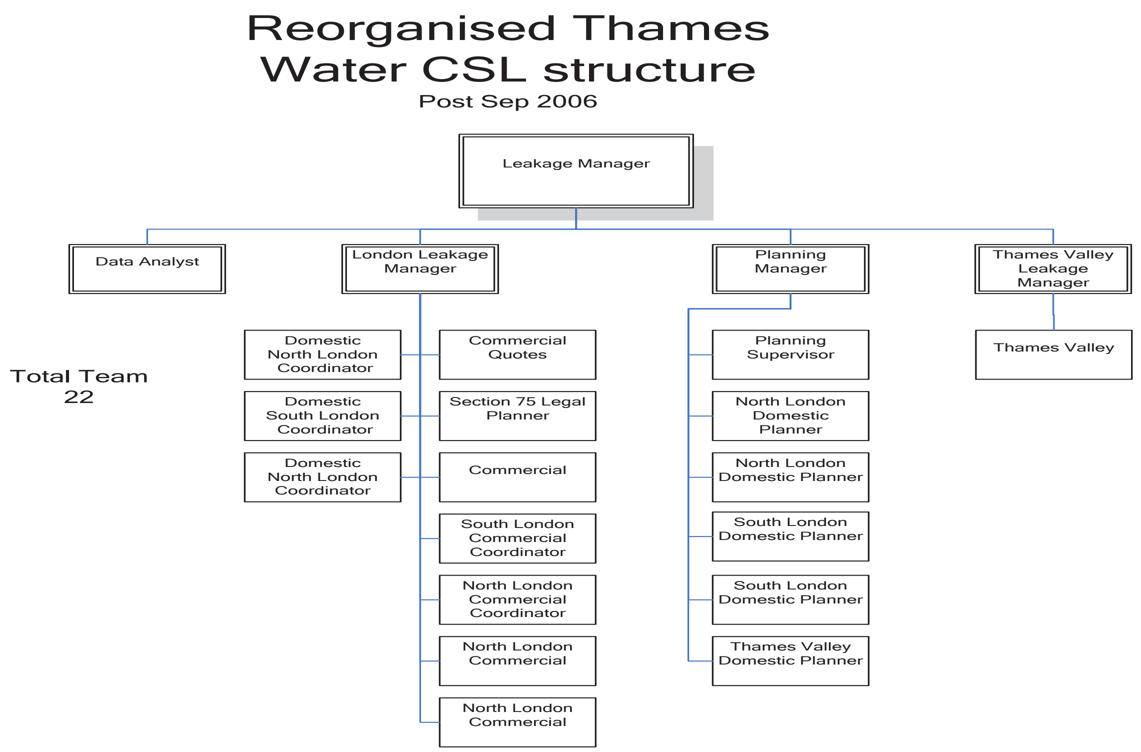

Figure 2.02: Customer Side Leakage Organisational Structure Post September 2006

2.3 Customer Side Leakage Current Process

The CSL detection and repair process is broken down into five parts, shown in figure 2.03, with customer communications linking them all as stated by Shannon (2006:1-2). They are:

- Detecting the leak
- Proving the leak
- Planning the repair
- Repairing the leak
- Invoicing the customer

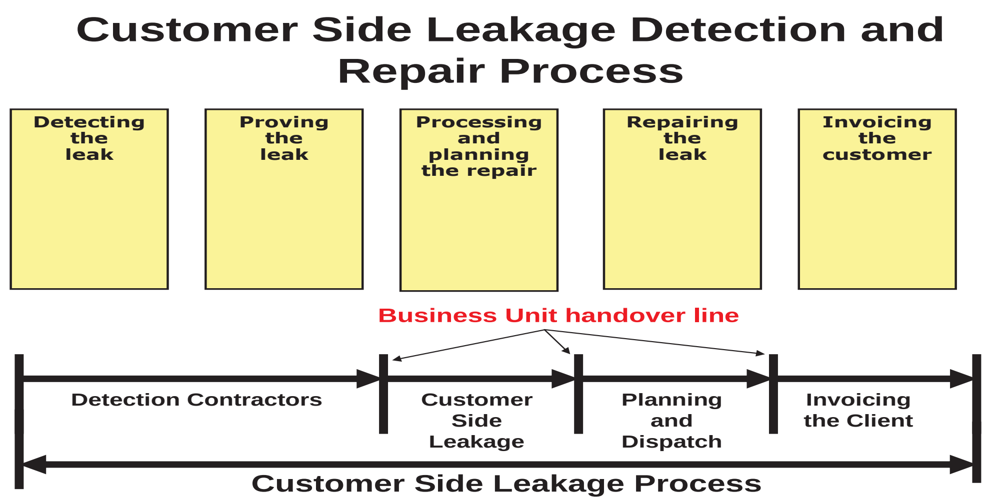

Figure 2.03: CSL Detection and Repair Process

Detecting the Leak: The CSL Team is made aware of possible leaks when customers report a leak on their property from an issue such as low pressure, or when the night detection team locate a possible leak. The team can find a possible leak by either walking the streets listening to stop valves outside houses or they are part of the systematic checking of areas that show high leakage which has been targeted by the leakage engineers who manage the network. A detected leak is registered onto the Company database which creates a job for the proving teams to assess. Historically the frustration for the detection teams was that they would find what they thought was a certain leak, register it onto the system, and it would be closed the next day as no leak by the proving contractor who would give little or no reason why the job was closed. If the detection contractor was certain it was a leak, they would resubmit the leak, and this cycle could continue for weeks. As there was no feedback loop between the detection teams, and the provers were often from the same subcontractor as the detector, this was a continual source of frustration for both parties, resulting in frustrated crews and wasted efforts.

The challenge for the provers was that it was hard to prove a leak in areas such as congested industrial estates, busy roads, a large sewer main, underground rivers or inner city locations such as the City of London high rise blocks, because there is a lot of background noise making it hard to locate leaks. The detection contractors were paid on how many leaks they found, not if they were proven as a leak or not; which drove a culture of submitting as many leaks as possible to maximise possible income. This created work for the proving teams sorting out genuine leaks from jobs that had been submitted to improve the contractors' revenue streams. There were seven different contractors working in the Company area on leak detection work during the majority of the three years this information was gathered; which created a number of points of failure for the leak moving from being detected to being proven as a leak.

Proving the Leak: Once a leak is recorded into the Company database as a possible leak, a proving technician goes to the customer's house and proves a leak to the customer by two tests. One of the tests requires the technician to gain access to the customer's property which can delay the process significantly as the provers carry out their duties during working hours when most customers are at work. If access is unable to be gained at the customer's property, a card is left informing them that they have a possible leak, and asking them to call so that a prover can come to their house to prove a leak, which can take seven to 14 days. Once a leak is proven, the technician surveys pipe layout and notes issues that need to be addressed before a repair gang can carry out the repair, for example parking, special driveway, lots of trees etc. The customer is informed that they have a leak and is given the option of either repairing the leak themselves or having the Utility carry out the repair. They are left with an offer pack with an acceptance form that should be submitted within seven days.

In the case of commercial properties, if the customer requests that the Company carry out the repair, then a quote is given as all commercial properties are charged at the cost of the repair plus 15% for administration and profit. The customer can either accept the Quote, or engage a contractor to carry out the repair. Survey quality is critical for the repair teams that will carry out the repair; if poor information is provided then there can be long delays for the repair gangs to get the necessary equipment they require to complete the repair which is a waste of resources.

Processing and Planning the Repair: Once the survey is collated with the customer's acceptance to carry out the repair, the system is updated and the customer contacted to set a date for the repair to be carried out. If after seven days the customer does not submit their acceptance, they are contacted and if they still do not confirm which option they are going to undertake, the Company enact their legal rights to enter the premises and repair the leak. The challenge faced by the CSL planning team was the increase of customer leaks and a decrease in personnel to manage the workload in the three year period from 2005 to 2008 when this data was captured. To manage this increase, the team had to improve their processes and working patterns to cope. Other challenges faced during this time were: dealing with leakage teams, proving technicians, and repair teams to ensure that they provide the correct information to allow the next part of the process to carry out their role efficiently, whilst managing the legal process that is available to ensure repairs are carried out in a timely manner. As a lot of the teams had worked in silos there was little experience in how other parts of the repair process worked. For example, the planning team had never been out with the proving technicians or the repair gangs and therefore had very little understanding of the importance of the information they were processing or the impact it had on all parties within the repair chain.

Repairing the Leak: Each gang is normally allocated four to six planned repairs a day; of which three to four are customer facing. The average at the end of the 2005/06 regulatory year was 2.4 repairs per gang per day, which is low when compared to other like organisations which carry out 3.4 leakage repairs per day. The repair gang carries out the customer's repair using the survey sheet from the proving technician (Perrin, n.d:1-3). So the quality of work of the proving technicians is critical for the gangs, with a poor survey resulting in lost earnings and aborted work. The repair gangs are paid by the amount of repairs they complete, so planning and preparation of jobs is critical for them to hit their targets. A good gang, properly planned can carry out six to eight repairs a day. The challenges for the repair gangs are: having work planned in as small geographical area as possible to reduce travel between repairs; relevant preparation work been carried out e.g. parking bay closures and street works notification so that they can go to site and complete the repair with no interference; confirming that the customer is at home; and communication between all parties so if something changes then they are updated and can change work priorities if required. Until December 2006, there were three planning centres to plan repair gangs' work, with each centre using its own processes resulting in administrative duplication and different areas being focused on, which was a hindrance to carrying out repairs effectively.

If a poorly planned gang carried out 2.4 leakage jobs a day, not all of which were customer facing, it resulted in customers taking half a day to a day off work to wait for their repair gangs and becoming frustrated when the gang would show up late or not make the day at all. The overall result was complaints, most of which were valid. The gangs' work has to be re-planned and the customer would have to take additional time off work, which could result in additional complaints.

Invoicing the Customer: Once the repair has been completed and the job closed on the corporate system, the invoice is sent to the commercial team to recover the debt from the customer. The rates charge for the three years of data collected was £250 for relays (replacing the complete pipe) and £150 for shared relays, with the first repair (repairing the leaking section, but leaving the rest of the pipe work intact) being free and subsequent repairs being at cost to the customer. There was little communication between CSL and commercial and the challenge for both of these business units was to be aware of the outstanding debt and collectively work together to provide the relevant information to the debt collection agencies to recover the income.

Communication: Communication between all parties is key to the success of the process whether it be with the customer, customer service centre, proving technician, planning team or the repair gang. It is the critical activity to ensure that the process is a success. All of the roles in the CSL team are customer facing and the focus must be to give the customer a positive experience to investigate and repair their leak as quickly as possible with the minimum of disruption for them. This had never been focused on in the past (Shannon, 2006:5). The breaking down of barriers between business units and contractors and the continued drive to improve the relationships enables issues to be resolved proactively rather than reactively within the organisation. The Company and its contractor use an integrated IT system, but there was no standardised process for inputting data and the Company did not look at the complete repair chain, only business units in isolation.

2.4 The Challenges

The Company had no visibility of contractor performance, and the average age of the repair backlog, cycle time, process time or contractor jobs per gangs were not known, making performance improvement challenging. It was a situation that had to change (Ashby, 2006:4) as the total time from leak detection to repair was used as the benchmark for assessing CSL performance by OFWAT in the yearly regulatory review (OFWAT, 2007a: 31-2).

The definition of VM is that it is a management program aimed at improving logistics processes. VM looks at logistics by process (e.g., the processes of ordering and receiving a spare part or repairing a piece of equipment) , and as processes cut across functions, it can manage logistics by process and streamline them to improve their “velocity,” and reduces the time it takes to perform basic processes, It improves quality and lowers costs (Rand. N.D:67). VM has been used by the US military since the mid 1990 in a drive to improve their performance in both garrison and on operations. These factors linked into the process orientated procedures and the ability of VM to cut across business silos, which is a restriction in a process orientated organisation such as Thames. Implementing VM was considered to be a low risk option as it focused on improving processes and there was no threat of new competition due to their monopoly position; the possible loss of their licence though a risk, is not a likely option for the business; fines for not meeting regulatory goals as they had failed for the past seven years; they had signed a commitment to OFWAT to spend an extra £150 million of shareholders’ money due to breaching its target for 2005-06 to replace the Victoria mains in London until 31 Mar 2010 (Pelczer, 2006); and the Company had just been sold by RWE to MacQuaries in early 2007 and had to meet the due diligence of the contract to enable to sale to go ahead.

The bargaining power of a utility is great as there are a number of contractors capable of providing repair chain functions within the market, but they do compete for similar staff skills with like industries such as electricity and gas (Dorling, Scott and Deakins, 2006:186). In the past the Company has driven costs down with their contractors by selecting the lowest bid and adopting an adversarial relationship which has resulted in some contractors leaving due to their business tactics. Working with the contractors to improve the processes to allow the number of jobs gangs can complete a day to increase had not been considered; therefore generating improved revenues for gangs, and reducing gang numbers whilst still meeting leakage targets. Utility rivalry exists as they compete to excel in the regulator rankings in order to gain additional funding in later years; as they are located closely together due to geography, gangs can move to other providers if there are better conditions.

The Company had no risk appetite to manage their own repairs and outsourced the repair capability and risk management to contractors, allowing them to plan and conduct repairs with little external control. The contractors who won the contract were able to cherry pick easy repairs, ignoring challenging repairs and the customer complaints that came from them. This poor management of jobs resulted in 60 contractors gangs completing an average of 2.4 jobs a day with a high unit rate due to the large contractor risk, and a low number of jobs completed to enable the repair gangs to be paid sufficiently to retain them (Ashby, 2006:4-5).

The end result was an average time to repair CSL leaks of 40 days, process times of 75 days, and a total job backlog of more than two months old. This did not meet contractual KPIs between the Company and the contractors, but with no incentive based contract to drive improvement, the only option was to cancel contracts once the relationship broke down. This resulted in frustrated customers, a poor relationship with contractors, poor processes, a high level of complaints, and the non-achievement of the OFWAT regulator set leakage targets for seven consecutive years (Pelczer, 2006).

Chapter 3 Literature Review

3.1 Introduction

No related research has been found for introducing Velocity Management principles to a utilities repair chain within the UK. This is not surprising because water companies in England and Wales tend to be quite protective of their processes and procedures; as the position that the company finished on the OFWAT table of comparison dictates funding as part of the regulation five year funding plan, with the next plan to be submitted for 2010 in Dec 2008 (OFWAT, 2007). What was found was continuous improvement in utility management: a framework for integration (John, et al., 2004) which was work carried out in the United States on continuous improvement in water and waste water utilities and the challenges of integrating initiatives within a framework.

3.2 Challenges

The main challenges that were highlighted from US research were ageing infrastructure, challenge of government funding, new and more stringent regulatory regulations, increasing public expectations for the rates they pay, environmental performance, and transparency. (John, et al., 2004: 1). These issues are the same ones being faced by utility organisations within the UK, so these lessons are very relevant for utilities in the water and waste water industry in the UK.

Though the research did not focus specifically on Velocity Management, it discussed the challenges of continuous improvement of which Velocity Management is one of the many tools that can be used. The review focused on 15 types of management initiatives that were being used within the US water and waste water industry, of which some were international standards such as ISO9000 that are relevant, and grouped them into three types that supported some or all elements of a continuous improvement system. (John, et al., 2004: 1). The three areas were:

- Best management practices
- Strategic business planning support tools, and
- Continuous improvement management systems frameworks.

The framework of Plan, Do, Check and Act is shown in figure 3.01 and is a set of standard procedures and steps to support consistent and continual improvement of management areas. It considers the balance between environmental performance, Health and Safety, quality, financial performance and personnel management; with the focus on a core set of subjects that are critical to embedding the culture of continuous improvement and consistent performance success within a utility. The focus is on the interrelationship between these core areas, understanding the impact that improvement can have on them (both positive and negative), and continually finding the balance which is the advantage to the utility as a whole and not just the business unit. (John, et al., 2004: 4-6). These challenges are the same those faced when incorporating Velocity Management into the repair chain, showing that there are like challenges in all utility industries no matter where they are located.

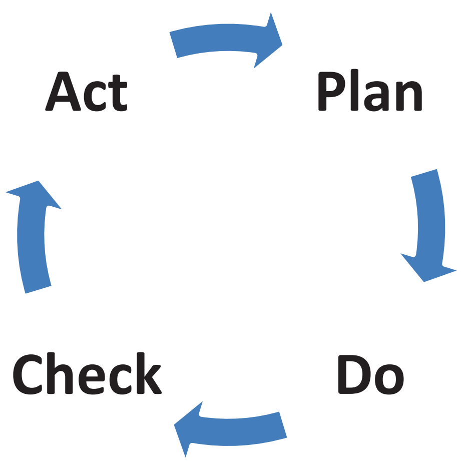

Figure 3.01: Continuous Improvement Management System Framework (John, et al., 2004:1)

Plan is establishing the commitment from senior management to carry out the improvement, preparing policy that reinforces senior management commitment and ties into the utility's vision and mission statement, identifying the areas that are going to be targeted by the improvement project, identifying legal or voluntary requirements, setting objectives and targets to be focused on and the benchmark that the improvement will be compared against (including the logic for setting this benchmark), and developing work streams for achieving these targets. (John, et al., 2004: 6).

Do is the implementation of the project to align the project to the operational and administrative practices and procedures, and process of the utility. This includes the communications plan, employee training programme, and other elements that were identified during the planning phase. Document management and operational controls are also identified and put in place or aligned depending on the maturity of the existing processes.

Check is the aligning of the processes and procedures for the on-going monitoring of the performance with the policy, objectives and targets that were established during the planning phase. This includes the audit of the systems for the performance reporting process and formats and the review process (John, et al., 2004: 7,8).

Act is the last part of the cycle and establishes a process for regular improvement to the operations and management systems that have been put in place to support the improvement across the utility. This is based on the data and reporting that was established during the check part of the improvement cycle. The need to act is based on developing corrective and preventative plans and adjusting performance goals and policies on a regular basis to reflect the data that is being reported. This relates to those areas that are exceeding expectation as well as those areas that are under performing. (John, et al., 2004: 8). Velocity Management ties into this system and it shows that although Velocity Management was not one of the 15 initiatives named, any performance improvement initiatives can use this structure.

All continuous improvement systems focus on the ongoing monitoring of the measurements, auditing of the processes and procedures, and review by management. This continually challenges all areas of the process and is critical to the success of a continuous improvement strategy. The report identified areas that benefited from a continuous improvement management system which were:

- Continuous improvement of the targeted management areas such as environmental, operating costs, financial, skills development, quality, and health and safety. An added advantage occurs if the initial scope of the project can be defined and focused on specific areas of the complete utility, then redefined and the scope widened once initial success has been delivered allowing for a phased approach to continuous improvement. This is an important tool to achieve acceptance and buy in from staff and unions and avoid trying to make too many changes too quickly.
- Enhanced operational consistency and reliability can be achieved with enhanced knowledge across the business units resulting in reduced staff turnover.
- Improved teamwork, business unit coordination and employee awareness. Continuous improvement breaks away from business unit silos, educates staff on the impact that their work has on the whole of the utility; and as a result there is improved teamwork, coordination and awareness of issues by staff. This was enhanced by defining and documenting job descriptions so that staffs were fully aware of the management expectations.
- Customer responsiveness and recognition is as a result of this work, as the better the utility operates the less customer complaints that are received; and there are linked reductions in areas such as capital spend, health and safety and environmental.

Although Velocity Management was focused on just CSL, it did focus on the improvement in the same areas, especially: operating costs, financial, skills development, quality, enhanced operational consistency, knowledge management, improved teamwork, the breaking down of business unit silos, improved coordination and awareness of issues of staff, and decreased customer complaints as a result of these improvements. With the success of the work in CSL, there was the ability to widen it to the rest of the operational areas and into other areas such as waste as well.

One of the major challenges identified by the Continuous Improvement in Utility Management was the integration of all the different improvement techniques under one management system. Integration ensures that utilities are more effective and are able to align their strategies across all management areas. It sets priorities and their interrelationships which drive personnel roles and responsibilities and the allocation of resources. Utilisation enabled the utility to leverage from all areas of the continuous improvement process which resulted in streamlined operations and decision making; enhanced employee training; improved internal and external communications; and substantial cost efficiencies in all areas of the business. The challenge of integrating new initiatives within the improvement framework was discussed and how the initiatives are introduced into the process at what stages are dependent on the interrelationships between improvement initiatives. (John, et al., 2004: 11-19).

3.3 Critical Success Factors

All the critical success factors that were identified by the continuous improvement in utility management are identical for the successful implementation of Velocity Management. Where Velocity Management was unsuccessful against the critical success criteria was the management commitment to ensure that adequate resources were in place to support the initiative in the long term. The critical success factors that were identified for the continuous improvement management system to be successfully implemented and maintained are:

- Strategic business planning with a limited number of measurable objectives.

- Management commitment to ensure adequate resources are in place for the implementation phase but more importantly the maintenance phase to ensure the continuous improvement remains embedded within the organisation.
- Connection to the budget process to ensure that the organisation's priorities are funded appropriately.
- Awareness of the best management process to assist the utility to understand where it sits in terms of the competition from other utilities that are fighting to gain more of the funding that is available.
- Effective internal and external communications to ensure that all personnel are brought into the changes and are aware of the journey that needs to be undertaken to successfully deliver the improvements.
- Updated training that is a reflection of the lessons learnt from the improvement cycle as well as defined job descriptions that ensure staff own and understand their part of the process.
- Employee and union buy in to the changes that are being undertaken throughout the organisation and the ability for them to contribute to the lessons that are learnt and the changes that arise from this. Explaining initiatives to staff and giving the time for them to become embedded within an organisation is key to the initiative's success. Failure to do this can lead to a high level of scepticism and a perception that managers are chasing fads, without focussing on long term initiatives under a consistent approach.
- Effective use of the information that is gathered that allows management to make proactive and timely decisions. This includes the continuous refining of information, but not adding additional measures that result in information overload.
- Specific checking and acting activities that close the loop on the continuous improvement process and which drive the development and maintenance of the continuous improvement culture. (John, et al., 2004: 11-19).

The barriers that were identified from the continuous improvement in utility management all related to the challenges that were encountered when Velocity Management was being implemented across CSL, in particular:

- A general reluctance to change exists, and implementing management systems requires a substantial culture shift for all staff at all levels. Gaining buy in from all staff is one of the key activities that must be undertaken in order to be able to implement a successful performance improvement strategy and Velocity Management was no different in this regard.
- A performance management system generates close scrutiny, creates more transparent goals and results in specific operational evaluations. Increased scrutiny builds confidence with those outside the business and allows the ability to show increased performance. The challenges of showing the areas of improvement is the management of expectations both within the team and externally and keeping them against the business plan especially if they are over or under delivering. (John, et al., 2004: 30-31).

The framework for integration then sets out a number of examples of where different water and waste water utilities have introduced a continuous improvement system into their organisations and how it was carried out. These utilities, whilst not as large, still have quite large throughput and some of the lessons from their experiences would have been useful. In summary the continuous Improvement in Utility Management: A framework for integration is very relevant literature; that if known about before introducing Velocity Management into CSL would have been of benefit.

Outside the continuous improvement in utility management: A Framework for integration, the closest comparison for Velocity Management was Vendor Managed Inventory (VMI). All articles about VMI discuss a shift from firm versus firm to supply chain versus supply chain competition over the last 20 years that has been created by strategic alliances, and this relates to both the supply chain and repair chain of the Company (Dorling, Scott and Deakins, 2006:176).

3.4 Oligopoly

The most relevant information from VMI discussions for the Company was about introducing VMI into an Oligopoly, with the example of the dairy industry in New Zealand (Dorling, Scott and Deakins, 2006:176). There is relevance between the two industries in that the New Zealand food industry due to its size, location and reliance on specific institutions had four unique factors which are: over capacity in process industries reducing the amount of returns gained, technology spill over where joint vendor manufacturing technologies are shared across competitors to reduce development costs, industry concentration to specific areas, and corporate citizenship in partner selection (Dorling, Scott and Deakins, 2006:180). The specific industry consideration to be taken into account was that it is a monopoly with a fixed customer base that can only improve profits by focusing on cost cutting measures, as they cannot gain more customers due to regulation restrictions. This needs to be achieved whilst continuing to meet regulatory targets and provide similar or better levels of customer services (Dorling, Scott and Deakins, 2006:177).

The article focusing on VMI introduction to a bulk environment was relevant, as the challenges faced would be identical for bulk environments such as waste treatment works. High Electronic Data Interchange (EDI) costs, scalability of introduction and IT overheads for bespoke systems should all be considered (Brand, n.d). The cost of specialised lines for data movement from the consumer to the supplier is a consideration, but internet capacity is advanced enough in most countries to allow this with little overheads, though bandwidth must be considered for remote sites (Brand, n.d). Some of the specific drivers for bulk industries were reduced capital, lower management overheads and transport costs (Brand, n.d). All these points are relevant for utilities bulk supply and had case studies to further support its points. Though informative with useful methodologies that could be used, it should be noted that the article was advertising its specialist skills to introduce VMI for bulk supply chains, so more reading would be required in this area to balance this article. One thought is that the Company bulk holdings could have VMI integrated into it as a standalone project, with the lessons learnt points being used companywide or it could be part of a companywide implementation. The advantages of introducing VMI into bulk holdings first is that it can be used as the pilot scheme, prior to introduction across the rest of the company. Some of these considerations can be utilised by Velocity Management for example data considerations and position within a market.

Additional literature into improvements within utilities would be relevant as this is an area which is critical to the basic needs of humanity, and needs to be run effectively and efficiently with a reasonable investment in its infrastructure so that they can be sustained in the long term. With the majority of the UK utilities companies being privatised, and some in Europe and the US, then this concerns needs to be managed against the needs of the shareholders to make profits.

Chapter 4 Methodology

4.1 Introduction

The methodology used at the Company had to be easily understood by all involved and simplistic enough to be embedded within CSL efficiently, taking into consideration the business was being sold and reorganised during this process. Due to the challenges faced, it was thought that a business improvement technique should be adopted, but this was restricted by no funds being available for software to support a business improvement technique such as Six Sigma.

The definition of Velocity Management is the management of processes, people, and systems so that they operate reliably and accurately at high speeds to enable fast responses to orders and inquiries. The development of information and communications technologies has led to faster delivery of value chain information, and Velocity Management is used to develop the strategies, processes, people, and organisational discipline to fully support and exploit this advantage (*'The Computer Language Company'* 2010). Velocity Management is a form of process management which has been used in different industries from the military to financial management to the health service. Velocity Management was chosen as the methodology as it empowered the business to make changes across business units not in isolation, communicated with personnel to get their buy in to the change, set and achieved realistic goals, obtained senior management buy in to the project, and set an achievable time line for changes to take effect (Shannon, 2006:1-3). It was supported by existing software within the Company so no additional cost was required to introduce this technique.

4.2 Collection Methods

There are a number of different collection methods available to gather information for analysis as part of a thesis. Though statistical analysis was used to determine if Velocity

Managements introduction improved the CSL performance against some Key Performance Indicators (KPI's), due to the Company focus on leakage and income generation as the keys for CSL, other types of research methods were used to assist Velocity Management during the investigation stage to determine the best performance improvement technique for the CSL team, that could then be used across the Company. A *literature search* was used to gather information from the library, internet, university databases or this in this instance gathering information from the regulatory body OFWAT. The literature search was useful in gathering back ground information on Velocity Management and as part of the literature review, It was not used as the main method of research as the driver for this thesis was to show improvement over the three years to prove if a performance measurement technique was successful or not.

Talking with people who are involved with the subject matter was another way of gathering data. It was subjective and as improvements generated by Velocity Management are predominately objective was not used as the main method of research for this thesis. It should be noted that people were talked to when information was gathered to identify issues and to determine how improvements could be articulated and subsequently measured. Though a subjective method, the manager of the CSL team used this method at the start of the Velocity Management process mostly when chatting to their team either formally or informally.

A *focus group* was used when KPIs were set for the CSL team, to allow all the team to buy into the new idea of change and not feel as though Velocity Management was being fostered on them. The CSL team were broken into two parts due to geographic locations, with a trained facilitator leading the group through the options to identify what was key in terms of KPIs and how these could be measured. It was not formal in terms of videoing or recording the session, with the outcome of this being the KPIS that drove Velocity Management. The cost of a focus group is normally significant, but in this case was negated due to the CSL manager being a trained facilitator, and all those involved being from within the CSL repair chain.

Personal interviews are a method of gaining information on a particular subject when other methods were not successful. It is quite expense and takes a significant amount of time to carry out. The information gathered must be balanced as there is a risk of interviewer bias during the interviews. It is used to measure subjective measurements, and not objective measures. This method was not used during this thesis, as the key information wanted was objective being driven by the amount of repairs and income that could be generated by CSL for the Company. Telephone surveys (Groves & Kahn.,1979:2-37), are the fastest method of gathering information from a large sample and are used to gather a cross sections of society opinions quite often politically or as part of an advertising campaign. They are statistically measureable and can be completed quite quickly (over a few weeks to a month) and cheaply (only a few thousand dollars). As the individuals in the CSL team were quite small at only 20 odd, there was not requirement to run a telephone survey in this instance.

Mail surveys are fast, and cheap and not affected by interviewer bias, but they are slow and additional information is hard to gather. Internet surveys are now being utilised more with sites such as survey monkey enabling survey questions to be generated for specific groups and for the numbers to be tracked. It still allows those who respond privacy and it a lot quicker than mail survey which they have started to replace. They are used quite successfully for scene setting before big conferences or trying to bridge the gap between two parties before a facilitated workshop is held to help frames the agenda to be set. For this thesis, neither of these methods was used as the drive for the Company was for an increase in leakage repairs and income. Though this thesis did not do this, they could have been used to gauge customer thoughts as to CSL performance as set period during the three years. This was not done, and could not be done retrospectively due to the time from when the information was gathered. (D. Nulty., 2008: 1:15).

From other research being carried out in like industries, it appears that the majority of methods used were statistical analysis against baselines which were linked to both the Company's and regulators performance requirements. This focuses all parties on achieving the profit and sustainability that is wanted whilst also showing the regulator that their objectives are being taken into consideration. To set KPI's focus groups could have been utilised to set them, but it seemed that Critical success factors were used to target where the Company thought areas of success could be. *(John, et al., 2004: 21-24). Planning and self-assessment using a peer review process to form a balanced scorecard and ISO 14001 are all means to create KPIs (John, et al., 2004:26 - 27).*

4.3 Data Source

The source of the data sample was the complete age profile of all Customer Side Leakage repairs carried out by the Company and recorded in their corporate system during a three year period from April 2005 to March 2008, which corresponds to the OFWAT annual reporting data (OFWAT, 2007a: 5). This data is broken down into three twelve month periods; the benchmark from April 2005 to March 2006 which was before Velocity Management introduction. April 2006 to March 2007 when Velocity Management was introduced to CSL and this data will prove or disprove the thesis. April 2007 to March 2008 was the third 12 months of data, when Velocity Management had been introduced, but not been embedded within the organisation (due to the movement of staff who had implemented Velocity Management). The three data sets will be compared to show what benefits, if any, Velocity Management had delivered in the long term.

The original data was from VISTEC, the Company's corporate system used to manage the repair process for the Company Utilities from detecting, proving, processing, planning and repairing of leaks. This information was downloaded from VISTEC by the Business Objects reporting tool and converted into an Excel spread sheet for analysis (OFWAT, 2007a: 6). The Excel file holds all data and shows individual job, originating detection work (for calculation of the average time to complete the proving, planning and repair), whether a job has been completed free of charge or not, and work type split (repairs, sectional relays and full relays) (Shannon, 2006:1). The Company accountant compiles the cost from the General Ledger and this is loaded into the system. This data complies with the annual June regulatory report that the Company submits to OFWAT (OFWAT, 2007a: 6). Both univariate and multivariate analysis was used to assist the study.

A confidence grade is attached to each line of information that is submitted to OFWAT in their yearly regulatory submission (OFWAT, 2007a:1-2). For Customer Side Leakage, Thames submitted a grade for the information from VISTEC and Business Objects as B3 (OFWAT, 2007a: 6). This means that most of the process is documented and can be traced back to final data; compliance testing of the data was conducted regularly throughout the year to confirm that the source data is transferred properly. Whilst the source information is automated, some manual manipulation was required to standardise information. The information had been validated internally and the total data adjustments of 9% placed the information within the accuracy band of 3 (OFWAT, 2007a: 6), and was reflected by the confidence grade assessment matrix OFWAT use to standardise water utilities (OFWAT, 2007a: 1-2).

Though this was not covered in depth in other studies, it is important as it shows the validity of the work being carried out as well as the accuracy in terms of auditability. The regulator and shareholders need to understand this fully to be able to buy into any of the improvements that are being stated. It provides the foundation for which the benchmark of performance can be measured and compared with over time to highlight were the deltas are over the key areas being measured. What were discussed were the potential benefits by shifting to a continual improvement system in areas such as improvement in targeted management areas; enhanced operational consistency and reliability; improved teamwork, coordination and employees awareness and critical customer responsiveness and recognition. None of these improvements could be easily understood unless the validity of the information could be proven by means of an audit trail. (John, et al., 2004: 8-10).

4.4 Implementing Velocity Management

The process for detecting, proving, planning, repairing and invoicing a customer side leak was identified; where previously there was no formal process which leads to confusion as to who was responsible for specific activities and the handover points between business units. Once confirmed, the process was measured to determine the time taken and what income it generated. The responsibilities of both individuals and business units were identified and these were linked into job roles as part of the individual's job plans and service level agreements for business units.

The CSL Team held workshops to identify parts of the process where there had been challenges in the past and suggested options that could be implemented to resolve these. Emphasis was placed on handover points between business units (as these had been historical weak points), lack of understanding about each part of the process amongst the team, lack of communication, and lack of CSL KPIs. The outcome of the workshops was collated and the CSL Team were presented with the main challenges to implement Velocity Management. A plan was written to address detection, proving, planning, repair, customer invoicing, communication, contracts variation, data input standardisation, change management, KPIs and training. There was a priorities list based on business benefit, timeline, amended job descriptions and a communications plan which supported the plan (Shannon, 2006:3-4). This was implemented over a two month period, communicated to staff, and was completed in November 2006; resulting in Velocity Management only fully influencing the 2006/7 OFWAT reporting figures for five out of the twelve months of the reporting year.

Plan, Do, Check and Act as shown in figure 3.01 was the basis of one study to drive the improvement which is based on a total quality framework to support systematic, consistent and continual improvement across a number of utilities in the US (John, et al., 2004: 5). The base logic is the same in that there is a frame work process that lays down how the improvement can be carried out that can be tailored to meet an organisation's needs. That is the critical part for continuous improvement.

4.5 Future Process

As a result of the implementation of the plan, a number of adjustments were carried out to the CSL process. The objective was to improve the detection process by assessing how the detection teams set their strategy and what information drove this? The activities to improve the detection process were:

- Time and motion studies were conducted on the detection teams, which enabled a performance benchmark to be set. The detection contracts were reviewed to consider how to spread the work over fewer contractors, whilst still ensuring resilience. The pay structure for detectors was changed to reflect additional pay for leaks that were proven, which in turn drove correct behaviours.
- Standardised data input: standardised information was critical as contractors were using their information to show themselves in a positive light, leading to tension between the Company and the contractor. Standardised information benchmarked all parties from the same data source. The benchmark set average age backlogs and cycle times which were linked into cost of detecting and proving a leak, and the percentage of leaks detected that are proven to be leaks (there is approximately a 50% fall out rate from leaks that are detected to being proven). This information was compared monthly to track trends.

- Reviewing KPIs: Combining detection and proving KPIs changed contractor behaviour as there was focus on the conversion percentage from detected to proven, and a reduction in the number of detected leaks due to less detector speculation.
- Standardised training was introduced across all detection teams, resulting in a known skill base across CSL.
- Improved communication: The detection and proving teams' communication had been identified as an area for improvement. Weekly meetings were held between proving and detection teams to discuss their top ten repeat leaks so they could be given additional information as to why it was not a proven leak. This reduced the number of leaks continuously being inserted back into the system, and avoided duplication. Detection and proving teams went out together periodically to gain an understanding of the challenges each were facing, and how they could improve them.

Proving the leak future: The focus was to establish and maintain the link between the detection and proving contractors to focus on the areas where they are successful whilst ensuring the information they provided was accurate to enable the repair gangs to carry out a repair as quickly as possible. The activities to improve the proving process were:

- Improve leakage surveys: The repair gangs are reliant on the leakage technicians' survey so this needed to be detailed and clear to ensure the repair teams carry out the repair within the shortest time and were not delayed. The two factors that resulted in the provers realising they contributed to a strategic repair chain and the implications of an inferior survey were:
    - Provers had monthly reviews with the planning teams who showed them the consequence of a poor survey leading to customer complaints and the prover having to return to the same address to resurvey the work.
    - The additional time for the repair teams to carry out the repair in a timely manner, which often resulted in them having to return to the address to

complete the repair. Identifying this as a KPI and introducing penalties for poor surveys started to drive the correct behaviours.

- Detection and proving teams went out together periodically to gain an understanding of the challenges each were facing, and how they could improve them.
- Standardised training was introduced across all proving teams, resulting in a known skill base across CSL.
- Improved communication: The detection and proving teams' communication had been identified as an area for improvement. Weekly meetings were held between proving and detection teams to discuss their top ten repeat leaks so they could be given additional information as to why it was not a proven leak. This reduced the number of leaks continuously being inserted back into the system, and avoided duplication.
- Standardised data input: standardised information was critical as contractors were using their information to show themselves in a positive light, leading to tension between CSL and the contractors. Standardised information benchmarked all parties from the same data source. The benchmark set average age backlogs and cycle times which were linked into cost of detecting and proving a leak and the percentage of leaks detected that are proven to be leaks (There is approximately a 50% fall out rate from leaks that are detected to being proven). This information was compared monthly to track trends.
- Reviewing KPIs: Combining detection and proving KPIs changed contractor behaviour as there was focus on the conversion percentage from detected to proven and a reduction in the number of detected leaks due to less detector speculation.

Processing was carried out by one organisation, but the planning was carried out by three different organisations across the Company's area of responsibility. The planning was consolidated into one area to allow a focus on CSL and this proved to be beneficial. The processing personnel had no experience of the challenges to prove a leak to a customer and the difficulties faced by a repair crew in conducting a repair. To improve their performance, time was organised for all of the processing staff to spend time with the provers and repair team to enhance their understanding of other parts of the repair chain and how they all contributed to the success or failure of the complete repair process. This resulted in a more engaged work force that understood their role in the repair process and took responsibility to proactively gather all the information from the customer so that they were able to provide a clear and succinct explanation as to what was occurring with the customer. Furthermore there were reductions in the amount of times provers had to return to addresses to get additional information and the amount of repairs that were planned and aborted as the locations identified were not relevant to the situation that the repair teams found themselves in.

By establishing benchmarks for backlogs and cycle times, the planners knew where they were in terms of performance and what needed to be resolved to ensure that they were achieving their targets. The benchmarks were taken into account when changes to the process were considered, and were compared against the changes at monthly intervals from information collated weekly.

Repairing the leak: The repair gangs are the face of the Company when they are carrying out customer repairs, so it is vital that they are empowered to achieve the repairs as quickly as possible. The repair gangs are incentivised on the number of the repairs that they carry out, with more being paid for leakage and income generating repairs than network enabling repairs; but they have little influence on planning, access to properties, parking, poor proving technician inspections and London traffic, all of which is outside their control. Any of these issues can result in customer complaints when gangs do not attend within the agreed time windows, but this has been mitigated by gangs being able to ring forward and inform the customer that they may be late due to traffic or the previous job taking longer than anticipated. Educating the gangs on the challenges facing other parts of the repair chain changed some behaviour that had been shown in the past, such as aborting repairs because they think a job was too hard to complete.

The number of daily repairs carried out per team drives the number of teams required to ensure the average day of repairs and the backlog are managed. Benchmarking the types and number of repairs completed and focusing them on leakage and income generating repairs set the appropriate behaviours amongst repair teams. The process of completing repairs was assessed including: permanent reinstatement, travel time, planning logic, aborted repairs, customer interaction and working hours; and the non value added time was identified and reduced enabling gangs to carry out more repairs. Network integrity repairs were only given to a gang when there were no other repairs available. Setting an average number of jobs per gang per day, tracking the number of aborted repairs and reasons why, examining repairs not completed and delays out due to poor surveys, and tracking customer complaints meant there was a coherent set of KPIs that could be managed; and resulted in less gangs completing more work and earning more money per gang. This benefitted both parties as the gangs increased their utilisation, there were less gangs for the contractor to manage, and it increased the amount of leakage generating repairs and income.

Establishing backlogs and cycle time benchmarks meant that the repair gangs and planners knew where they were and what needed to be resolved to ensure that they were achieving their targets. The benchmarks were taken into account when changes to the process were considered, and were compared against the changes at monthly intervals from information collated weekly.

Invoicing the customer: Though invoicing customers was carried out by the commercial team, there were issues with unpaid invoices primarily due to the significant delays in the repair being completed and the customer being invoiced. This delay meant that a number of customers were reluctant to pay the invoices and asked questions to delay payment or not pay at all. A process was created and regular meetings between the CSL Team and the commercial team were established to ensure that information was provided in a timely manner so that the commercial team had the necessary information to recover the debt and maximise revenues. Benchmarks were established on the percentage of debt being recovered and the reasons for inability to recover the outstanding debt. The personnel responsible for providing the relevant information to the commercial team had this responsibility added to their job descriptions and were measured on the jobs being closed in a timely manner. The CSL Manager was updated fortnightly, and this was used as a tool to manage the staff to improve efficiencies. The end result was debt recovery increase from 67% to 89%, which was an increase of £850,000 to the bottom line.

Communication is the key for CSL to carry out its role efficiently. The five points where the process internally crosses either between business units or contractors within CSL must be understood by all parties, information must be clear and concise, and all parties must use the same templates and time lines so there is no ambiguity. A continuous improvement loop was embedded into the process to allow areas of concern to be addressed quickly and concisely to stop them affecting the chain of locating and repairing leaks across the process. There must be strong communication between CSL and the customer services team so that any queries from the customer are answered quickly to stop the issue escalating. All parties who are involved in the process are reminded that they are all in customer facing roles; and the better they deal with the customer and resolve their issues the less customer complaints that will have to be dealt with in the long term. The CSL Team created a link with customer services to educate them about the CSL process used so that they can explain it to customers clearly; and it allowed both parties to put a name to a face for those individuals that they are dealing with. This improved the management of customers' queries and complaints which ultimately reduced because all parts of the CSL team were focused on communication both within the team and with customers.

KPIs were changed to focus on the average age of the complete backlog which resulted in all parties adopting a strategic outlook to the detection, planning and repair process. This was vital in getting buy in to the improvement process.

Other studies had worked off a framework of Plan, Do, Check and Act as shown in figure 3.01 and had a set of standard procedures and steps to support consistent and continual improvement of management areas. It considered the balance between environmental performance, Health and Safety, quality, financial performance and personnel management; with the focus on a core set of subjects that are critical to embedding the culture of continuous improvement and consistent performance success within a utility. There was a lot of focus on the interrelationship between the core areas, understanding the impact that improvement can have on them (both positive and negative), and continually finding the balance which is the advantage to the utility as a whole and not just the business unit. (John, et al., 2004: 4-6). Though the detail of how the KPIs were set and what techniques were used to reflect the core subjects was not gone into in any great detail, these will be critical to the success of the improvement process as they need to be able target quick wins as well as long term changes that need to be implemented in order for continuous improvement to be sustainable in the long term.

4.6 Limitations

A limitation of this study was the time it took to implement Velocity Management principles into the repair chain; caused in part by a delay in changing the detection and repair contracts as they had to tender the contract for a minimum of a month, and negotiate with the preferred repair contractors, which could take between three to six months to complete. With only three years of data available (which allows the benchmark of 2005/6 to be compared to when Velocity Management was introduced into the repair chain in 2006/7 and the residual effects from Velocity Managements to be able to be assessed for 2007/8) long term trends post

2007/8 can only be commented on and not proven due to the lack of information available from this period. This limitation should be considered when assessing possible trends. Ontologies are the structural frameworks for organising information (Wikipedia, 2011), so it is the KPIs that are used to:

- Detect the leak
- Prove the leak
- Plan the repair
- Repair the leak, and
- Invoice the customer.

This management of information within a domain of the CSL repair process allows for information to be grouped and managed, and for informed discussions to be made regarding the theory - can Velocity Management be introduced to the repair chain of a utilities monopoly?

Epistemology asks three questions which need to be addressed in order to understand how the knowledge is obtained. The three questions allow for base beliefs to be established as beliefs are justified creating foundationalism. It is not thought the coherentism is required because of this. They are:

- What is knowledge? In this case it is the setting and measuring of a process to be able to make informed decisions as to how this can prove or disprove the theory if Velocity Management can be introduced to the repair chain of a utilities monopoly.
- How is knowledge acquired? It is acquired by continually measuring the process of locating, proving, planning and repairing leaks over a period of time; in this case three years to build up a picture of how this process works and how it can be improved.
- How do we know what we know? We set a process, which can be measured and by changing the process and tracking the measures over a period of months, the process

changes can be seen to be improving or degrading the measures. This allows decisions to be made as to whether the changes are successful or not.

The largest limitation is that there is only three years of data available to be analysed, so that the effect of Velocity Management in 2007/8 which is the last year of data is the last point of comparison for Velocity Management. This means that trends that we beginning to form for 2008/9 and subsequent years can only be intimated as there is no subjective data to support the claims. The Company would not allow further data to be given and the June Return information that is available on the OFWAT website does not give the breakdown in data that is necessary to obtain detailed comparisons against the three years of data already available.

Now that the methodology has been confirmed, the biggest challenge was to be able to measure and report within the organisation and compare this to the 2005/6 baseline to determine is the thesis of Can Velocity Management be introduced to the repair chain of a utilities 0monopoly can be proven or not?

Studies have identified a number of barriers whether they are real or perceived that must be overcome to allow continual improvement to be successful, from the acknowledgement of the requirement for upfront resources and time to set a framework in place; justifying resources when it is difficult to quantify benefits some of which will be realised in the long term and there are no clear requirements, reluctance to change within the culture of the company; increase paperwork generated from continual improvement and increase scrutiny from senior management to name a few (John, et al., 2004: 30-31). All of these were identified during the process of introducing a continual improvement process within the company. All these need to be identified and planned for if the limitations are to be overcome and continuous improvement is to be successful within an organisation.

Chapter 5 Analysis and Discussion

5.1 Introduction

Of the six objectives that were set in the introduction, at least 4 or more would have to meet their targets and the Mega litres per Day (MLD) saved target must be met for the Hypothesis to be proven correct. MLD is the critical measure for the business both internally and by OFWAT:

- An increase in the number of repairs being carried out by the CSL Team. Specifically an increase of those repairs that contribute to leakage and income generation. To support the thesis as being correct, leakage generating repairs would have to be improved by 20%, and total repairs by 15%.
- Mega Litre per Day (MLD) saved. This saving is reported by the Company to OFWAT yearly and this is the key indicator that is used by OFWAT to place the utilities into a performance table. To support the thesis, there would have to be an increase of MLD of 20% against the baseline.
- Income: The Company would want to at least keep with parity to the benchmark of 2005/6 during the year that Velocity Management was introduced 2006/7. If the income generation could be increased, then this would be seen as a success as income generation is only second behind leakage repairs in the Company drivers for CSL. To support this thesis, there would have to be at least the same income generated or an increase. The target for income generation was set at 15%.
- The age of the backlog, specifically the management of those repairs over 365 days old, as this is an indicator that is assessed in the United Kingdom by the Economic Regulation for the Water and Sewerage Industry in England and Wales (OFWAT) during the yearly reports that are provided by the Company to the regulator. Linked to the backlog age is customer complaints - with the longer time taken to carry out the repairs, there is an increase in the amount of customer complaints received by the

CSL Team. To support the thesis, the backlog of repairs of 365 days would have to reduce by over 50% during the period when Velocity Management is being used.

- The average age of all reportable repairs. This must be considered in conjunction with the average age of the backlogs, personnel manning with the CSL Team, and the amount of repairs being carried out in the period; as the less repairs that are carried out, the lowering of the average age as the repair turnaround time should be less. To support the thesis, the average age would have to be linked in to the amount of repairs carried out and be within 15% variation of the baseline once additional repairs were known.
- Personnel: That the personnel can manage the increase in work that is projected to occur and manage the possible reduction of numbers as part of the restructure. To support the thesis, the personnel would be able to manage an increase of repairs of 20% within the same or up to 10% reduction of staff.

5.2 Type and Number of Repairs Conducted

To support the thesis, leakage generating repairs would have to be improved by 20%, income by 15% and total repairs by 15%. The pure numbers of repairs gives a very simplistic view to determine if Velocity Management is successful across the CSL team, it is not able to break down the numbers to show that of the repairs carried out, they either contribute to the leakage targets, income targets of both. This detailed view can only be formed once the type of CSL repairs is determined. This shows which part of the repair chain is successful and which is not and then highlights those areas that require improvement and the solution tailored to the issue to reduce the amount of wastage in the repair chain whilst increase the amount of income generating or leakage generating repairs, which improves the business.

The total numbers of repairs are shown in Figure 5.01 which highlights a significant increase in repairs carried out by the Company over the three year period that data was gathered, with the largest gains made during the 2006/7 reporting period which was when Velocity Management was used within the CSL repair chain. The increase from the baseline year of 2005/6 the second year of gathered data was from 14,351 repairs to 19,474 an increase of 44% which highlights a marked improvement. Repairs in the third year were 18,175 which is a 33% increase when compared to the benchmark. In terms of repairs, the 44% increase against the baseline is significantly higher than the target of the total repairs increasing by 15% and support the thesis.

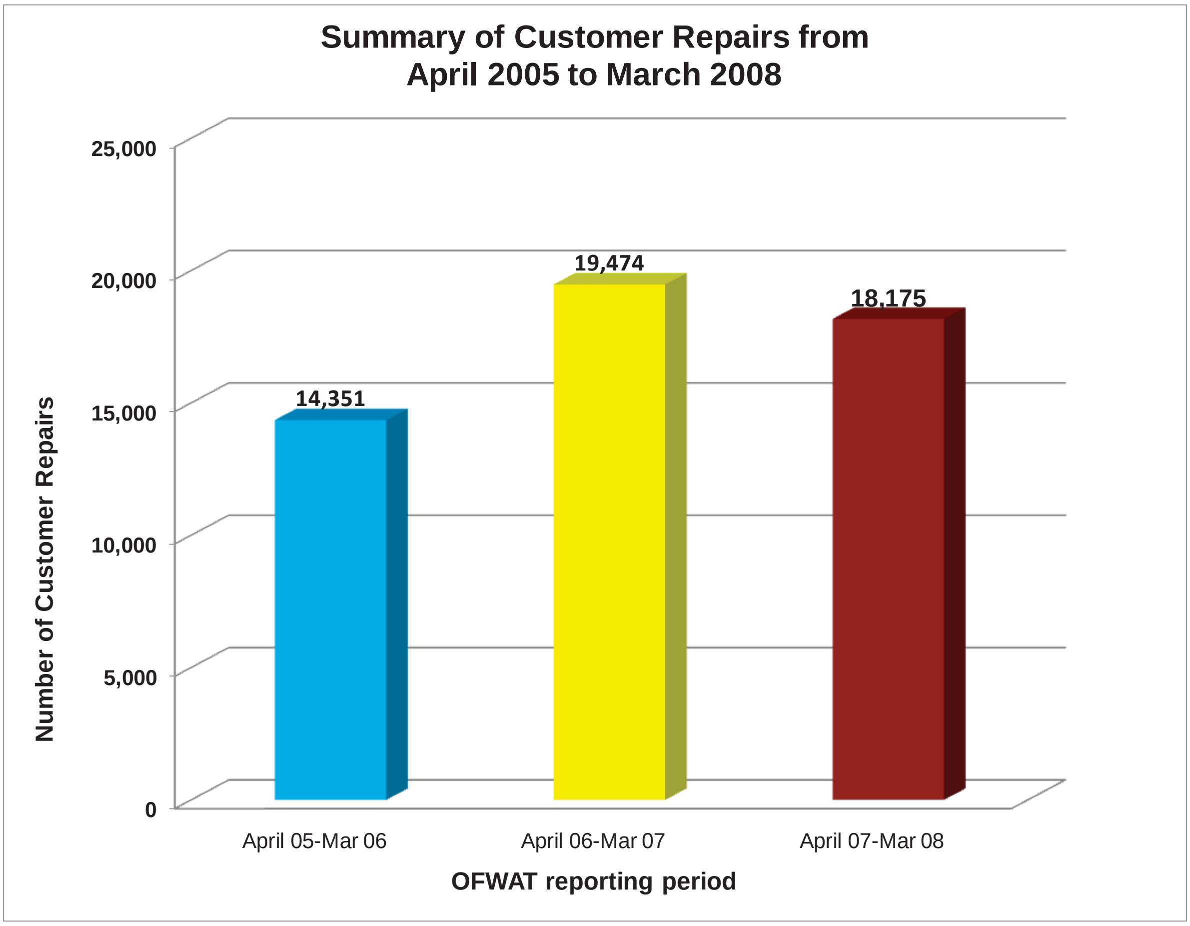

Figure 5.01: Annual Summary of Customer Repairs

The CSL Team had increased the number of repairs carried out in the 2006/7 reporting year, and maintained them in the next period of reporting (though at a lower rate). These gains highlight that Velocity Management has generated improvements within the CSL process, but does not show which or all parts of the process contributed to the increase of repairs. A better understanding of the information is required before a more detailed conclusion can be drawn, as it does not show the important factors to the Company, namely repairs that either contribute to leakage or contribute to income or those that do both.

These are summarised in Table 5.01 but are explained in more detail.

Summary of Repairs Which Contribute to Leakage Savings or Income for CSL

Type of Repair	Contribute to Leakage	Contribute to Income	Comments
MRRPB	Yes	No	
Repairs	Yes	Free	
Relays	Yes	£250	
S75	Yes	£250	Are either relays or repairs
Commercial	Yes	£1040	
OSVTB	No	No	Maintains network integrity
Aborts	No	No	
Dry Holes	No	No	

Table 5.01: Summary of Repairs Contributing to Leakage Savings or Income for CSL

- Meter Rear Replacement to Property Box (MRRPB): Is the pipe running from the mains to the customer's boundary box. It contributes to the leakage targets for the Company, but does not generate income;
- Repairs: When the customer's leaking pipe is traced to the leak, the ground is dug up, and a spot patch (like a puncture repair) is placed on the pipe. These are free for the customer, but they are only allowed one before their pipe is relaid and they are

charged. This contributes to leakage targets for the Company. Repairs are in a lot of cases a stop gap, where the pip should be replaced;

- Relays: When the whole pipe is relaid from the customer's boundary box into their house. In simple terms the relaying of the pipe means that the chances of having a leak for this specific piece of pipe is reduce and it last for a lot longer than a repair. The customer is charged a reduced rate of £250. This contributes to leakage and income targets for the Company;
- Section 75 (S75) is the name of the legal process that all water companies are legally entitled to use to ensure that customers repair leaks on their property as part of the drive to stop water leaking and saving water. The customer is charged the cost for the Company to enforce this. There are three steps in the process and 95% of customers agree to the repair being carried out once the second notice is served to avoid court action. This contributes to leakage and income targets for the Company;
- Commercial Repairs which are repairs carried out for commercial customers, who are charged the full cost of repair and an additional 25% for managing the process. The customer does have the option of going to another supplier to carry out the repairs if they choose. This contributes to leakage and income targets for the Company;
- Outside Stop Valve to Boundary Box (OSVTBs) is the pipe that runs from the customer's stop valve near their front door to the boundary box which is normally found on the footpath. OSVTBs do not contribute to either leakage or to income but are important as they contribute towards network integrity, which in turn is important for managing the network. They are used by planners as filler jobs for gangs to go to if they have run out of work, or if there are few leakage repairs in their immediate vicinity;
- Aborted jobs occur when the repair gangs cannot get access to the property because the home owner is not at home, the suspended car parking bay has a car parked in it and they are unable to park, they have dug up the pipe to find that there was no leak

and the prover had either marked the suspected leak incorrectly, or there was no leak in the first instance;

- Dry holes occur when a repair gang digs a hole that has been specified by the provers and there is no leak located. This can happen twice before the job is aborted and the prover has to relocate the leak.

The focus therefore is what types of repairs were carried out, did they contribute to the Company meeting its leakage targets and what income did they generate? These define the savings, and are illustrated by Figure 5.02 which displays the breakdown of all repair types carried out by the CSL Team.

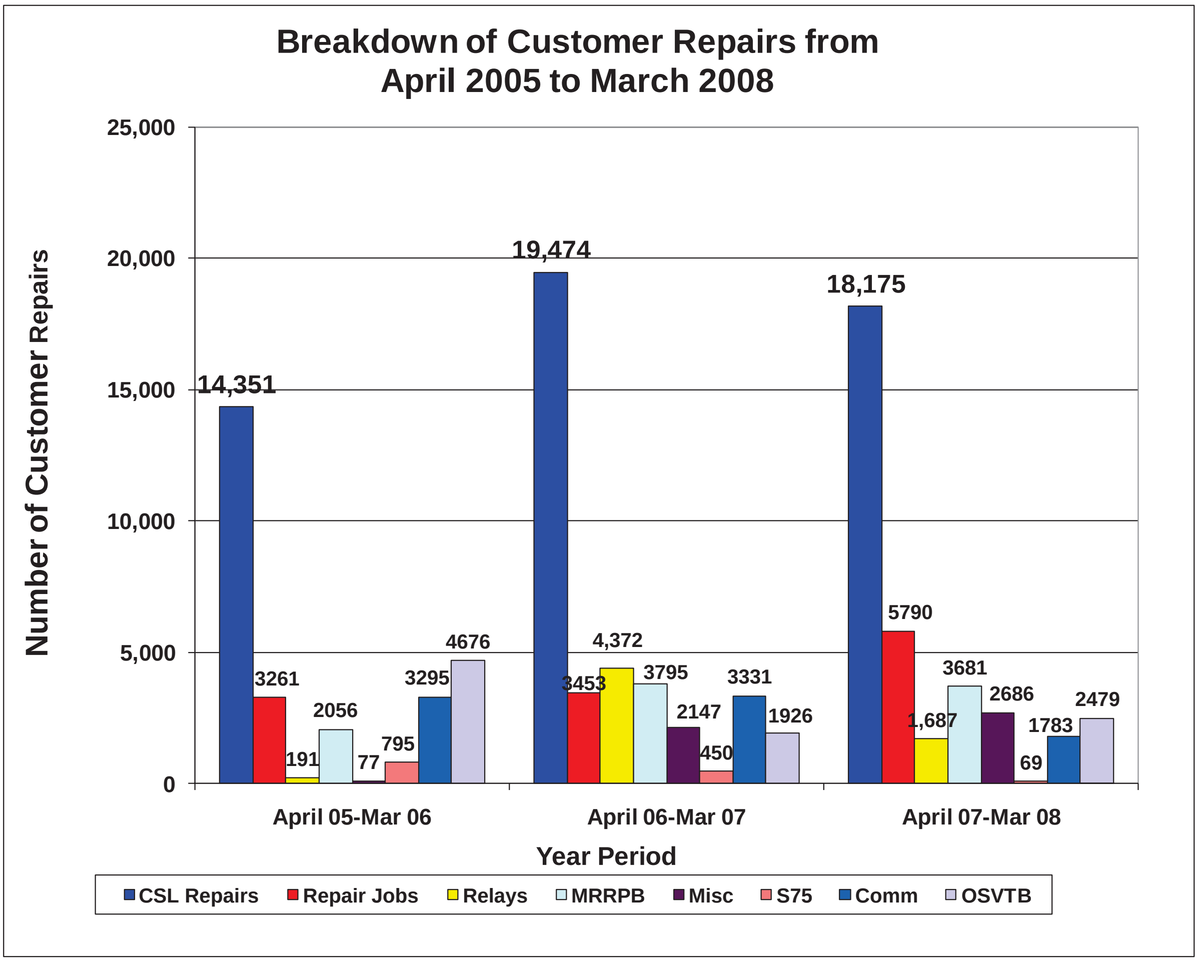

Figure 5.02: Breakdown of Customer Repairs

The largest increase in the breakdown of repairs carried out by CSL over the three year period was relays. The difference between the first year and the second year was an increase of 4,200 relays which had a large impact on leakage targets, and generated an additional £1 Million in revenue. Whilst relays decreased in the third year by 75% (or 2,685 relays) compared to the second year when Velocity Management was utilised, they were still higher than the first year by 1,496 repairs. There were some contributing factors to this increase, relays were harder to plan, and previously planners had avoided them due to the difficulties in booking gangs to repair them. A lot of relays are shared supplies meaning the water pipe feeds multiple properties, and the repair coordinator had to gain approval from all the properties on the pipe in order for the relay to be carried out. This caused delays resulting in some coordinators placing these repairs low on the priority list to be completed. If one property refused to accept the CSL offer, then S75 action had to be initiated which took months, and further delayed the relays. As these were challenging, they were generally left alone and were not identified within the existing CSL processes. This meant that there was a large backlog of relays already in the system allowing for an increase in relays when Velocity Management was introduced as it looked at the weaknesses in the systems and improved them.

Historically for the Company, there had been no link between the backlog of repairs and relays, customer complaints and prioritisation of leaks; low numbers of relays could be carried out, resulting in a lot of them taking months longer to complete. Velocity Management linked all these indicators together and made the coordinators responsible for their backlogs by incorporating it into their job description and managing their performance. This resulted in a surge of relays being carried out that not only increased leakage targets and brought in additional income in to CSL; but reduced the backlog and the number of customer complaints that were being dealt with. Though Velocity Management was the catalyst for the increase in relays, it was also (to a certain extent) the result of the restructure and the coordinators being properly managed. This management forced them to improve their performance, which coupled with Velocity Management resulted in a large increase in relays. As relays increased by more than 2000%, in the last two years, then Velocity Management has shown that it can be introduced to the repair chain of a utilities monopoly. The drop off from 2006/7 to that last year by 61% is linked into the smaller amount of relays in the backlog and the efforts of the coordinators to clear their outstanding works in the previous year.

Relays cannot be looked at in isolation, and must be compared with repairs which are free to the customer to give an indication if leakage is being increased across the Company area. From the first to second years, there was only a slight increase of 5% or 192 repairs in repairs. This is not significant taking into account the increase in relays during the same period. There was a large rise in repairs from the second to last year of data by 60% or 2,337 repairs. The total repairs/relays in the first year were 3,452 which was less than half the amount achieved in the subsequent two years (7,825 and 7,477 respectively). This shows that Velocity Management increased the total numbers of leaks repaired in the first year of introduction, and then kept this total number of relays and repairs to a similar level in the next leakage period, even though Velocity Management was less of a focus for the Company. As leakage repairs were the focus for the Company, this is a significant gain for the organisation by introducing a performance improvement tool within a business unit. The measured objective was for leakage generating repairs to increase by 20% against the 2005/6 baseline to support the thesis, they increased by 58% against the baseline, which strongly supports the thesis question.

Though the total amount of relays/repairs is approximately the same between the second and third years, there is a significant difference in income generated between the two periods. This showed that Customer Side Leakage had moved away from relays and focused on repairs from April 2007 to March 2008.This was driven by the CSL Team restructure that occurred in June 2007, reduction of backlog of relays (once resolved) would not be occurring in the same numbers as seen during 2006/7. A change in direction was required to keep up the number of leakage generating repairs being carried out. As repairs and relays made up the majority of repairs that contribute towards the Company leakage targets, this was a noteworthy achievement. It was managed by a team which had lost three personnel during 2006/7 as part of a restructure that the Company underwent during that time. This data shows that to improve the CSL repair process, and increase leakage repairs, they had to have become more efficient in processing leaks through the system enabling them to manage this increase of work.

Meter Rear Replacement to Property Box (MRRPB) generated leakage savings increased by 54% (or 2316 jobs) from the baseline to the first year that Velocity Management was utilised, and they remained steady between for the other two years decreasing by only 3% (or 114 jobs). Part of the reason for this was that although they generate leakage savings, they are non customer facing repairs being carried out on the pavement and not in a customer's property meaning that there are no customer issues to deal with. They are used by planners as fill in jobs for gangs between customer facing repairs or relays. The increase of Meter Rear Replacement to Property Box (MRRPB) jobs between the baseline and second year is in line with the general trend of all the works from that period as a result of the introduction of Velocity Management; and the maintenance of this level in the last two years, shows that planned works were focused on leakage jobs for the repair teams, but not necessarily focused on the income generation which occurred when Velocity Management was being used. It was unlikely that income generating repairs could be sustained due to the reduction of backlogs, and the normal tempo of finding leaks was not sustaining the large number of income generating jobs. That said, the increase in MRRPB and the sustainment of these repairs highlights the success of Velocity Management in targeting those repairs that increased leaks and or income.

Miscellaneous repairs are made up of aborted jobs, free repairs, dry holes, repairs completed by the customer and repairs that do not contribute to either leakage or income generation. Miscellaneous jobs carried out between 2005/6 and 2006/7 increased by over 98% (or 2070 jobs). Between 2006/7 to 2007/8, they increased again by 20% (or an additional 539 jobs). The increase of aborted jobs is in part due to the large increase in works carried out by the repair gangs. It is also a sign that the gangs are being over planned and have too much work which they could not complete in their assigned day. This increase in all areas shows that additional improvements could have been made in the Velocity Management process. Some of the increase in 2006/7 can be attributed to Velocity Management being introduced as the contractors were aborting jobs to show that new processes and procedures are not working, or that they were at the end of the working day and it was inconvenient for them to carry out these repairs. At the time this was addressed by a change to the process where the Company coordinator confirmed that an abort was justified by the contractors which reduced the number of aborts significantly.

These tactics had to be accepted as part of transforming the process within the CSL Team, but was then identified as one of the issues where wastages had to be reduced. The continued increase in 2007/8 would be a concern for CSL which could be a result of CSL reverting back to old habits without changes being put in place to improve this area of performance. It could be due to less management concern being placed on this area of the process, but this is unable to be confirmed. By itself it is an indicator that further refinement could be made to the Velocity Management process to fully integrate it within the CSL repair process. Though there was an increase in the amount of miscellaneous jobs, which highlighted an area to be further, improved, there was still significant other repairs being carried out that were of greater benefit to the Company.

Outside Stop Valve to Boundary Box (OSVTBs) is the pipe that runs from the customer's stop valve near their front door to the boundary box which is normally found on the footpath.

They do not generate leakage savings or income but contribute to improving the integrity of the water network, which is important as it enables the leakage engineers better visibility of their leakage areas and improves their ability to identify and target high leakage areas. If there is poor network integrity, it is harder to trace and close the leaks and understand the dynamics of the network. These jobs are planned for repair gangs that have completed their planned work to keep them productive, or used as a stop gap measure between large leakage repairs. Previously, they had been classed as important as leakage repairs because they were easy to plan, had no customer impact, and it was seen by planners as the path of least resistance instead of planning harder repairs.

Between the first and second year, there was a decrease in Outside Stop Valve to Boundary Box (OSVTBs) by 60% (or 2750 jobs), which was during the period when Velocity Management was being utilised within the Company. This reduction of work was reversed in the third year with a 22% increase (or an additional 553 OSTVBs carried out) but compared to the first year baseline, there was still a decrease of 47% or 1897 jobs. This highlighted 2006/7, which was when repair planners were focused on planning as many leakage jobs as possible to maximise the ability for the CSL Team to generate leakage and income savings rather than plan for work that only contributed to network integrity. This drive was due to Velocity Management. Although there was an increase in Outside Stop Valve to Boundary Box (OSVTBs) carried out in the third year, it showed that the Velocity Management processes put in place were still being utilised, just not as effectively. As OSVTBs had decreased drastically in the second and third year, when compared to the first year benchmark, Velocity Management showed that it can be introduced to the repair chain of a utility monopoly successfully in this area, as the total number of repairs carried out was a higher proportion of leakage and income generating repairs. This balance of repairs vs miscellaneous and OSVTB is the real measure of success for Velocity Management within the Company.

There was a rise in the requirement for the Company to enforce Section 75 (S75) legal notices to ensure customers repaired leaking pipes in times of economic hardship and when the customer was getting frustrated with the way they are being managed by the water company and the amount of delays for the Company to delay with a challenging customer at this time. Although water companies are entitled to enact these measures within seven days, they are not often enacted until two to three weeks after first contact with the customer. A lot of customers are served with the first letter as part of the Section 75 (S75) process, but this is normally the reminder they require to either request the Company repair their leak or get another contractor to carry out the repair for them. The number of S75s recorded are those repairs where the Company had carried out the complete S75 process and received court approval to enter a customer's property to carry out the repair, the cost of which is invoiced to the customer. From the first to second year, there was a decrease of 44% or 345 jobs. During the last two years, there was a decrease of 85% or 381 jobs carried out. This was positive; in that the Company had reduced the number of times they needed to use legal recourse to carry out a repair.

This improvement was a result of elevation and prioritisation of the Section 75 (S75) process within the CSL process team, meant repairs were resolved in a timely manner instead of being delayed for as long as possible by the CSL team. This was partly due to the link between the S75 repairs and the oldest jobs in the repair system. The majority of repairs over 365 days old were found to be Section 75 (S75) repairs as these jobs meant having to deal with difficult customers and the preference was to delay resolving these due to their complexity and the time and effort involved to achieve success. The continued drop of S75 repairs during the last two years was as a result of a management restructure, de-linking of the relationship between S75 and their impact on the average age of repairs in the process and the continued use of Velocity Management. As soon as this occurred, the process staffs were able to take the path of least resistance and delay resolving these repairs, which was to their detriment in the long term.

Anecdotal evidence shows that for subsequent years, there was a marked increase in Section 75 (S75) jobs as this outstanding issue then had to be resolved, but as data for the 2008/9 reporting period was not available for this report; then this cannot be substantiated. What this does show is that when process improvement is introduced into an organisation, then there was improvement in a lot of the areas of the process. In this case the area that took up a lot of management time and effort with staff having to attend court to enforce the Company's right to repair a leak was substantially reduced; and the reduction of customer complaints allowed staff to focus on other challenges for CSL and to continue to improve the Velocity Management process already in place. It also shows that once a process improvement technique is not supported by management, staff begin to resort to the path of least resistance and the gains made deteriorate with time. The upshot is that the embedding of a process is just as important as its introduction to ensure long term benefits are maintained.

The number of commercial repairs carried out during the first two years was similar with an increase of 1% or 36 jobs. Yet between the second and third year, there was a decrease of 46% or 1584 jobs completed. As commercial repairs had such a significant impact on both leakage and income this was an issue for CSL. The main reason for a similar number of repairs being completed in the first two years was that the commercial team had a streamlined process and the same commercial manager, who managed a good return for the business in terms of income generation and leakage contribution. When that person left the business in May 2007, although there was a strong pipeline of work for a few more months, the amount of jobs carried out by the commercial team dropped significantly in the last six months of the third year, which coupled with a change of organisation contributed to the decrease in work. The reduction of work carried out was a result of the commercial manager not being replaced as a short term cost cutting measure resulting in a substantial loss of income for CSL.

This could look as though Velocity Management had no significant impact on the commercial team, but the fact that the commercial manager took over another position and more staff to manage as part of the reorganisation in September 2006 needs to be taken into account. Despite this additional work, they maintained the same level of performance for the commercial team whilst substantially improving the performance of the domestic team in terms of repairs and relays carried out. It showed that the individuals involved managed a demanding role and had support in terms of clear differentiation of roles and responsibilities and a focus on what was required in terms of improvement and priorities which came from Velocity Management. The introduction of Velocity Management gave them the tools to continue to deliver a high level of work commercially whilst improving the domestic situation, which reduced staff numbers. It does show that areas of a business can be performing well without a process improvement process being introduced.

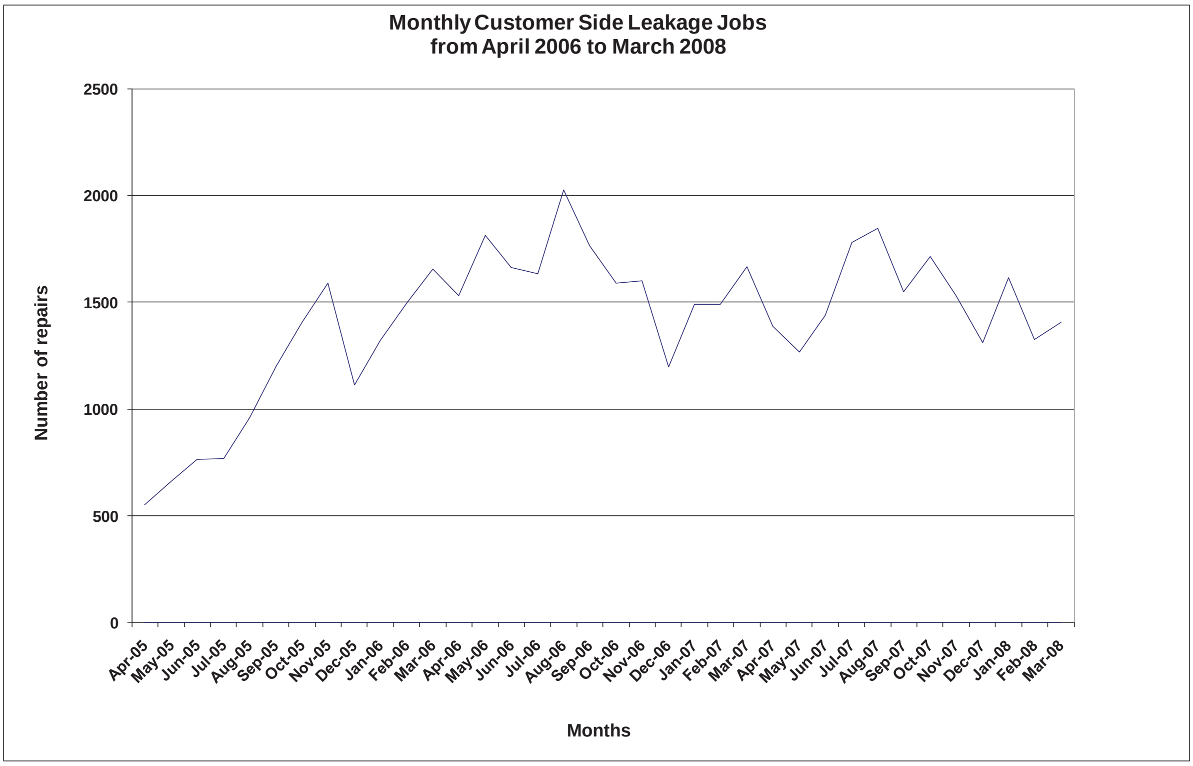

Figure 5.03: Monthly Trend of Customer Repairs

Figure 5.03 shows a significant rise in the amount of leakage repairs carried out by CSL from a low of just over 500 a month to a high of just over 2000 16 months later; a large variation for such a short period of time. The first year was the first time that the CSL Team played an important part in contributing to the Company trying to meet their leakage targets as set by OFWAT. The downward spikes over the December/January in each year are due to the reduced repair teams that the Company operates due to Christmas leave. The Company had previously tried to keep a higher level of planning staff and repair teams on over the Christmas period, but it was found that a lot of the repair teams that were rostered on did not turn up and after three years of trying different techniques to keep them on, a reduced level of repair teams was accepted. There is a smaller spike in August/September for the school holidays as parts of the CSL repair chain take summer holidays. Therefore these reductions must be taken into consideration when setting targets that can be achieved.

The average number of repairs carried out during the first year was 1123 repairs per month, for the second year, the average was 1623 repairs per month, with the third year recording an average of 1514 repairs per month. These averages showed a significant increase in repairs carried out by CSL between the first and second years with an additional 500 repairs carried out a month when Velocity Management was used by CSL. Even with the full effects of Velocity Management being eroded in the last year to the movement of staff and it not being fully embedded and supported by senior management in the long term, there were an additional 391 repairs carried out monthly when compared to the first year baseline which was before Velocity Management was introduced within the Company. This increase in repairs per month supports the theory that Velocity Management can be introduced to the repair chain of a utilities monopoly; but like all performance improvement techniques, time must be taken to embed the changes and have them continued to be supported and championed by management for their full benefits to be realised.

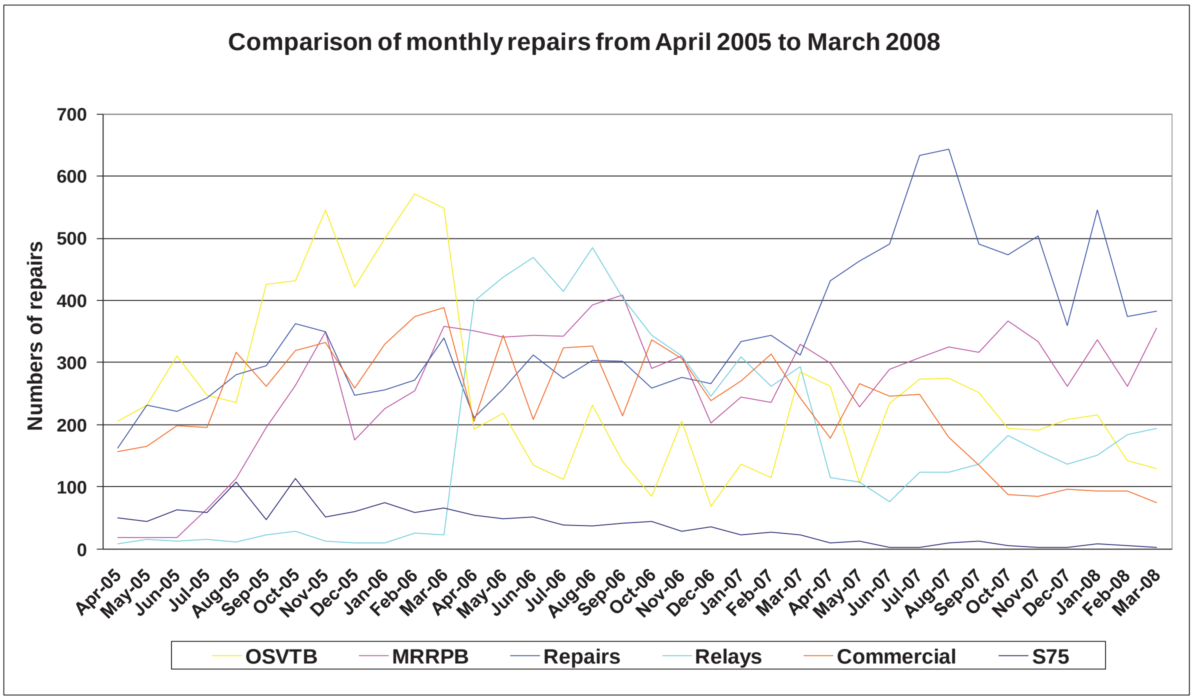

Figure 5.04: Comparison of monthly repair types

Figure 5.04 illustrates the type and number of repairs carried out that either generated leakage, income or contributed to the network integrity of the Company network. All other types of repairs are not relevant in terms of proactive activities for meeting leakage targets. Velocity Management when fully utilised during the second year of 2006/7 can be compared against the 2005/6 benchmark and the third year of 2007/8 when Velocity Management was no longer used by CSL and only residual benefits were being felt. This comparison will either support or disprove the thesis of can Velocity Management be introduced to the repair chain of a utilities Monopoly?

Outside Stop Valve to Boundary Box (OSVTBs) was widely used during the first year 2005/6 when there was a lot less control of the planning process in lieu of leakage and income generating repairs. This was significantly reduced during the second year, when leakage and income generating repairs were focused on and OSVTBS utilised in their proper function which was to act as filler for repair teams that had either completed their work for the day or were linking long leakage or income generating repairs. During the last year, when the

Velocity Management controls were relaxed and some of the key management left, there was a rise in the amount of Outside Stop Valve to Boundary Box (OSVTBs) that were planned. The management and reduction of OSVTBs during the period when Velocity Management was used allow more leakage and income generating repairs to be carried out by the CSL team using the less resources when compared to the first year benchmark, which contributed to the Company meeting their leakage target in that year. This focus to carrying out work to maximise the benefits to the company is a key of Velocity Management and supports the theory that Velocity Management can be introduced into the repair chain of a utility company.

Meter Rear Replacement to Property Box (MRRPB): Is the pipe running from the mains to the customer’s boundary box. It contributes to the leakage targets for the Company, but does not generate income. They were low in numbers during the first year with only 171 average repairs completed a month, but increased in March 2006 to remain constant for the remaining two years of repairs, though there was some drop in December 2006 which is in line with reduced repairs to coincide with the Christmas break. The average number of repairs in the second year was 316 and in the third year were 306. This increase of Meter Rear Replacement to Property Box (MRRPB reflects their increased importance which was identified when Velocity Management was introduced to the repair chain, as they were easy to plan and repair due to no customer involvement and they contributed to leakage targets.

Repairs were low in the first six months of reporting with an average of 272 a month, but they remained at a constant level for the next 18 months until they increased dramatically in April 2007 and remained high for all of the third year. The average monthly repair for the second year 2006/7 was 288 and the third year were 483. This reflects the increased leakage generated by repairs, but also the loss in income that this caused as repairs were free to the customer. Although the second year was higher when compared to the first year benchmark, it was a lot lower than the last year of results, but this was marked by a drop in a number of other areas during the last year such as relays and commercial repairs which resulted in its total numbers being lower for both leakage and income than the middle year when Velocity Management was being used.

Relays were recorded in very low numbers during the first year of 2005/6 with an average of 16 a month, but increased in April 2006 to an average of 364 a month during the second year and remained high for the rest of the reporting period when Velocity Management was being used throughout CSL. They dropped at the start of the third year in April 2007, and slowly rose for the rest of the reporting period to have an average of 140 repairs a month. The sudden increase of repairs in the second year was due to the Velocity Management focus they were given because of the large amount forming part of the CSL backlog and the issues associated with resolving them meant that they took a lot longer than other repairs to carry out. The drop off during the last year was due to the majority of relays being cleared from the backlog, and there was not the same number of relays being located by the detection and proving teams; although the increase near the end of that period does suggest that the backlog was increasing but with no data for 2008/9 available, then this cannot be confirmed. This increase in numbers during the 2006/7 period highlights the success of Velocity Management within CSL.

The monthly average for commercial repairs was 274 for the first year of 2005/6, 278 for 2006/7 and 149 for the last year of data, 2007/8 which showed that for the first two years they remained constant due to the efforts of the CSL commercial manager during this period who had developed a high performing team, but they dropped in August 2007 which was three months after the commercial manager left and was not replaced. The pipeline of work had run out and CSL had not won the work to the same level as they had been in the past, this coupled with the CSL manager leaving resulted in the drop of repairs being carried out. The CSL commercial manager was not replaced until January 2008, then it is assumed that the level of commercial repairs would not have increased until March 2008 at the earliest.

Initially this shows that there was little effect as a result of Velocity Management being introduced to the part of the CSL team, but this was during the period when CSL commercial lost staff and the CSL commercial manager took on more responsibility in other areas of CSL. For the commercial team to continue to deliver the high amount of work, shows the Velocity Management can assist an already high performing team.

The monthly average of repairs for Section 75 (S75) in 2005/6 was 171, in 2006/7 were 38 and for 2007/8 were 6. S75 had downward movement during the three year period, which was an indication from 2005/6 to 2006/7 of the decrease in the backlog of repairs which decreased the amount of Section 75 (S75) being carried out as repairs were being dealt with proactively, resulting in more customers signed on to get their repairs completed without the Company resorting to the S75 process. For 2007/8, the lack of S75 is linked to the number of free repairs that were being offered by CSL to resolve outstanding repairs. If the free repair policy was continued in 2008/9 then the number of Section 75 (S75) would continue to be low which would reduce the amount of income that could be generated by CSL, but leakage would still be claimed for carrying out the repairs. As leakage is the key for the Company, then it was thought that this policy would remain.

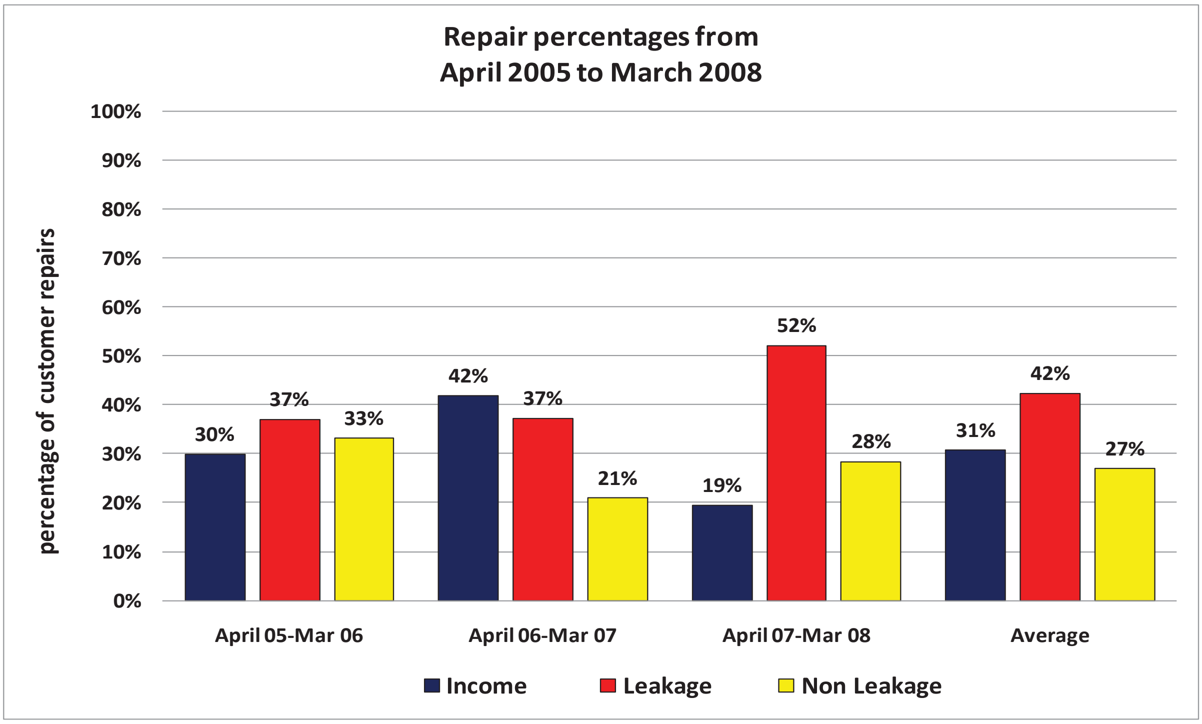

Figure 5.05: Percentage breakdown of repair types

In summary the breakdown of repairs shown in Figure 5.05 illustrates that Velocity Management contributed to the increase of income and leakage repairs during 2006/7 which in the main continued into the third year of 2007/8, though the focus had moved to delivering leakage income at the expense of income generation; but 2007/8 still benefited from Velocity Management albeit to a lesser extent. There was a decrease in the amount of S75 repairs carried out which was a combination of reducing the backlogs during 2006/7 and the changing of the CSL policy during 2007/8 to offer free repairs instead of invoking the S75 powers. The one type of repair that did not match the trends during the three years was commercial, which was static during 2005/6 and 2006/7 even with the reduction of two personnel from their team, but this area was most affected with the loss of the commercial manager. Senior management failure to replace this position quickly resulted in a large drop in repairs completed and income generated. It does show that personnel are key for any technique or process to work effectively. The breakdown of repairs shows that Velocity Management can be introduced successfully to the repair chain of a utilities monopoly.

An assessment of the breakdown of the types of repairs shows an increase in the amount of income and leakage generating repairs, and a decrease in non-leakage jobs with significant movement between 2005/6 and 2006/7 when Velocity Management was introduced. Figure 5.05 shows the breakdown percentages of income, leakage and non-leakage repairs over the three years and compares it to the three year average. Income increased 12 % in 2006/7 when compared to the 2005/6 benchmark, and this is due to the number of commercial repairs being kept at the same level, which delivers significant income for CSL. This dropped by 23% in 2007/8 or 11% when compared to the 2005/6 benchmark. The driver for this significant reduction is the loss of income from commercial repairs in 2007/8, which delivered over £1M less than the first two years. This was a concern for the Company as though it was not the key driver which is leakage; it was significant enough for senior management to take an active interest in this area.

Leakage generating repairs between 2005/6 and 2006/7 percentage wise were the same, with the difference being that in 2006/7 there were an additional 5,000 repairs carried out which increases the amount of repairs completed. 2007/8 showed an increase of 15% when compared to the 2005/6 benchmark. This increase, coupled with approximately 4,000 additional repairs carried out in this period meant that the total leakage numbers for 2006/7 and 2007/8 were similar and substantially more than the 2005/6 benchmark. Non leakage repairs reduced from the 2005/6 benchmark high of 33% by 12% in 2006/7 then increased by 7% in 2007/8. This showed that the focus from Velocity Management's introduction in 2006/7 was not sustained at the same levels for 2007/8, because the personnel who introduced Velocity Management into CSL had left the Company and there were no champions who supported the existing system's continuation due to lack of knowledge and drive to continually improve within the business unit. For the staff of CSL, this was because Velocity Management was not embedded for long enough for all personnel to fully understand it and continue to use it even when key staff had moved on. During the period of

2006/7 when Velocity Management was used by CSL, most gains were made in those areas that delivered value for CSL which were leakage and income generating repairs. During 2006/7, there were large reductions in non leakage repairs which had been identified as an area of concern and were targeted with the introduction of Velocity Management. This active targeting resulted in more leakage and income generating work being carried out by CSL.

In 2007/8 when some Velocity Management processes were being utilised, but were no longer drivers for the CSL management team, there was a reduction of income but a rise in the number of repairs enabling the Company to hit their leakage targets which was their priority. The increase in non leakage repairs would have been a concern and it is thought that this would have continued to rise in subsequent years as a result of it no longer being an area of focus.

In summary during 2006/7 when Velocity Management was introduced, the number of repairs increased significantly compared to the 2005/6 benchmark and these repairs increased in the areas of leakage and income generation which are the two drivers for CSL. This increase of repairs, coincided with a decrease in the amount of non leakage repairs so the work that was being conducted had a larger benefit for the Company. This resulted in an increase in leaks repaired and income generated during 2006/7. This was maintained during 2007/8 for leak repairs carried out, but there was a drop of approximately £1M in income generation which would have been a concern for the Company, due to the reduction in commercial repairs. This shows that Velocity Management be introduced to the repair chain of a utilities monopoly and can be utilised successfully to deliver additional work that links into the key drivers for the organisation which in this case in repair of leak and income generation.

5.3 Mega Litre per Day (MLD) Saved

Although the amount of leakage generating repairs is important, the measure that OFWAT assesses is derived from the number of these repairs, and that is the amount of water saved per day as stated in mega litres. Mega litres are used by the water industry to report to OFWAT how they are tracking against their negotiated targets. A megalitre is a thousand litres of water which is the equivalent of an Olympic sized swimming pool. Figure 5.06 shows the volume of mega litres saved by the Customer Side Leakage Team over the three years of data. When compared to the benchmark of 2005/6, there was a substantial gain in megalitres saved in 2006/7 and 2007/8.

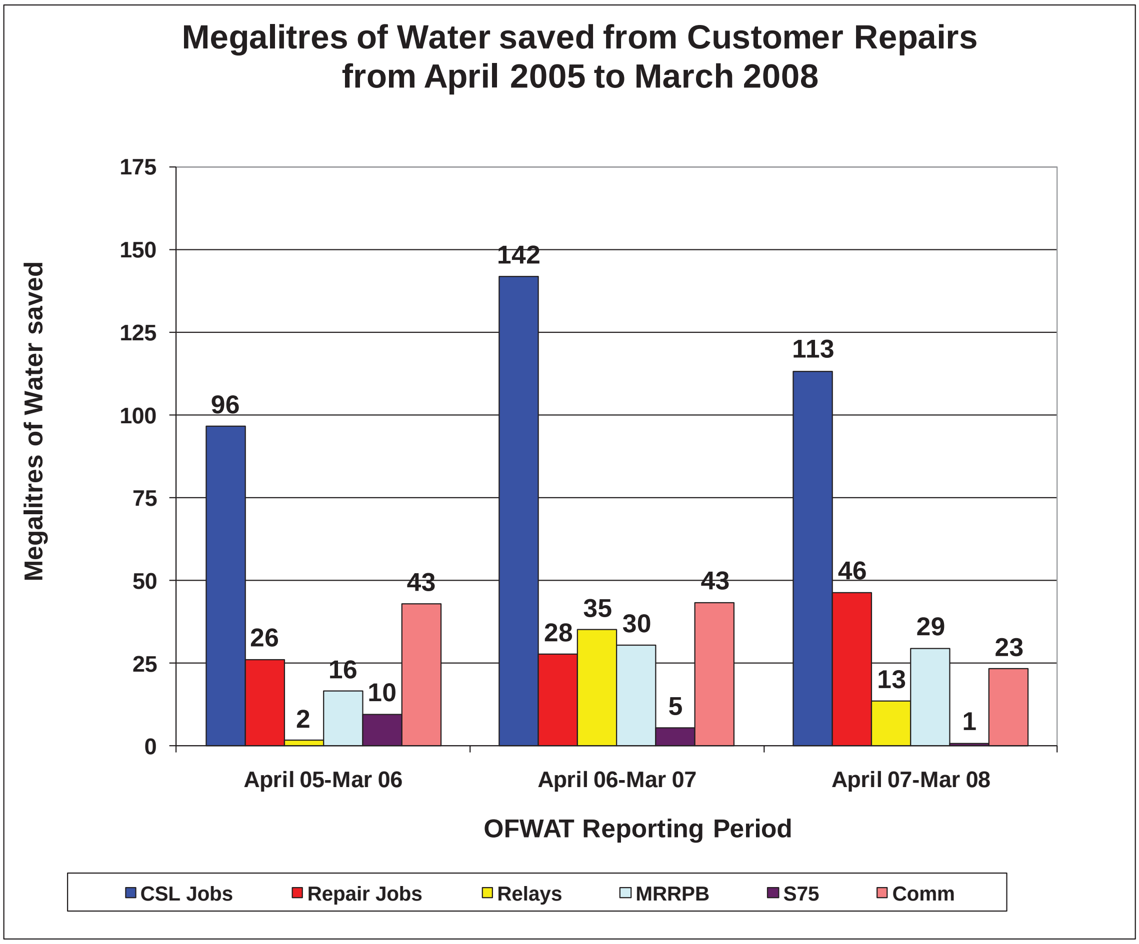

Figure 5.06: Megalitres of Water saved from Customer Repairs

The water saved by the CSL Team from 2005/6 to 2006/7 was an increase of 32% or 46 megalitres a day (MLD) during the 12 month period, which is the critical measured objective which supports the thesis. The target was an increase of 20%, with 32% being a strong indicator of the increase in the performance across the business. This success strong supports the success that Velocity Management can bring when introduced to a utilities Monopoly. To place this contribution into context the additional leakage delivered by CSL resulted in the Company being able to meet their leakage targets for the first time in seven years; and that formed part of the promise that Rheinisch-Westfälisches Elektrizitätswerk (RWE) who owned the Company made when they sold the company to McQuaries Bank in early 2006. This significant increase in Megalitres during the period that Velocity Management was being used within CSL supports the theory that Velocity Management can be introduced successfully into the repair chain of a utility monopoly. The decline of MLD from 2006/7 to 2007/8 was 20% or 29 MLD, which showed that whilst the delivery of water savings in terms of MLD had declined from the high during 2006/7, it was 17 MLD above the 2005/6 benchmark; and that was due to key personnel being moved out of CSL at the start of 2007/8 and Velocity Management not being supported by senior management. Velocity Management (like all new ideas or concepts) takes time to be embedded within an organisation and needs to be supported at the highest level in order for it to be fully embedded and the full benefits realised and sustained for any significant period of time. In the case of CSL, this did not occur, due to the key stakeholders being moved on within the organisation or leaving for other opportunities and senior management not continuing to support the initiative.

Repairs between 2005/6 and 2006/7 did not vary significantly with an increase of 2 MLD, with the significant move occurring in 2007/8 where there was an additional 20 MLD of leakage saved compared to the 2005/6 benchmark. This is an indication of CSL focusing on leakage generating repairs during 2007/8 due to the ease of getting into customers' properties when compared to relays and having the residual effects of the Velocity Management still delivering benefits. Relays was the largest movement in MLD going from 2 MLD in 2005/6 to 35 MLD in the space of 12 months. This shows that that the prioritisation of relays as a result of Velocity Management within CSL due to their negative impact on the average age backlog, customer complaints and the complexity to resolve them was significant. Between 2006/7 and 2007/8 there was a drop of 63% or 22 MLD which highlights that issue that without management focus on maintaining Velocity Management within CSL then the same levels of savings are difficult to maintain and will decrease towards the levels of MLD saved that occurred in the 2005/6 benchmark.

Meter Rear Replacement to Property Box (MRRPB), increased from 2005/6 to 2006/7 by 47% or 14 MLD from 16 MLD during 2005/6 to 30 MLD during 2006/7. This highlighted the improved management of repairs to generate savings was effective and Velocity Management was successfully utilised to identify areas of improvement. The advantage of MRRPBs were that there was no customer interface to carry out the repair, so it removed the customer interface yet contributed to the CSL leakage savings. MLD savings were maintained between 2006/7 and 2007/8 and it was thought that this was because Meter Rear Replacement to Property Box (MRRPBs) were the easiest leakage repairs to plan and carry out therefore the last repairs to be effected by Velocity Management not being supported during 2007/8.

The decrease in MLD from the S75 process during the three year period showed that by improving the way S75 was managed, and carrying out all the other repairs in a timely manner, it decreased the amount of leakage savings they generated for the business. This was good news as it took a significant amount of time to resolve these issues they were out of proportion with the savings they delivered. Therefore the reduction in leakage from the benchmark of 2005/6 to 2006/7 should be seen as a benefit to the business as it enabled other types of leakage generating repairs to be carried out instead. The continued decline from 2006/7 to 2007/8 was not a continuation, but simply an inability to resolve these repairs and not using the S75 process resulting in jobs continuing to build up as a backlog, which would ultimately result in more time to resolve them in the future. This should have been a concern for the business unit for the 2008/9 Financial Year in terms of how this backlog would have affected their performance and how they are going to resolve it.

Commercially, between 2005/6 to 2006/7 similar leakage savings were generated with 43 MLD delivered for both years, but this fell markedly in 2007/8 (a decrease of 47 % or 20 MLD) which was a serious leakage shortfall. If commercial repairs had stayed at a similar level as the two previous years, then 2007/8 would have contributed to overall leakage targets as opposed to being a liability. The main driver for the reduction in the commercial repairs in 2007/8 was the fact that the business unit manager and the second in command of the business unit (who was the commercial lead) left in early 2007. This left the commercial team without the direction and support they required to enable them to continue to perform as they had in the previous 12-24 months. The end result was that in 2007/8 leakage savings from the commercial team fell significantly creating a leakage shortfall in 2007/8. This highlighted that the financial bottom line of a business' performance could be affected by the introduction and removal of key personnel and processes. Whilst the loss of revenue did have an effect on the Company, of more significance was the leakage savings that CSL contributed towards the Company targets.

In summary, the substantial increase of 46 MLD during the second year of 2006/7 when compared to the 2005/6 baseline or a difference of 29 mega litres a day (MLD) compared to 2007/8 showed that in this key area for the Company, Velocity Management made a difference to the CSL performance. During 2006/7 there were increases in MLD saved in all areas apart from commercial which stayed the same and S75 which showed that less customers were being to court to gain access to their houses to carry out repairs. This was due to the clearing out of the backlog and the increase in the time that repairs were being conducted which was a positive for CSL. This increase in mega litres a day (MLD) contributed to the Company meeting their leakage target for the first time in 7 years, and avoids OFWAT penalties as a result of poor performance.

5.4 Income Generation by Customer Side Leakage

The Customer Side Leakage Team is unique within the Company as it had not only the ability to carry out leakage repairs, but could generate income, which was a driver for CSL. The difference in income over the three year period showed that focusing on increasing leakage and income for an organisation by using Velocity Management had significant benefits which are illustrated by Figure 5.07. The increase in income between 2005/6 and 2006/7 was £0.9M or an increase of 24%, which was as a result of this 12 month period benefiting most from the introduction of Velocity Management to the repair chain; with the team having a clear purpose, set of objectives and tools to drive performance. When compared to the measure objective of 15% which was set to support the proving of the thesis, this shows success in this area and supports the theory that Velocity Management could be successfully implemented within a utility monopoly.

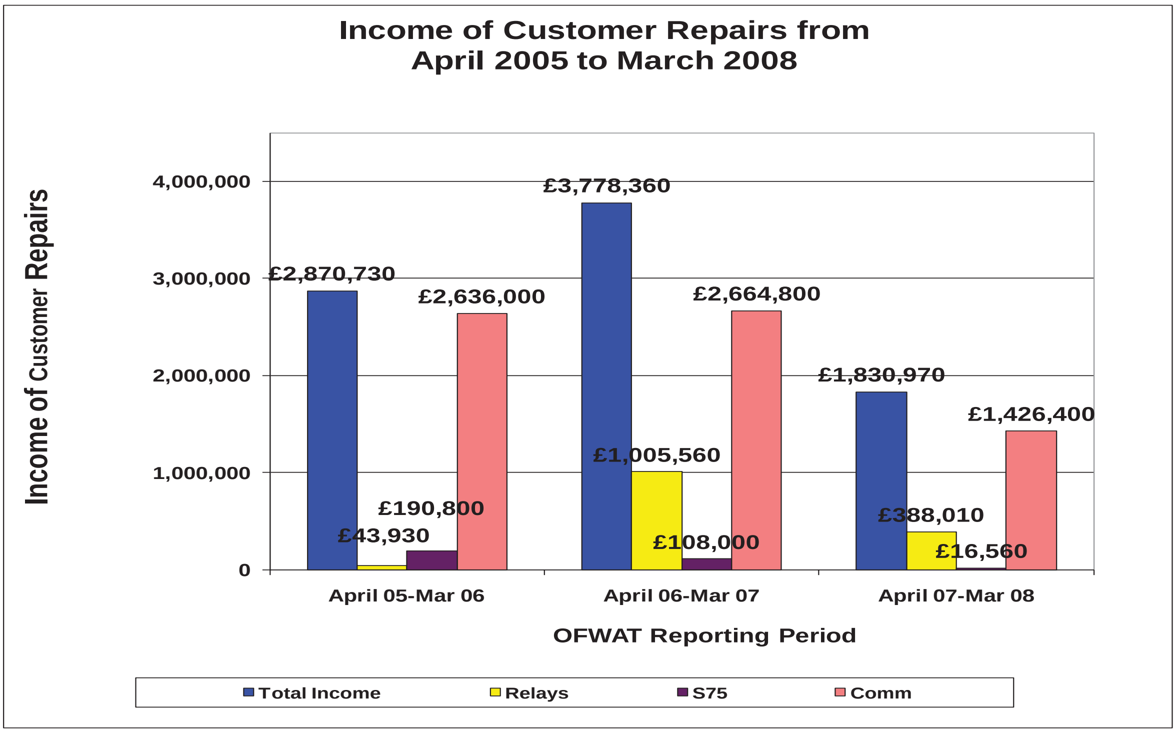

Figure 5.07: Income of Customer Repairs

The income then dropped markedly in 2007/8 by £1.95M or 48% compared to the 2006/7 period, which was not forecast resulting in a budget shortfall. It was anticipated that this loss of budgeted income would have continued into subsequent reporting years, due to Velocity Management no longer being integral to CSL. This was because the manager who implemented Velocity Management in CSL was not replaced for 12 months resulting in the gains not being sustainable. Coupled with the fact that the second in command of CSL left at the same time, leaving the CSL team without direction and support that was required to continue the present performance that had been achieved in the previous 12 months of 2006/7. When 2007/8 is compared to the bench mark of 2005/6 there is a difference of £210,000 less against the bench mark even though more leakage repairs in 2007/8. This was due to the commercial income falling off during the 2007/8 period. The end result was that in 2007/8 the income from the CSL unit fell in all areas, and created a funding gap for 2007/8. This highlighted the issue that the bottom line of a business will be affected by the introduction and removal of key personnel and processes. Whilst the loss of revenue does have an effect on CSL, of more significance is leakage savings that CSL contribute to the Company's targets.

The variation of income generated by relays was approximately £1M between 2005/6 and 2007/8, with the largest movement between 2005/6 and 2006/7 when income increased by £962,000. Due to their more complex nature, relays are more challenging to resolve than repairs, and Velocity Management allowed these to be found, proven, processed, planned and repaired significantly faster resulting in substantial improvements of leaks and revenue generation. From 2006/7 to 2007/8, income decreased by 61% or £0.62 M, which was due to the fact that the majority of the outstanding relays backlog had been resolved during 2006/7, and relays were not being found by the provers in the same numbers to allow these repair numbers to be sustained. The other reason was that Velocity Management was not fully embedded within CSL when key staff left and a lot of the processes were not used as staff resorted back to their old habits and took the path of least resistance, creating inefficiencies which further slowed the repair cycle. Although 2007/8 shows £344,000 additional income than the benchmark of 2005/6, it was predicted that subsequent years' income for relays will continue to decline as the impact of Velocity Management is reduced over successive periods. As there is no available data from 2008/9 onwards, this cannot be substantiated.

The improved management of the S75 process led to a decrease in the amount of income they generated for the business; but as the amount of time required to resolve these issues was significant, then the income reduction between 2005/6 and 2006/7 was a benefit as it allowed other faster revenue generating repairs to be carried out. The continued decline from 2006/7 to 2007/8 was not a continuation of this, but simply an inability to resolve these repairs and not using the S75 process meaning that these jobs would build up in the backlog, and more time would be needed to resolve them in the future.

Income delivered by the commercial team remained static between 2005/6 and 2006/7 even with the increase of workload for the commercial manager with the additional responsibilities to deliver. This showed that Velocity Management created an environment where more work was carried out by fewer personnel as pipeline blockages were identified and resolved across the repair chain, resulting in the income being maintained. In 2007/8 the loss of key personnel and the lack of support for Velocity Management resulted in a reduction in income of £1.24M which created a substantial hole in the CSL budget. It is thought that this lack of commercial income would have continued into subsequent years, but this cannot be proven because no data is available post 2007/8.

The increase in revenue during 2006/7 did not just highlight the significance of focusing on the handover points between business units to maximise the revenue streams that were available to CSL; it focused on reducing the amount of bad debt written off by the Company. Bad debt from the first to second year fell by 63%, which indicated the improvement of the revenue gathering process and communications within the Company and between the

Company and its customers. This reduced by 5% between 2006/7 and 2007/8, which mirrors other reductions in gains across most of the measures in 2007/8 when Velocity Management was not fully utilised and supported within CSL. It suggests that the links between CSL, commercial and customer services were starting to unravel as personnel began to focus on business units and not look at the complete repair chain which was the hallmark of Velocity Management. The main reason for the reduction in bad debt was the queries were answered within 14 days where in the past it had taken up to 9 months. This improved turnaround meant the customers were more likely to pay.

In summary, Velocity Management enabled CSL to increase their income substantially in 2006/7 when Velocity Management was fully integrated within the repair chain. In 2007/8 when it was no longer supported by management as key staff left CSL and personnel were allowed to revert back to their old habits, the income generation could not be sustained. This lack of income did affect CSL, but was a secondary effect after leakage generation. The income generated in 2006/7 supports the theory that Velocity Management can be introduced to the repair chain of a utilities monopoly in order to produce a cost effective and efficient organisation now and into the future; but in this case Velocity Management was not maintained in the long term due to the movement of key staff before it was fully embedded within the organisation.

5.5 Backlogs of Work

It had been found that there was a link between the repair backlog and customer complaints; the longer repairs were in the backlog, the more customer complaints were received and the harder they were to resolve. By assessing the end to end process, it was identified that repairs such as relays were placed in a backlog for long periods of time because of the number of customers involved and their complexity to resolve. This artificially kept the average days of repair down as they were not reporting the number of jobs in the backlog and the amount of days they had been there for. To resolve the backlog mountain, senior management had to understand and accept that the KPIs for average age for repairs would increase dramatically as repairs (that were in some cases over one year old) would have a negative impact on their reporting. The backlog would increase as it was cleared and then settle down to a more stable average age in the medium term. Three measures are assessed:

- Detection to repair; This was the time that it took a leak to move through the whole process from when it was found by the detection teams or reported by customers, to when the repair gang arrived at the site and carried out the repair and it was closed on the Company corporate system.
- Detection to raised: This was the time from when the leak was found by the detection teams or reported by customers, to when the proving technician arrives at the customer's property and proves that they have a leak and carries out a survey which enables the planner to plan the job for the repair gang to carry out.
- Raised to repair: This was the time from when the proving technician arrives at the customer's property and proves that they have a leak and carries out a survey which enables the planner to plan the job for the repair gang to carry out, to when the repair gang arrived at the site and carried out the repair and it was closed on the Company corporate system.

Figure 5.08 shows the steady increase in the average age of detection to repair of CSL jobs beginning in March 2006 and continuing for a period of eight months until the average age stabilises from October 2006 onwards. This was caused by the increase of jobs completed monthly from an average of 1230 jobs a month in the previous eight months to an average of 1710 jobs a month from March 2006 (an increase of 480 jobs a month or 39%) with no increase in personnel levels within Thames; and from September 2006 the loss of three personnel from the CSL Team. Velocity Management allowed the same personnel to manage the increase of jobs whilst resolving the outstanding challenge of getting the average age of the repair backlog to within manageable limits. Then with the loss of three staff, they were able to continue to manage the increase in work and resolve outstanding issues.

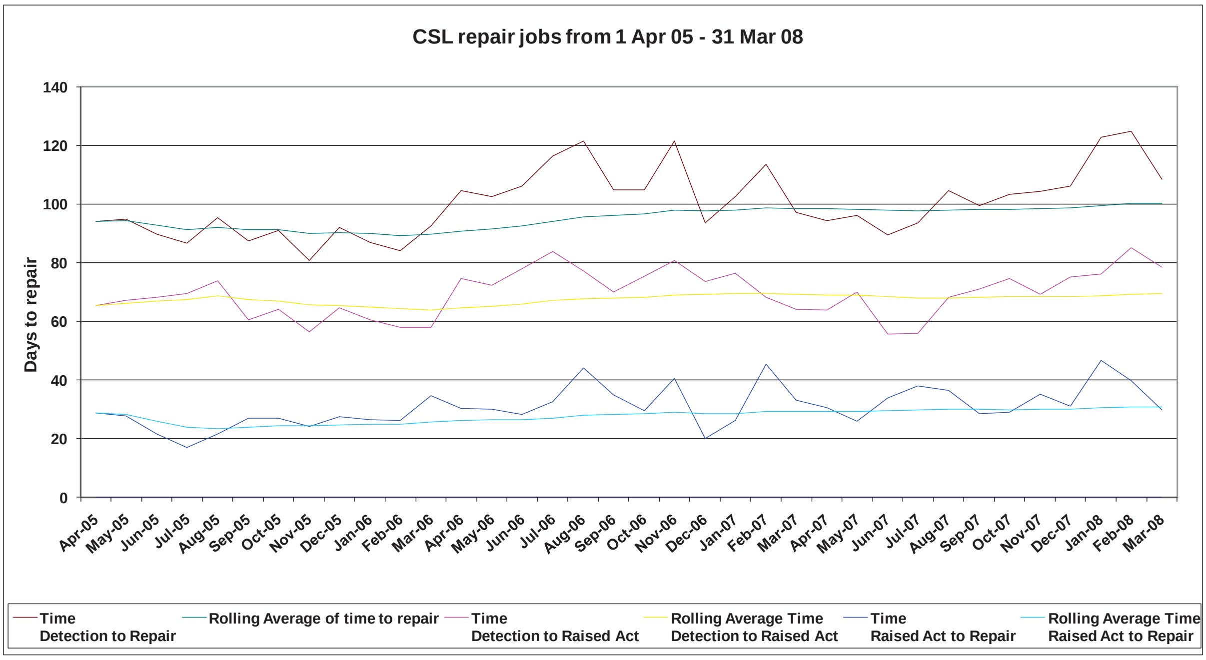

Figure 5.08: CSL Repair jobs

OFWAT uses a number of measures to ensure that the water utility companies are compliant and meet their leakage targets. One of the targets is customer service, and one of the measures they are concerned with is the ability of the Company to carry out a Customer Side repair as quickly as possible with the minimum of disruption to the customer. All repairs older than one year are classed as unacceptable, and OFWAT are continually looking for ways that utilities are trying to significantly reduce or cut out all repairs over 365 days within an organisation. One of the focuses of implementing the principles of Velocity Management was to highlight areas that had previously been identified by the regulator as being an area of weakness within the Company. All repairs that were live within the corporate system were identified and then split into bands of time as shown below:

- 0-60 Days
- 60-90 Days

- 90 – 135 Days
- 135-180 Days
- 180-365 Days and
- Over 365 Days.

This spread was then prioritised and the personnel who were directly responsible for the collective parts of the repair chain had to report back to the Business Unit manager of the Customer Side Leakage Team on their plan to resolve these outstanding jobs as quickly as possible. If they had any constraints that were not allowing them to resolve the repair, then there was an escalation process to highlight the issue and give a possible solution to those further up the escalation chain. This included those not only in CSL but all personnel involved in the customer side repair process from the external contractors to the debt recovery personnel in the Company commercial teams. As of 1st of Feb 2007, there were no outstanding leakage repairs over 180 days old. As the historic jobs were resolved and the average age of the older jobs significantly reduced, the spread of days was then reprioritised to reflect the improved management of the backlog.

This focus coupled with the measures being included into staff's bonuses meant that this issue was able to be resolved with the minimum of fuss. Figure 5.09 shows the split of repairs that were over 365 days old. This highlights the repair jobs that were closed, not the remaining back log of repairs. That information was not available for this thesis.

In 2005/6 there were 228 repairs over 365 days old which comprises 14% of the total repairs; this increases in 2006/7 to 794 repairs over 365 which was 49% of the total jobs that were closed over 365 days old. This is an increase of over 300% from the previous year, and showed the importance that was placed on resolving repairs over 365 days across the Company during 2006/7. The low amount of repairs older than 365 days in 2005/6 is not a positive reflection of the work carried out by the Customer Side Leakage Team during this period, but rather an indication of their inability to manage their backlog due to the increase in leakage repairs that they were processing during that period. The resulting effect was a bow wave of outstanding leakage repairs over 365 days being left to accumulate in the backlog.

When investigating what trends allowed repairs to become over 365 days old, a number of key factors were found to account for the majority of these:

- Customers were reluctant to pay for their repair to be carried out and the Company was forced to carry out the S75 legal action to get access to the property to carry out the repair.
- Multiple occupancy relays where one or more customers on the relay were not willing to pay, requiring the Company to carry out S75 legal action.
- An initial customer complaint, that due to the slow speed of response by the Company escalated for both the Customer Services Team and the Customer Side Leakage Team.
- Customers located in difficult situations that require a large amount of preplanning for the repair crew to gain access to the property. Some of the reasons for this include: they are located on a busy road resulting in the gang being unable to get easy access due to no parking, parking bay suspensions being ignored and the repair gangs leaving before the vehicle can be towed. Because these repairs were difficult to plan, they were ignored.
- Customers being located in isolated locations, meaning that a repair gang would only be able to carry out one repair, not giving them an ability to earn a wage for the day, so they are tempted to abort the job because it is too hard.

From April 2005 to March 2008, there were a total of 1617 customer repairs over 12 months old, of these 127 repairs were over two years old and 20 more than three years old (Thames Water, 2008). For the repairs that were outstanding, it was quite understandable that a number of customer issues had to be resolved in order to carry out the repairs and mitigate further complaints and approaches to OFWAT. Due to the 39% increase in customer repairs being processed, a backlog of jobs was created with no time spent on clearing them as they were not classed as a priority as they were too hard to resolve, too complex or it was a result of no procedures in place to resolve them in a timely manner. The introduction of Velocity Management identified this area as a challenge for the team and as an area that if resolved, would increase the income, reduce the amount of customer complaints from outstanding jobs, and clear the backlog of jobs to set a target of all customer repairs to be completed with 50 days of confirming a leak.

The spikes in the detection time to repair in August 2006, November 2006, February 2007, January 2008 and February 2008 were the result of old jobs more than 12 months old being cleared from the backlog. These five month periods had 445 jobs which were over 12 months old, which drove up the monthly and the rolling average significantly as illustrated by Table 5.02.

Month Periods Where Repairs Over 365 Days Old

Significant spike dates	Jobs over 365 days	Total days	Average over 365 days	Highest number of days before being repaired
August 2006	69	32,990	478	1416
November 2006	113	56,522	500	1192
February 2007	93	45,823	492	900
January 2008	90	46,066	512	1151
February 2008	80	38,057	476	1017

Table 5.02: Five highest periods where repairs over 365 days were resolved

Figure 5.09 illustrates that in 2005/6 before Velocity Management was introduced, 236 repairs over 365 days were carried out, but after the introduction of Velocity Management with a focus on resolving outstanding repairs over 365 days, this increased to 856 repairs over 365 days in 2006/7 and dropped to 525 in 2007/8. The increase in 2006/7 highlighted the focus that Velocity Management brought to outstanding repairs and its effects were still being realised in 2007/8 but to a lesser extent, and with the majority of very old repairs having been resolved in 2006/7 then there was not the same pressing need to resolve these issues that there was in 2006/7. The increase in the amount of commercial repairs over 365 during 2006/7 from 36 in 2005/6 to 262 in 2007/8, was as a result of Velocity Management identifying the issue and the commercial team then clearing out these jobs as a priority. During 2007/8 there was 124 commercial repairs being carried out, which was the result of the commercial team clearing out their remaining back logs as the amount of commercial work being won was reducing due to the commercial manager leaving the Company.

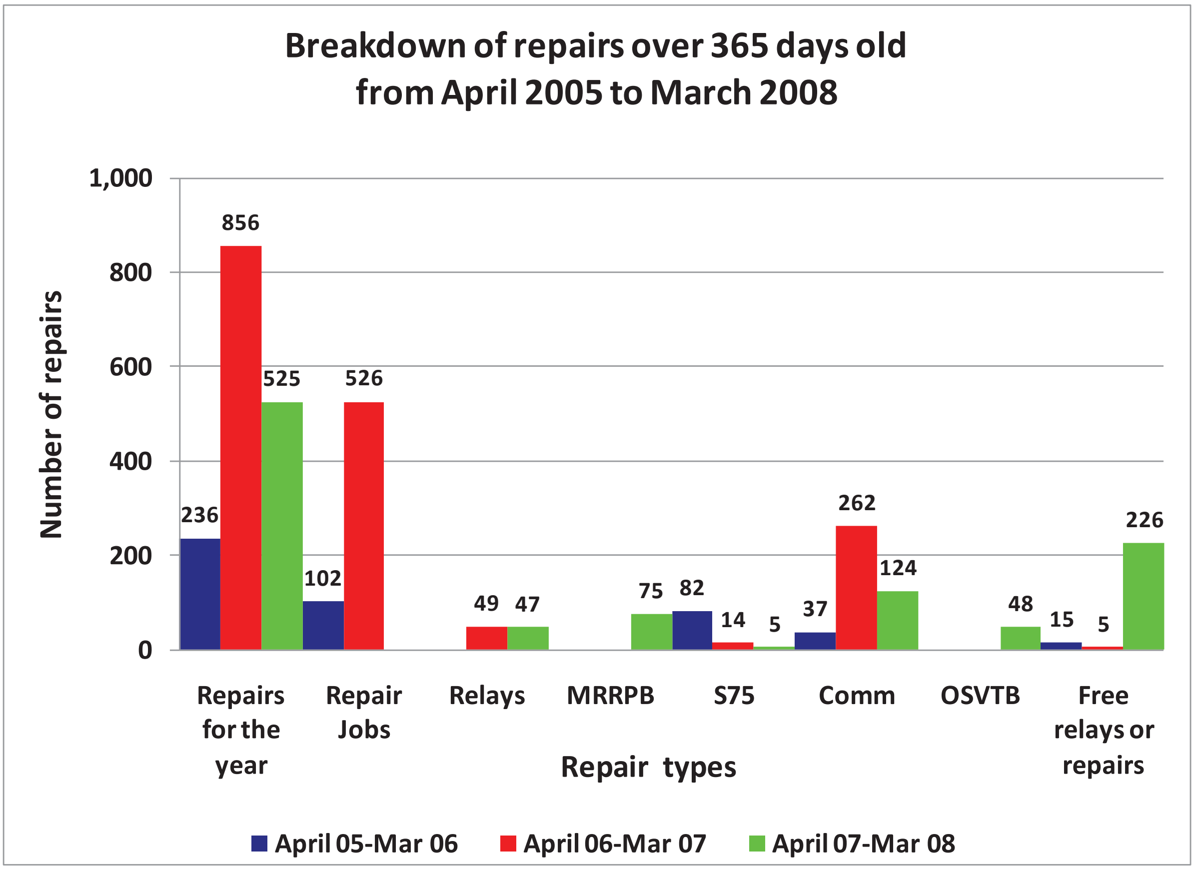

Figure 5.09: Breakdown of Customer Repairs over 365 days old

During 2006/7 repairs and relays contributed to the increase of repairs over 365 days and this was because of the focus to resolve shared relays. What is not shown in relays is that shared relays were assessed as one repair even though the leakage claimed for it is significantly more than a standard repair, so resolving these contributed significantly to meeting leakage targets. It meant that they were the hardest repairs to resolve due to the number of personnel involved in the process which was, on average, four home owners. 2005/6 and 2006/7 had repairs being the largest contributor to their outstanding figures (43% and 61% respectively) yet in the third year, there were no repairs outstanding but a large increase in free repairs which contributed to 43% of repairs. This would suggest that CSL had changed its policy and was offering customers free repairs instead of trying to enforce the S75 process or getting them to sign up for a repair. This would account for some drop in the 2007/8 income, the decrease in S75 repairs in 2007/8 and would resolve a lot of customer complaints that could have been outstanding. 2005/6 S75 illustrated that nothing had been done for a long period of time; and when the Company did follow up on the leaks, the customers refused to give them permission to carry out the repair forcing the Company to resort to the legal process to get it resolved, which is takes a lot of time and effort.

The third type of repair that made up the majority of repairs over 365 days in 2007/8 was Meter Rear Replacement to Property Box (MRRPBs), which as a leakage generating repair that had no customer interaction was a surprise because they are normally the first type of repairs carried out. On further investigation it was found that all these repairs were from the Victoria Main Replacement (VMR) which had a formal relationship initiated with CSL during 2006/7 with the introduction of Velocity Management. This relationship and clarification on how their repairs were being carried out had stopped in 2007/8 and these outstanding MRRPB were a result of this breakdown. It shows that some of the Velocity Management practises that had been put in place were starting to fail with loss of the key personnel who introduced Velocity Management.

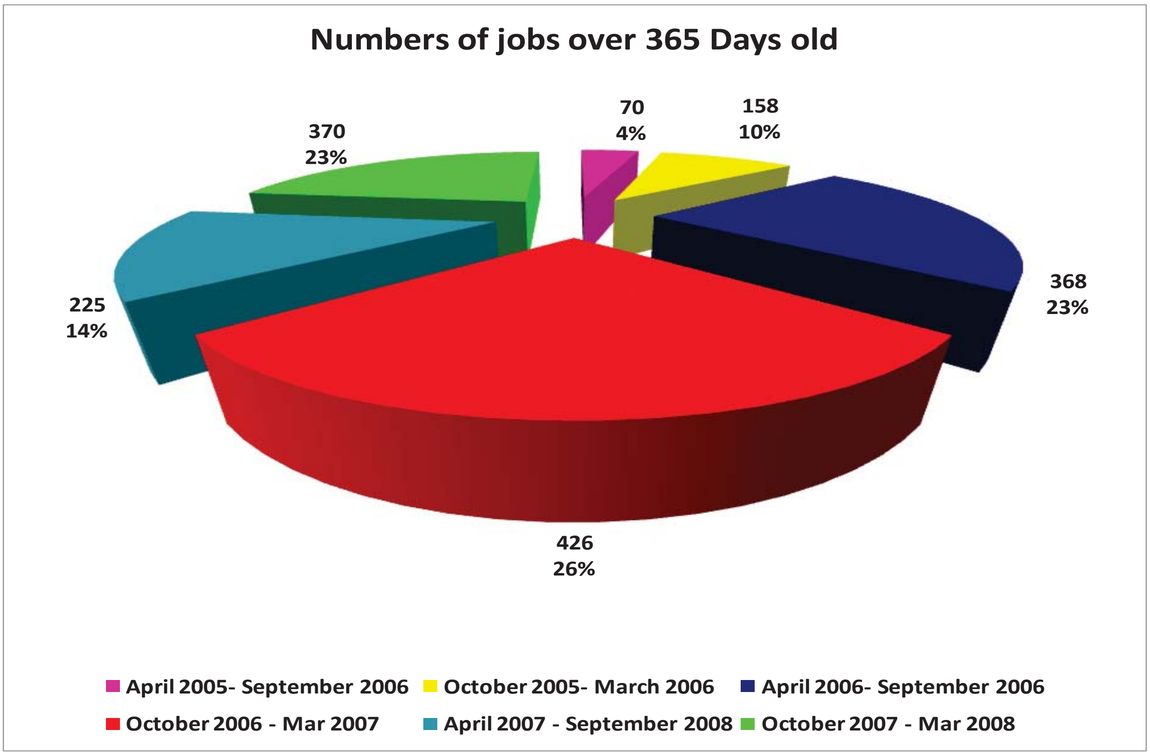

Figure 5.10: Number of Customer Repairs over 365 days old

Figure 5.10 illustrates the breakdown of when the outstanding repairs older than 365 days were completed in six month blocks over the three years of data. The two six month periods in 2005/6 had a low number of outstanding repairs over 365 days with the first period making up only 4% of the total and 10% in the second period, contributed 14% of the total outstanding repairs over 365 days conducted during the three years in the first year. This was because of the significantly smaller number of repairs being conducted in 2005/6, and by not focusing on the backlog of work, these would build up and affect 2006/7. During 2005/6 the lack of old repairs carried out resulted in a significant issue to address in 2006/7.

2006/7 was where the bulk of one year outstanding repairs were completed with the two periods making up 49% of these repairs which reflected the priority that Velocity Management had set on resolving this issue. The largest amount of repairs occurred in the second period of 2006/7 which was when Velocity Management had been implemented for some time and there was a strong focus on resolving this issue; it resulted in all repairs over

180 days old being completed in February 2007 and this was reported in the 2006/7 Company annual submission to OFWAT. Therefore leaks over 365 days would take approximately six months until August 2007 to become an issue for CSL if nothing was done on this.

With the CSL Business Unit Manager leaving in April 2007, the focus on the average age of the backlog was not continued which had been highlighted by Velocity Management; until the end of year reporting to OFWAT when it was realised that one of the issues for CSL that had been addressed in the 2006/7 OFWAT report was going to fail in the current year's reporting, and that was cutting out all outstanding repairs over 180 days old. Significant resources were focused on eliminating the backlog, resulting in an increase of outstanding repairs being carried out in the final six months of the reporting year, but it is not known if the backlog was fully eliminated by the end of 2007/8. This last minute surge of resources would have contributed to the low returns for both leakage and repairs as a lot more resources within the process are used to resolve issues over 365 days old, due to the history and challenges that they generate. The last two periods of the data contributed 37% of the total of year old repairs with the second period of six months reflecting the increased resource level, and was the second largest amount of repairs carried out over the three years of data.

In conclusion, the outstanding backlog of repairs over 180 days old was closed out during the time when Velocity Management was being used within CSL. During the period 2006/7, there were more repairs over 365 days than in the other two years, which showed the focus these were given by the business. These were time consuming repairs to resolve and this was carried out at a time when the most repairs were carried out over the three years of data. This focused targeting and closing of repairs was as a direct result of Velocity Management and support the thought of can Velocity Management be introduced to the repair chain of a utilities monopoly. The measured target that was set was that there jobs of 365 would reduce by 50% during the period when velocity Management was being utilised. With the clearing of all outstanding repairs over 180 days, then this objective was met.

5.6 Average Age of Repairs

Rolling averages show the effect on the time it takes to carry out the repair for CSL over the three years of data; they take into account the increase in jobs over the months and the time it takes to complete each repair. If the rolling average increases, then it shows pressure on the repair chain which can be investigated and resolved. The rolling average is affected by the backlog as the older the age of the repairs in the backlog the higher the rolling average is, so with the focus in 2006/7 from Velocity Management being the clearing of the backlog the rolling average should increase during 2006/7. With repairs over 180 days being completed in February 2007, then 2007/8 should see the rolling averages come down if Velocity Management was still being used within CSL. As this was not the case, then the rolling average could quite likely increase even with the reduction in the number of repairs carried out during 2007/8 and the clearing of the backlog during 2006/7. Rolling averages within CSL were broken down into three parts:

- Detection to repair; From being found by the detection teams to when the repair gang carried out the repair and it was closed on the Company corporate system. This assesses the whole system and does not pin point where the time is increasing in a specific part of the repair chain.
- Detection to raised: From being found by the detection teams to when the planners plan the job for the repair gang to carry out. This focuses on the work of the detection and proving teams and allows the underlying data to be assessed further to determine where the points of failure are.
- Raised to repair: From when the planner plans the job to when the repair gang arrive, carry out the repair and it was closed on the Company corporate system. This is focused on the work being carried out by the planners and the repair gangs.

The rolling averages that were recorded were for repairs that benefited the Company in that they either generated leakage savings, income or contributed to the network integrity.

Therefore Outside Stop Valve to Boundary (OSVTB), Meter Rear Replacement to Property Box (MRRPB), repairs, relays and commercial repairs were included in the average to discern if they were above or below the average and the reasons why. Figure 5.11 illustrates the detection to repair rolling average over the three years of collected data from April 2005 to March 2008, with a range of averages from 89 days to 100, and the largest movement between March 2006 and September 2006 when it moved from 89 to 98 days, which was a 9% increase. This increase in repairs was within the 15% variation against the baseline which was set by the measured objectives in support of the thesis question. With most of the repair types being stable, the average age was driven up during 2007/8 by commercial repairs where the number of repairs dropped from 3331 to 1783 between 2006/7 and 2007/8, and relays decreased from 4372 repairs completed in 2006/7 to 1687 in 2007/8, yet the average age still increased.

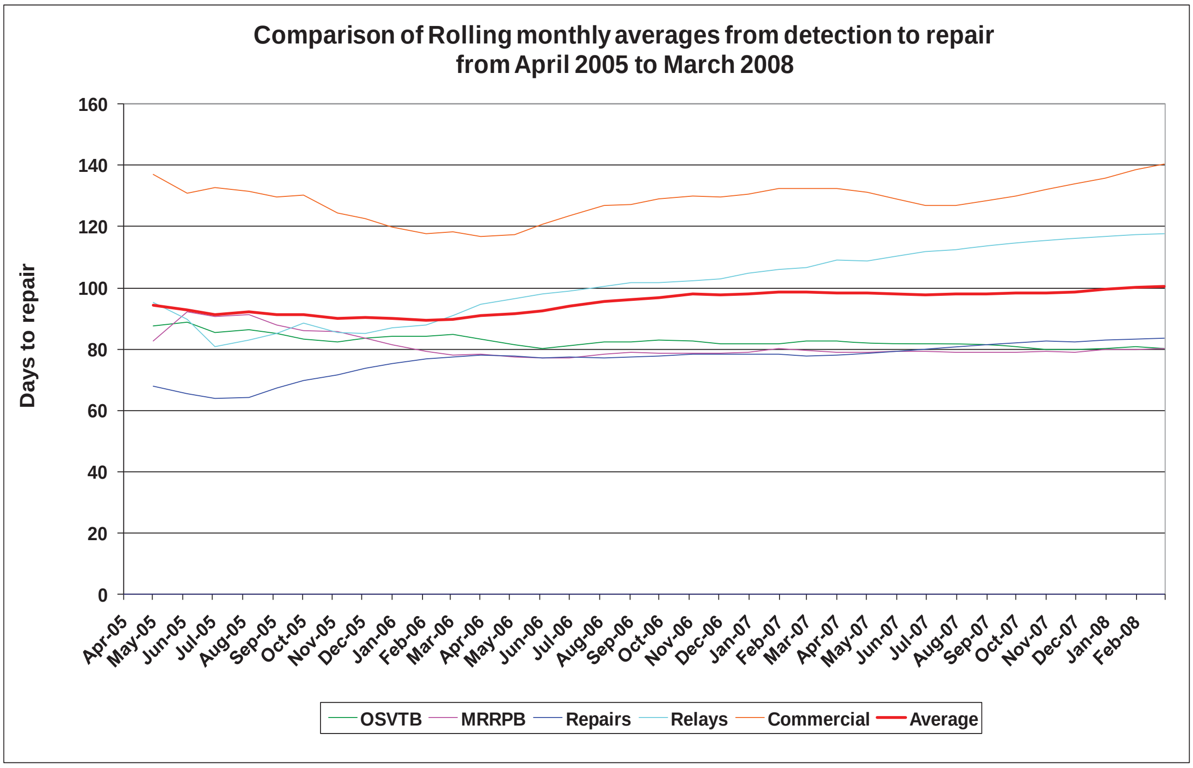

Figure 5.11 Rolling Average of Repairs from Detection to Repair

The average age does show that there was a significant increase in the number of repairs carried out during 2006/7 and 2007/8 which were 44% and 33% (respectively) more than the 2005/6 benchmark; yet the time it took to carry out the repairs was increasing which coupled with the decrease of three staff meant that it was likely to be unsustainable in the long term. Even with a reduction in the total jobs completed between 2006/7 and 2007/8 of 1,300 repairs the average still continued to climb. To ensure that the model was sustainable in the long term, additional staff were required to control the average age of repairs, or Velocity Management be reintegrated into the CSL repair chain.

Outside Stop Valve to Boundary (OSVTB) reduced from 90 days down to 79 days over the period, with the rolling average decreasing steadily from the start of 2006/7 when Velocity Management was used. What impacted upon this decrease was the reduction in the number of OSVTBs from 4676 in 2005/6 to 1926 during 2006/7 and 2479 in 2007/8. This indicated Velocity Management had reduced the number of OSVTBs in favour of leakage and income generating repairs during 2006/7; and the residual effect of Velocity Management was being felt during 2007/8 as the planning staff began to plan these repairs in greater number to the detriment of leakage and income generating repairs for the Company. For Meter Rear Replacement to Property Box (MRRPB) there was an improvement in the rolling average from a high of 93 days dropping down to 73 days to end the three year period at 80 days. When compared to the total number of MRRPBs being repaired, the peak was during 2006/7 when the rolling average was as its lowest, showing a strong indication that Velocity Management contributed to the reduction of the average age of Meter Rear Replacement to Property Box (MRRPB) during 2006/7.

Repairs moved from a low of 63 days in 2005/6 to its high of 83 days at the end of 2007/8. During 2006/7, the rolling average moved half a day to 77 days which was maintained for the period, showing Velocity Management assisted in keeping the rolling average in check. The residual effects of Velocity Management were still being felt during 2007/8 when repairs increased from 3453 to 5790 which was an increase of 40% and the average age only moved from 77 days to 83 days, an increase of 6 days. The challenge for 2008/9 would have been to maintain or reduce the average days to detect and repair with less staff and less influence from Velocity Management. It is anticipated that in future years, the average age would continue to increase even if the amount of jobs decreases as there is no continuous improvement cycle that is supported by senior management within CSL.

Relays moved from an average of 81 days near the beginning of 2005/6 to 117 days near the end of 2007/8, an increase of 36 days per repair. The number of relays increased from 191 repairs in 2005/6 to 4372 repairs in 2007/8, reducing to 1687 in 2007/8. Though the average age of relays increased during 2006/7 by 11 days from 95 to 106 days, it increased by another 11 days from 106 to 117 days during 2007/8 when there were 2,685 less repairs carried out. This continued increase of the average age when only half the repairs were carried out compared to previous years is an indication that Velocity Management had kept the average age in check during 2006/7; but was not being effectively supported and utilised by CSL from 2007/8 onwards, which inhibited their ability to control the average age of their key leakage and income generating repairs.

Commercial repairs take longer because of the time taken to interact with the customer, the requirements to quote for the work, the increased planning requirements due to the size of repairs being conducted, and the tendency to take more time before committing to the work to be carried out. During the three years commercial repairs went from a low of 117 days in April 2006 to a high of 140 days in March 2008, a difference of 23 days. Commercial repairs were decreasing until May 2006, when the average began to increase to an average of 132 days in April 2007, until dropping to a 126 day average in July 2007 which then increased to 140 days at the end of 2007/8. The drop in the average in July 2007 was linked to the commercial manager leaving in May 2007 and the pipeline of repairs running out in July 2007, which was reflected in only 1783 commercial repairs being carried out in 2007/8 compared to 3331 during 2006/7 and 3295 in 2005/6. The increasing of the average age during 2007/8 was during the period where 45% less repairs were being carried out. This supports the theory that Velocity Management had a significant influence on managing the average age and when fewer repairs were being conducted, CSL was not able to reduce the average age of repairs. This would have been an area of concern, linking into less income being generated as well.

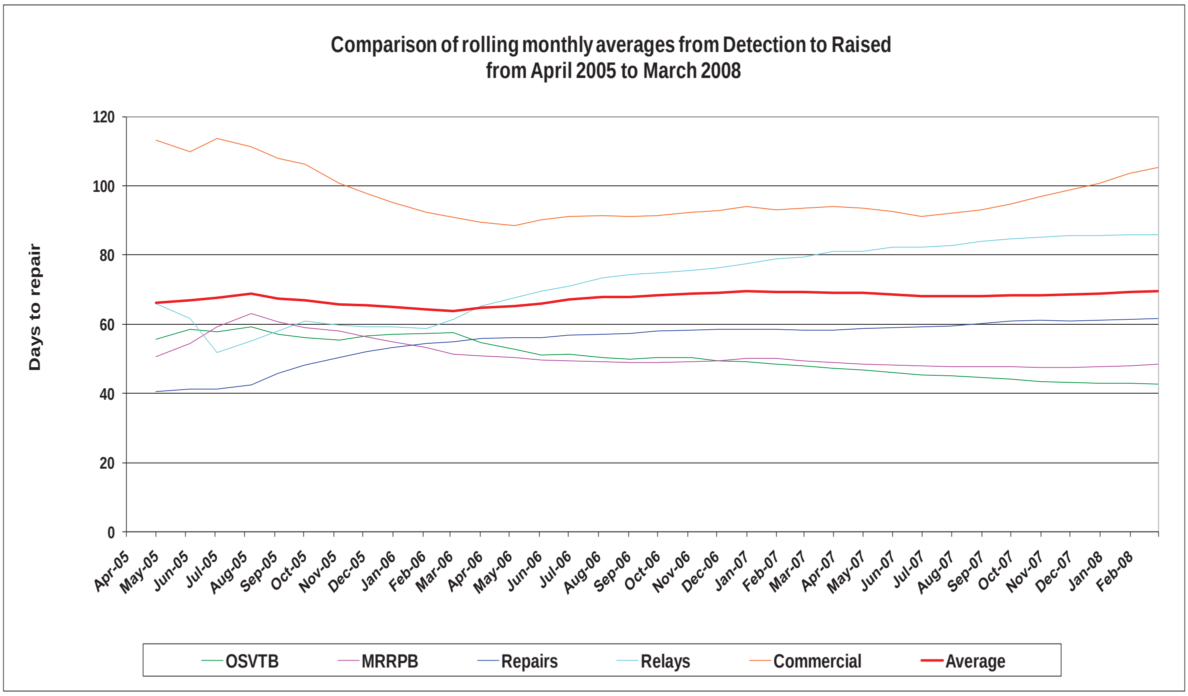

Figure 5.12: Comparison of Rolling Monthly Average from Detection to Raised

Figure 5.12 illustrates the detection to raised rolling average over the three years of collected data from April 2005 to March 2008, with the average varying from between 64 days to 69 days, and the largest movement between March 2006 and December 2006 when it moved from 64 to 69 days. This reflects the increase in the amount of proven leaks found by the detection and proving team during this period. Outside Stop Valve to Boundary (OSVTB), moved from a high of 59 days in July 2005 to a low of 43 days in March 2008 which showed they were being found quicker by the detection and proving teams. Looking at the total time from detection to repair, OSVTB were spending longer in backlogs, suggesting that they are being used more as stop gap filler during 2006/7 and 2007/8 than when they were planned with the same priority as leakage generating repairs during 2005/6. This highlighted the planning priorities that had been set when Velocity Management was used during 2006/7 were being followed, and that improvements for the detection and proving teams were being obscured by the longer time planners were taking to plan repairs for the gangs. In this case, as Outside Stop Valve to Boundary (OSVTB) only contribute to network integrity and not leakage or income, it was a positive, and formed part of the Velocity Management strategy.

Meter Rear Replacement to Property Box (MRRPB) varied from a high of 65 days to a low in March 2008 of 47 days, which showed the process for the detection and proving teams had improved because with no customer involvement, they could be proven quickly. Although MRRPBs were proven faster as a result of Velocity Management, they were not being planned as quickly as they should have been to keep the detection to repair rolling average down. Although Velocity Management had supported improvement in the process to detect and prove Meter Rear Replacement to Property Box (MRRPBs), there were still challenges within the repair chain that had to be resolved in order to maximise its potential.

The repair rolling average moved from 40 days in May 2005 to 62 days in March 2008, which was an increase of 22 days suggesting that the process of detection and proving repairs was not as effective as other parts of the detection process. Whilst there was a significant increase in the amount of repairs carried out during 2007/8 which would have put a strain on the detection and proving average age, a similar number of repairs were carried out during 2006/7 when compared to 2005/6. This was during the time when the Company was constantly in the press for failing to meet their leakage targets, and there were a lot of customer complaints which made it challenging for the provers to gain access to houses to prove leaks. During 2006/7 when Velocity Management was utilised, there was an increase from 54 to 58 days, compared to 2005/6 when the most significant move from 40 to 54 days occurred. When the number of repairs carried out increased from 3453 in 2006/7 to 5790 in

2007/8 there was only an increase in the average age of 4 days from 58 to 62, which highlighted the benefit that Velocity Management brought to CSL allowing a smaller team to manage a larger workflow. This was not shown in the dramatic increased during 2005/6.

The relay average age varied from the low of 52 days in July 2005 to the high of 86 days in March 2008, which would at face value show that Velocity Management had no effect on the detection to raised process for relays. In detail, relays moved from 65 days to 79 days during 2006/7 when Velocity Management was used; an increase of 14 days with 4372 relays carried out. In 2007/8, the average age increased from 79 to 86 days (an increase of only seven days) when 1687 relays were carried out in this period (a reduction of 62%). During 2005/6 when the movement was from 52 days to 65 days (an increase of 13 days) only 191 relays were carried out in the 12 months rendering most of this data of poor accuracy and the processes and procedures to allow this of little value. The proving of relays was poor but this was improved during 2007/8 when the majority of relays were carried out. Although the average age increased, it was at a slower rate than during 2007/8 when less relays were carried out, showing that Velocity Management had an impact on the average age because during that period all repairs and relays over 180 days were being cleared from the backlog therefore pushing the average age up as a result of this.

Commercial average age varied from a low of 88 days in May 2006 to a high of 113 days in May 2005; and during 2006/7 when Velocity Management was used the average age varied between 90 and 93 days (an increase of only three days). In 2005/6 when a similar amount of commercial repairs were carried out the range was 90 to 114 days. When the number of repairs reduced from 3331 in 2006/7 to 1783 in 2007/8 (a 46% reduction) the average rose from 93 days to 105 days (an increase of 12 days). This showed the average age when focused on as part of a complete process could generate more repairs whilst keeping the average age down; but when it was no longer the focus, the average age increased whilst less repairs were completed. Average ages are linked to the backlog, but the detection to raised average must be considered as part of the average age for the whole process in order to gain a good understanding of where the issues are that should be focused on next.

Figure 5.13 illustrates that there was a balance between the amount of repairs carried out and the average age to carry out the repair; as it gives an indication that something in the process is not able to keep up with the workload. When the average age of the repair goes up, the number of jobs in the backlog and their age rises. This places more pressure to clear the backlog (with the oldest repairs being of a higher priority) whilst maintaining the focus to determine the priorities within the types of repairs to maximise leakage and income for the Company. OSVTBs and relays are around the average whilst Repairs, MRRPBs and commercials cover the spread of time.

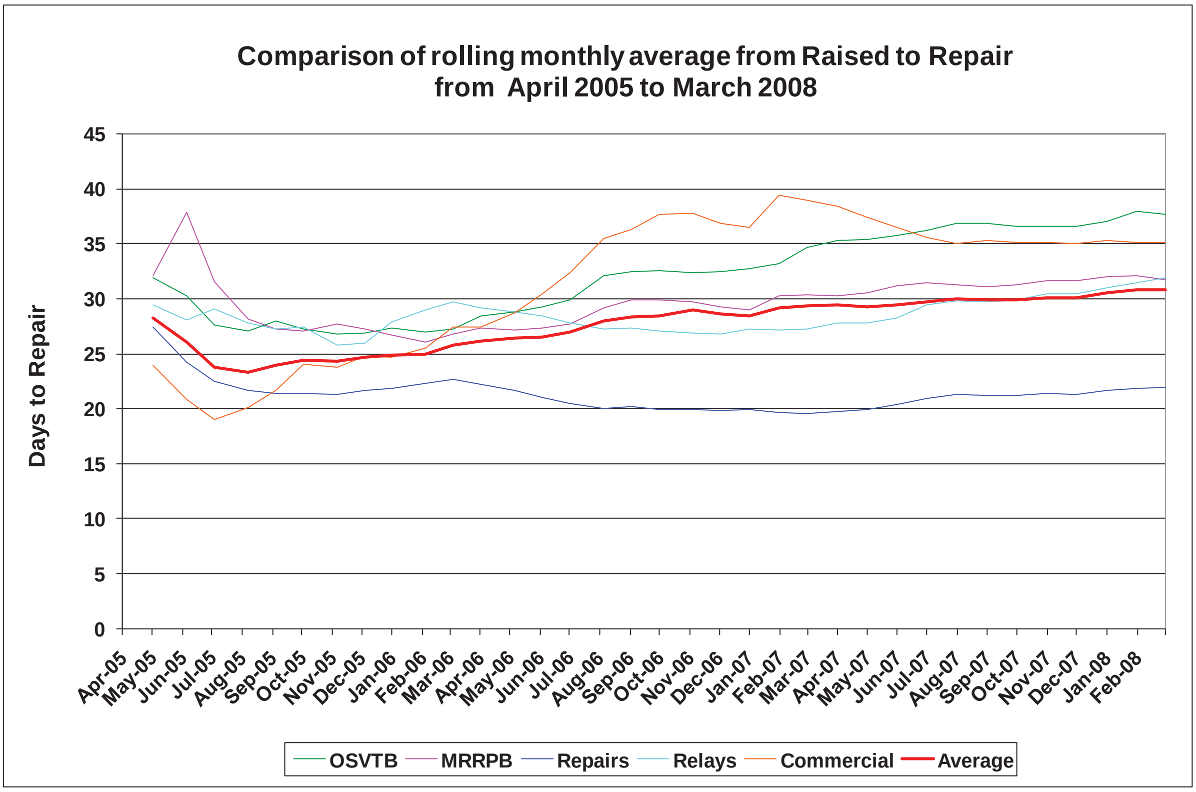

Figure 5.13: Comparison of Rolling Monthly Average from Raised to Repair

Outside Stop Valve to Boundary (OSVTB) sit at the upper end of the scale because they do not contribute to leakage or income but maintain the integrity of an area allowing a better understanding and targeting of leaks for the detection teams. The trend which saw the average age initially drop then move upwards is in line with the lack of priority that OSVTBs were set by Velocity Management, and their redefined role as filler jobs for repair crews to be fitted around other leakage work. As these were not measured by OFWAT as part of their June return, this was in line with the policy to do as little capital work as possible whilst focusing on maximising the commercial returns and leakage generation. During October 2005 and March 2006 when the highest amount of OSVTB repairs were carried out, this was the lowest period of the average for Outside Stop Valve to Boundary (OSVTB) during the three years of data collection. As OSVTBs contribute to the integrity of the water network, this shows that CSL were not focusing their efforts on the correct mix of repairs to maximise their leakage and income returns, but were choosing the easiest options to plan.

Meter Rear Replacement to Property Box (MRRPBs) varied from a high at the start of 2005 to a steady state for the rest of 2005/6, which was not in line with the amount of repairs that were carried out during this period. There were very few repairs carried out in the first four months of 2005 (which links into the high average age) and they became more relevant to CSL when OFWAT decided that they contributed to leakage savings (ofwat, 2006), which was to change the way MRRPBS were managed. Even though repairing Meter Rear Replacement to Property Box (MRRPBs) was the easiest way to carry out leakage repairs as there was no contact with the customer, the rolling average from raised to repair shows a steady increase from April 2006 onwards for the rest of the period, which in turn shows pressure on the planner and repair teams to successfully plan and carry out the repairs.

Relays varied between 26 days to 32 days over the three year period; during 2007/8 the average moved from a high of 30 days down to 27 days in March 2007, which was when 4372 relays were carried out. This is compared to 191 relays in 2005/6 and 1687 relays in

2007/8. During 2007/8, the average age of relays continued to climb from 27 days to 32 days (an increase of 5 days) even though 2,685 less relays were carried out. This supports the theory that Velocity Management was effective when used to plan relays as it reduced the average age during the period when the most relays were completed. The increase during 2007/8 with the reduction in numbers does suggest that with Velocity Management not being supported during this period, the planning staff were not focusing on the relays which are the hardest of all the repairs to plan due to the number of customers involved in the process. This lack of focus would result in a build up of a backlog, an increase in customer complaints, and more pressure on CSL to resolve during the 2008/9 reporting period.

The rolling average of commercial repairs in 2005 was initially low which linked to the low number of commercial repairs that were being carried out over the same period. The increase of commercial repairs from September 2005 started to have an effect on the rolling average of raised to repair. There was a direct link between the increase of repairs in 2006/7 and the increase in the average age, with the challenge faced by the commercial team was that commercial repairs were not subsidised by the Company and the customer would often shop around other repair agencies before they settled on an organisation to carry out the repair. An example of a commercial repair was Brent Cross Shopping Complex when the repair was carried out between 10pm and 5am over a four day period, to ensure that none of the shops or customers were affected by the mains replacement programme. There was a reduction from April 2007 for the next 12 months which linked to the drop of commercial repairs carried out over this period; due in part to the CSL commercial manager resigning and no successor being provided to replace them because of another restructure. The rolling average dropped from March 2007 onwards into 2007/8, but this is because of the drop off in the number of commercial repairs being carried out for the whole of 2007/8; and by November 2007 there were less than 100 commercial repairs being carried out each month. Even with this low number it still took time for the rolling average to drop and then it levelled out to around 30 days. This is due to the drop in repairs that were being carried out, but also shows the complex nature of resolving a commercial repair to the satisfaction of the customer.

In summary the detection to repair average over the three years of collected data from April 2005 to March 2008 was between 89 days and 100 days; with the largest movement between March 2006 and September 2006 when it moved from 89 to 98 days which is during the time that Velocity Management was being utilised by CSL. When taking into account the number and type of repairs carried out over the three year period, during 2006/7 when Velocity Management was used by CSL, non-leakage repairs reduced by 12% (when compared to the 2205/6 baseline).

It was during this period that all outstanding leakage and income generating repairs over 180 days old were resolved and an additional 5,803 income and leakage generating repairs were carried out as illustrated by Table 5.03, which placed a lot of pressure on the average age

	Number of leakage repairs	Number variance from 2005/6	Percentage variance from 2005/6
2005/6	9,598	0	0%
2006/7	15,401	5,803	60%
2007/8	13,010	3,412	36%

Table 5.03: Increase of leakage repairs compared to the 2005/6 benchmark

The greatest effect was on the detection to raised, where there was a reduction in some of the leakage types with the raised to repair process increasing as the planners were struggling to manage the current work with less personnel. They were focusing on clearing backlogs to catch up with the outstanding repairs that were already within the pipeline, whilst reducing the amount of non-leakage repairs being carried out and increasing both the number and income streams for CSL. The average age continued to climb during 2007/8 when less leakage repairs were carried out, and there was no backlog of repairs over 180 days old in the first part of the period. These factors do support the theory that Velocity Management can be introduced to the repair chain of a utilities monopoly in order to produce a cost effective and efficient organisation; and show that if Velocity Management (like other process improvement techniques) is not continually supported, then its full benefits will be negated as personnel start to look at the path of least resistance if the changes introduced are not given enough time to be embedded within the organisation and its process and procedures.

5.7 Breakdown of Repair Types

This section looks at the comparison between the monthly number of repairs carried out for each leakage and income generating repair, and the average age over the three years; as this can give a more detailed picture of the challenges that were faced by CSL in specific areas, and give more insight as to what is affecting the average age.

Figure 5.14 shows OSVTBs carried out and the rolling average, with the majority of jobs carried out during 2005/6 before Velocity Management was introduced to CSL. After its introduction in 2006/7, Outside Stop Valve to Boundary (OSVTBs) reduced dramatically, with an increase during the third year but not to the same levels as the first year 2005/6 benchmark. Because of the movement of personnel, Velocity Management was no longer supported by management and the controls that had previously been in place were relaxed. The reason OSVTBs decreased was that they were identified as being used above leakage repairs by planners because they were easy, and at times repair teams were given OSVTBs to repair which had no leakage value for CSL. By restricting OSVTBs to being used to link repair jobs or when gangs had completed their repairs quickly and needed additional work for the rest of the day, the focus was switched away from non leakage to leakage repairs. This reduction of numbers even though they were building up in the backlog, contributed to the decrease in the detected to repair average during the three years which continued to fall in 2007/8 even though the backlog was rising. Unlike other types of repairs OFWAT was not concerned that Outside Stop Valve to Boundary (OSVTBs) were in the backlog in great number as they only contributed to the improved integrity of the network, whereas leakage repairs contributed to CSL meeting their leakage targets.

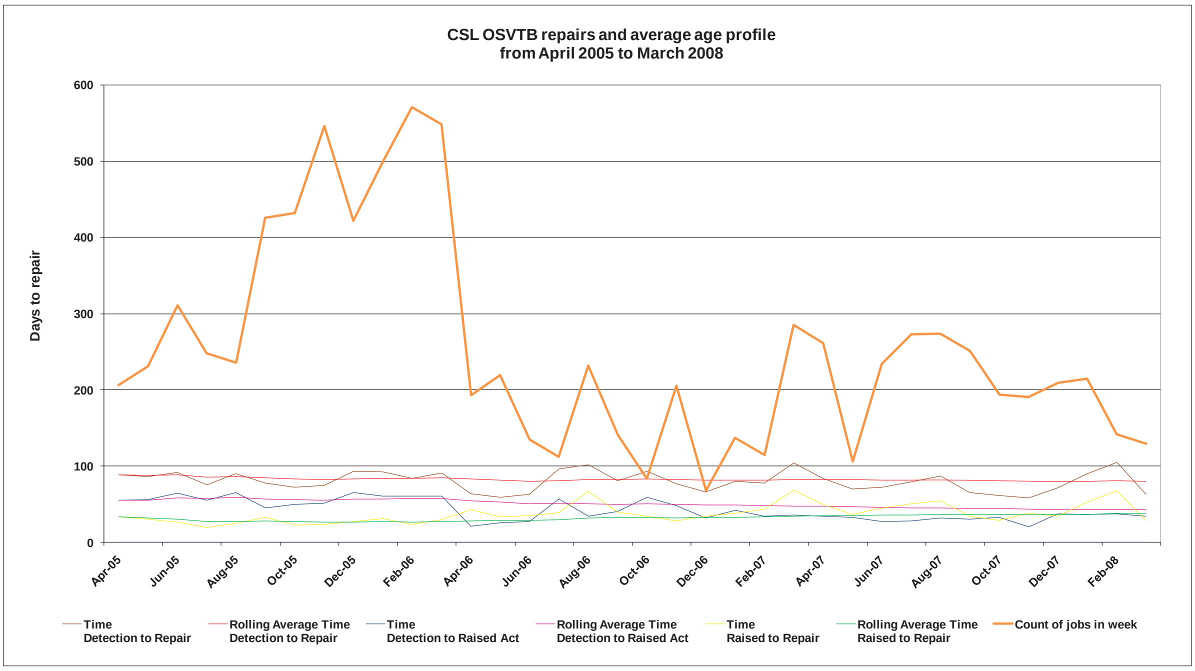

Figure 5.14: CSL OSVTB repairs and average age profile

Meter Rear Replacement to Property Box (MRRPBs) decreased dramatically during the end of 2006/7 with dips in repairs numbers due to the Christmas and summer holidays where there was a reduction in manning, with the majority of jobs being carried out during 2006/7 as illustrated in Figure 5.15.

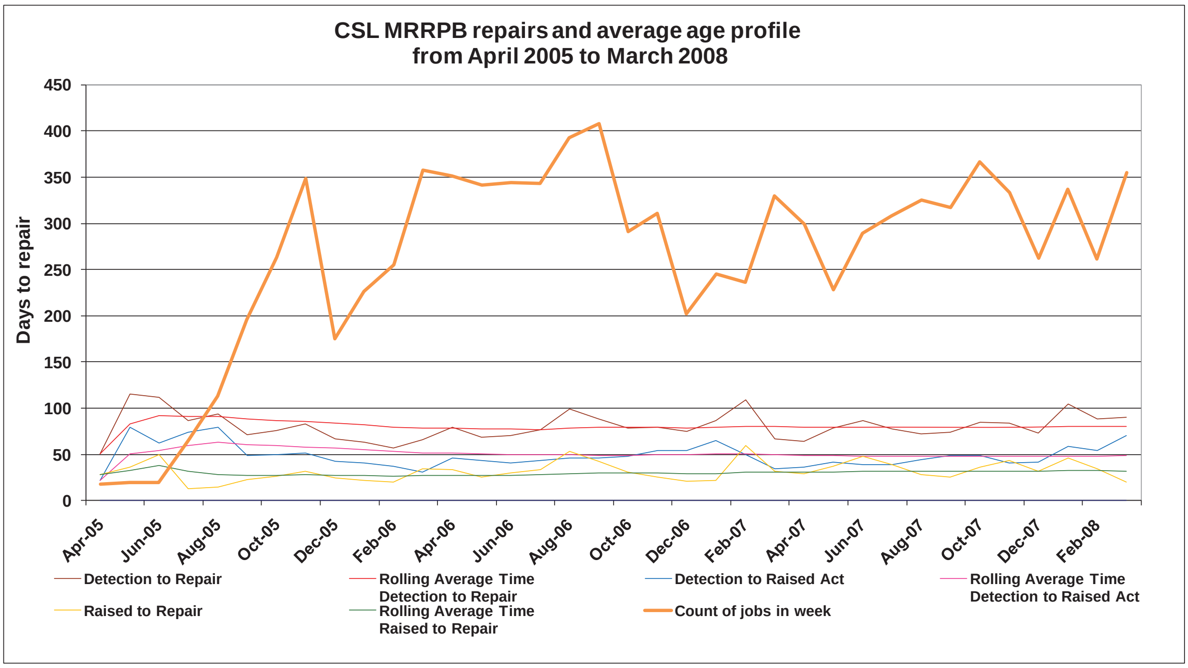

Figure 5.15: CSL MRRPB repairs and average age profile

Although the average increased at the start of 2005/6, this was due to having carried out few repairs previously, and detection to repairs decreased going into 2006/7 and kept steady for the remaining time. The increase of raised to repair was cancelled out by the improvement in the detection to raised process, which showed that Velocity Management enabled an increase in the amount of MRRPBs carried out, with the average age of the processed being kept stable, and the backlog of repairs over 180 days being resolved near the end of 2006/7. Although the average age kept steady in 2007/8, there was a drop in the number of repairs carried out, which if Velocity Management had still being used, should have led to a drop in the average age of the detection to repair process. In September and October 2006, there was an increase in the amount of repairs completed and a corresponding increase in both the detection to raised and raised to repair as they spike above the average to manage the increased repairs during this period; and are brought back under control when the number of repairs drop. This occurs again in March 2007. These spikes are linked to the increase in repairs, but later in 2007 the spikes in the monthly data are not as pronounced because fewer repairs were being carried out over the network during 2007/8. Meter Rear Replacement to Property Box (MRRPBs) played an important part in assisting CSL in meeting their leakage targets, and this was in part due to the processes and procedures in place from Velocity Management to support this increase of work.

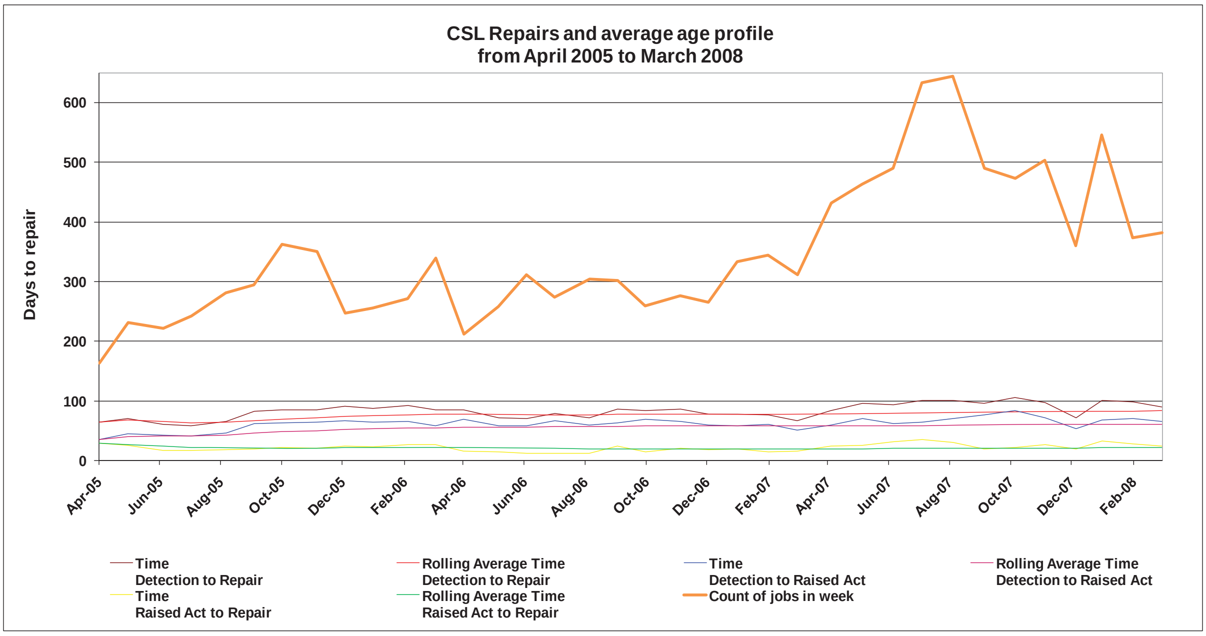

Figure 5.16 CSL repairs and average age profile

Figure 5.16 illustrates that the planning and repair time taken (both monthly average and the rolling average) was quite static over the three year period, with the rolling average only increasing by 3 days from 21.63 to 24.45 days from when the leak is proven until it is repaired for household repairs. Taken in isolation, this showed all parties are comfortable in this part of the process, and had managed the increased workload. In 2005/6, four months were below the rolling average, contributing to holding down the rolling average, even though there was an increase in the amount of repairs being carried out in the later part of the period. For the period 2006/7, there were eight instances where the monthly average was below the rolling average, showing improvement to the average age and contributing to holding down the monthly average.

In 2007/8 when only one monthly average is below the rolling average, the rolling average continues to increase with additional resources required to lower the rolling average in subsequent periods; but this was taken from the time when there was a large increase in the amount of repairs being conducted. Although there was an increase in repairs from March 2007 onward, there was no spike in the average ages of repairs because the decrease in the total amount of repairs being carried out during 2007/8 was not pushing resources as much as it did during 2006/7. What should be noted was that when compared to other types of repairs that have seen a dramatic increase in their numbers, repairs had an increase in the detection and repair during 2007/8; which other repairs types had mitigated. But the increase was during a time when Velocity Management was not being fully used throughout CSL, whereas the increase in number for other repair types occurred in 2006/7 when Velocity Management was supported and used across CSL.

The amount of relays carried out increased significantly 2006/7 as illustrated by Figure 5.17, which contributed to the average age profiles increasing. The increase of relays impacted on the average age which was negated by the introduction of Velocity Management, which in turn contributed to the average age of relays not increasing too substantially. The area that increased was the detection to raised process: once relays were processed and agreement was reached between all parties, the planning of repairs occurred at a consistent level over the three years.

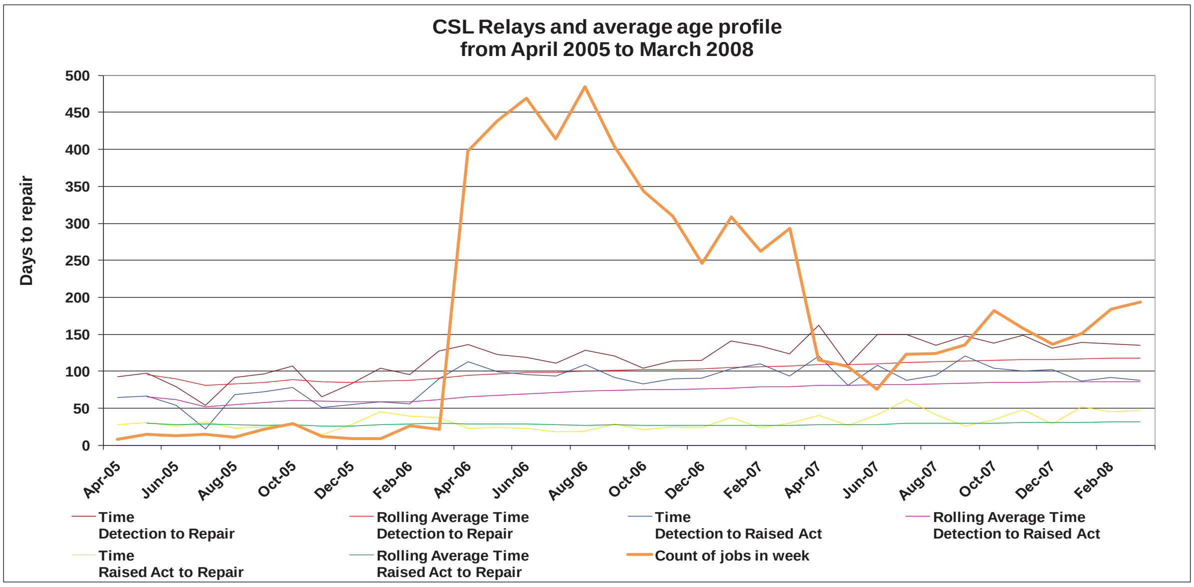

Figure 5.17 CSL Relays and average age profile

An area of concern during 2007/8 was the reduction in the amount of relays being carried out, but the average age continued to increase at a steady rate. With all outstanding repairs over 180 days being resolved during 2006/7, this highlighted that there was a lack of focus on resolving the challenge of relays which could have had an effect on 2008/9 average ages. During 2006/7 the detection to raised was above or in line with the rolling average from March 2006 to the end of the period, which showed the effect that the pressure to resolve relays was having on the coordinators. Yet this pressure should have reduced with the decrease in relays during 2007/8 but it did not, showing that the focus on this part of the repair process was lacking during 2007/8. During 2006/7 the monthly raised to repairs was consistently below the average age which was during the time when relays increased; but in 2007/8 when they reduced, the monthly raised to repair was above the average age for the majority of the 12 months, showing that the planners were less effective in planning relays from 2006/7 to 2007/8 even though there were less relays to plan.

Commercial repairs carried out over the three years of data were quite varied in number compared to other repair types which was linked into how they were found. Often a commercial customer like a council who had a number of housing estates agreed to all their repairs being carried out simultaneously resulting in large monthly variations in repairs as illustrated in Figure 5.18.

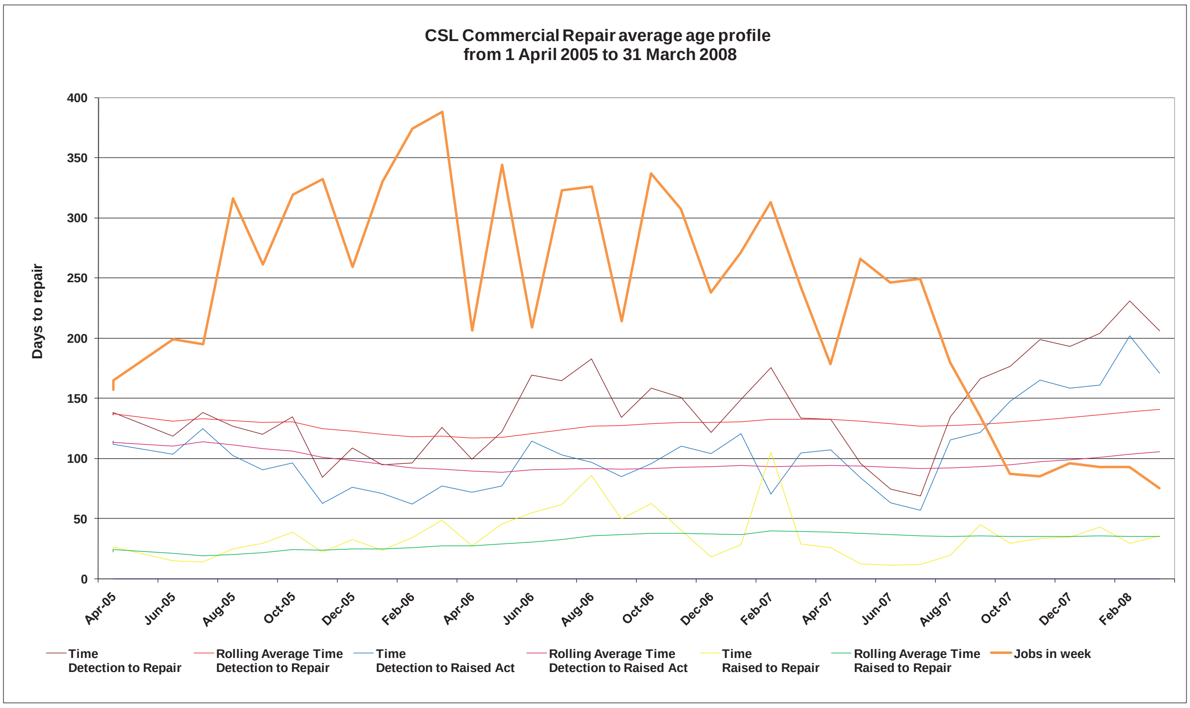

Figure 5.18 CSL commercial repairs average age profile

The amount of commercial repairs carried out during 2005/6 and 2006/7 were similar, with commercial repairs falling during 2007/8 when they dropped from an average of 262 repairs over the preceding 24 months, to an average of 88 repairs carried out in the last six months.

The age of repair increased during 2006/7 when Velocity Management was being used by CSL as part of the drive to clear outstanding commercial repairs, with this decreasing and being below the average for the majority of 2007/8. The monthly detection to repair was above the average for most of 2006/7 which contributed to the average increasing during this period; with it then being below the average at the start of 2007/8 as the outstanding commercial repairs were carried out. From July 2007, the monthly detect to raised rose substantially until the end of the reporting period; when at the same time the number of commercial repairs dropped substantially, and the monthly raised to repair rose during the same time. This was due to the commercial manager leaving the business, the delay in replacing them, and the lack of focus that was being placed on this area. Velocity Management, which was being used effectively during 2006/7 was no longer being given management support and staff were not supporting the processes and procedures which resulted in going back to silo working. The result was that although the number of repairs fell, the average age rose, which supports the theory that Velocity Management can be effectively introduced into a repair chain of a utilities monopoly.

In summary, the repairs that contributed to either leakage savings or income for CSL benefited from Velocity Management during 2006/7. It enabled CSL to carry out more leakage and income generating work whilst identifying and resolving all the leakage and income generating jobs over 180 days in the backlog by the end of the reporting period; which either reduced the average age of the backlog or controlled it so that it did not spiral out of control when the increased work came through the repair chain. When compared to 2005/6, Velocity Management highlighted that there were few procedures in place to control the flow of work, and the average age for repairs were about the same as 2006/7 even though a lot more repairs were carried out and CSL has three less personnel during 2006/7.

The comparison with 2007/8 shows that some residual effects from Velocity Management were still being felt, but it highlighted the requirement to embed any process improvement tool within an organisation so that it is owned by the team. The loss of the business unit manager and the commercial manager, removed the management focus from Velocity Management and it had not been embedded long enough to continue into 2007/8 and realise its full benefits. This was highlighted by some of the averages increasing when jobs were decreasing as staff reverted back to the path of least resistance as they were not being managed to continue to drive CSL's improved performance. It is predicted that this average age increase would continue into 2008/9, with a decrease of leakage and income generating jobs back to 2005/6 figures and an increase of leakage and income generating repairs over 180 days in the backlog which would lead to an increase in customer complaints. This could have been recovered if CSL was to introduce another performance tool into CSL, as occurred during 2006/7.

5.8 Personnel

Personnel are key to the success or failure of a new process and procedures being introduced, maintained and embedded into an organisation in the long term. The challenge for introducing Velocity Management into CSL was convincing staff that Velocity Management would be of benefit and enable them to carry out their roles with less obstacles, resulting in an improved understanding of the process and less frustrations in carrying out their day to day work. Although the introduction of Velocity Management had the support of senior management, limited resources were provided for the training of staff in the new process and procedures to be used across the organisation. This was overcome by the personnel carrying out the improvements, but it resulted in no formal training being established to account for staff turnover both in the management of CSL and when new personnel arrived.

This proved to be the 'Achilles heel' for CSL from 2007/8 onwards when the two senior personnel within CSL left and no replacement was identified for either position. The responsibilities for CSL were split between three jobs which did not continue the focus that had been on it in the past. The staff were placed into other areas of the business and the relationships and knowledge that had been built up during 2006/7 (when the focus was on breaking down business silos to allow a free flow of information and a holistic look at the repair chain) started to fail.

As part of introducing Velocity Management into CSL, a link was created with the KPIs that were being reported to focus all staff on leakage repairs, average age, backlog and income generation. These performance measures were included into staff's job descriptions so that if they delivered they would be rewarded at the end of the financial year in bonuses; and if they did not perform, then they could be supported to identify the areas that needed to be improved. This goal setting for staff drove the correct behaviour across CSL (not just in business units), and the performance requirements being inserted into staff job descriptions was matched by an increase of personnel management time so that staff did not feel that they were being left in isolation. Workshops and team meetings were held regularly and staff were kept up to date with the situation on changes. All CSL personnel were met with at least monthly and this was a combination of management and training as they became used to using the new processes and procedures. The end result was that all staff knew their roles, the reasons for the changes being introduced within CSL, how they affected the performance of the team, and the training needed for them to perform.

All CSL key processes were mapped and these process maps were used as the benchmark for performance, with regular meetings held as to how they could be improved from across the repair process. When the responsibility for CSL was split into the three leakage areas, these process maps were passed to the leakage managers to continue to drive the performance of CSL; but due to their other responsibilities, the time was not given to this resulting in them not being used and staff not being responsible for their performance. This lack of management care, and lack of support from senior management to continue to keep Velocity Management in place or to roll it out over the rest of the Company repair chain resulted in personnel beginning to take the path of least resistance to deliver repairs and ignore some of the key indicators that were being used to drive performance. This is reflected by the reduction in commercial repairs and the increase of OSVTBs carried out in 2007/8.

The introduction of Velocity Management occurred during the period when CSL reduced from 25 staff to 22 staff, which happened in September 2006; but the uncertainty had begun from April 2006 with all three staff being on gardening leave from July 2006. As a team, CSL managed to increase the amount of leakage by 46 MLD and generate an additional £900,000 during this period having bought into Velocity Management and the change that had to be gone through to effectively use it. This shows the effect that Velocity Management can have to a process, but also the buy in by the staff to make the new processes work even though there was a lot of uncertainty about their jobs in the current structure. CSL personnel during 2006/7 showed that Velocity Management can be introduced to the repair chain of a utilities monopoly in order to produce a cost effective and efficient organisation. When compared to the measured objective of with a 10% reduction of staff, all the objectives were met with a reduction of staff of 12%.

In summary to sustain the Velocity Management and the savings realised in the long term, there needs to be long term senior management support, formalised training to retain knowledge, a process champion, communication, clear KPIs linked into staff performance, embedded processes that are owned by all parties, and a reward mechanism for the staff who are making these improvements happen. If these do not occur, then any performance improvement technique will not be able to deliver to its full potential. In the case of CSL, all of these things did not occur post 2006/7 resulting in Velocity Management not being as effective in 2007/8 as staff reverted back to the path of least resistance and the business barriers that had been broken down by continuous communication started to fail. It was possible to sustain Velocity Management in the long term within a utility company, it just did not occur in this situation.

Chapter 6 Conclusions

6.1 Introduction

In conclusion, the hypothesis of can the principles of Velocity Management be introduced to the repair chain of a utilities monopoly was proven as shown by the three years of data. The Company was able to increase its performance in the five key areas that were identified as linked to the success of Velocity Management in the utilities repair chain. All the objectives set in the introduction were met which supports the thesis that velocity management can be introduced into the repair chain of a utilities monopoly.

6.2 Objectives

The objectives set in the introduction stated that of the six objectives that link into the thesis being proven, at least 4 or more would have to beat there indicators for the thesis question to be proven correct. The measure of MLD must be proven correct as this is the key that is measured by OFWAT. As is shown below, all of the objectives were meet.

- **Increase in Repairs:** The objective set in the introduction was an increase in the number of repairs being carried out by the CSL Team. Specifically an increase of those repairs that contribute to leakage and income generation. To support the thesis as being correct, leakage generating repairs would have to be improved by 20%, and total repairs by 15%.
    - What was found was that there was a 26% increase in the reporting period that Velocity Management was used against the 2005/6 baseline which dropped to 21% during 2007/8 which is a significant increase the year after Velocity Management was used, which supports the thesis.
- **Mega Litre per Day (MLD) saved:** The objective set in the introduction was that this saving is reported by the Company to OFWAT yearly and this is the key indicator

that is used by OFWAT to place the utilities into a performance table. To support the thesis, there would have to be an increase of MLD of 20% against the baseline, which was 19 MLD.

  - What was found during the period when Velocity Management was utilised, there was an increase of 46 MLD during 2006/7 and 17 MLD during 2007/8 compared to the 2005/6 baseline, the year before Velocity Management was introduced. This increase in MLD savings was the key driver and contributed towards the company achieving their leakage targets for the first time in 7 years and avoided OFWAT penalties.

- **Income:** The objective set in the introduction is that the Company would want to at least keep with parity to the benchmark of 2005/6 during the year that Velocity Management was introduced 2006/7. If the income generation could be increased, then this would be seen as a success as income generation is only second behind leakage repairs in the Company drivers for CSL. To support this thesis, there would have to be at least the same income generated or an increase. The target for income generation was set at 15%.
  - What was found is that there was an increase by circa £1M during 2006/7, the year that Velocity Management was introduced into CSL when compared to the 2005/6 benchmark. Income dropped during 2007/8 due to the reduction of relays, commercial and S75 repairs being carried out, but this was the secondary focus and this was reflected during 2007/8 when there was more focus on repairs than other types of leakage and income generating repairs being carried out. This supports the thesis question.

- **The age of the backlog:** The objective set in the introduction was that the management of those repairs over 365 days old had to be addressed, as this is an indicator that is assessed in the United Kingdom by the Economic Regulation for the Water and Sewerage Industry in England and Wales (OFWAT) during the yearly reports that are provided by the Company to the regulator. Linked to the backlog age is customer complaints - with the longer time taken to carry out the repairs, there is an increase in the amount of customer complaints received by the CSL Team. To support the thesis, the backlog of repairs of 365 days would have to reduce by over 50% during the period when Velocity Management is being used.

  - What was found during the period 49% of the backlogs over 365 days were resolved during the year that Velocity Management was utilised. All leakage and income generating repairs over 180 days were cleared during 2006/7 when Velocity management was being used. This was linked into the reduction of customer complaints, as repairs were being carried out in a timely manner. The backlog effect the average age of repairs. This clearing of the backlog over 180 days supports the thesis.

- **The average age of all reportable repairs:** The objective set in the introduction was that there must be considered in conjunction with the average age of the backlogs, personnel manning with the CSL Team, and the amount of repairs being carried out in the period; as the less repairs that are carried out, the lowering of the average age as the repair turnaround time should be less. To support the thesis, the average age would have to be linked in to the amount of repairs carried out and be within 15% variation of the baseline once additional repairs were known.
  - During the period of three year, the average age rose from an average of 91.41 days to repair prior to Velocity Management to 95.71 days to repair with the introduction of Velocity Management. This 5% increase in days to repair should be considered against the 49% increase of repairs; all leakage repairs over 180 days being resolved and an additional 500 repairs monthly, resulting in an additional £1M income generated. This proves the theory that Velocity Management can be introduced to a repair chain of a utilities monopoly as these targets were met.
- **Personnel:** The objectives set in the introduction was that the personnel can manage the increase in work that is projected to occur and manage the possible reduction of

numbers as part of the restructure. To support the thesis, the personnel would be able to manage an increase of repairs of 20% within the same or up to 10% reduction of staff.

- During the period when velocity management was introduced, there was an increase of 26% in repairs with a 12% personnel reduction. This supports the thesis. The drop during 2007/8, the year after Velocity Management had been introduced was as a result of the individuals who were championing Velocity Management left before it had time to become embedded within the CSL team. This showed that new process need time to be embedded within an organisation and be supported by senior management for the gains made to be maintained in the long term.

6.3 Increase in Repairs

During the period when Velocity Management was introduced in 2006/7, repairs increased from 14,351 to 19,474 which were maintained at 18,175 in 2007/8, when Velocity Management practises began to fall away. Leakage and income generating repairs as a percentage of total repairs were 67% in 2005/6 (broken down into 30% income generating and 37% leakage); this increased to 79% during 2006/7 when Velocity Management was introduced (which was broken down into 42% income generating and 37% leakage repairs); and fell to 71% in 2007/8 (but the split was away from income generating repairs at 19% and was high in leakage repairs 52%, which was out of balance when compared to 2006/7). This split showed that not only was there an increase in the number of repairs being carried out, but a reduction in those repairs that did not contribute to either income generation or leakage savings. This supports the hypothesis that Velocity Management can be introduced in to a utility monopoly.

In detail, repairs are broken down into leakage, income generating and non-leakage. Leakage generating repairs increased from 3,261 to 3,453 between 2005/6 and 2006/7 and to 5,790 in 2007/8, showing Velocity Management had delivered significant gains that were being maintained. The same trends were being shown for relays which increased from 191 to 4,372 and were 1,687 in 20007/8, again showing a significant rise in the number of relays delivered, during the period when Velocity Management was being full utilised. MRRPBs increased from 2,056 to 3,795 between 2005/6 and 2006/7 and were 3,681 in 2007/8 again showing the increase in repairs that were able to be carried out with the introduction of Velocity Management.

These gains were partially offset by commercial which did increase slightly from 3,295 to 3,331 between 2005/6 and 2006/7, but dropped significantly in the last year of data to 1,783 showing that Velocity Management did not always deliver success in every area across the organisation. This was to be expected and highlights areas that can be improved upon. On investigation, the drop in performance was more due to the movement of key personnel and the lack of time allowed for Velocity Management to be embedded within the organisation meant that the full improvements realised during 2006/7 could not be maintained in 2007/8.

Non leakage repairs do not deliver income or contribute to leakage savings although OSVTBs assist with network integrity. The percentage reduction of these repairs shows that Velocity Management was reducing repair process wastage and ensuring that the resources were being focused towards delivering leakage and income generating savings. Although S75 does contribute to income and leakage, the reduction of these shows that the services being provided by the CSL Team had improved and there are less S75 enforcements being carried out by CSL. S75 uses a lot of resources to enforce so it is preferable to carry out the repairs without having the resort to the Section 75 process.

In the first year of Velocity Management's introduction, non leakage repairs reduced by 15% within the CSL repair chain but this was not maintained in the second year when there was an 8% rise compared to the 2005/6 benchmark, before Velocity Management was introduced. If S75 are added, there is a 19% reduction with the introduction of Velocity Management during 2006/7 compared to 2005/6, and a 6% reduction in 2007/8. In detail, miscellaneous repairs had increased significantly in the year that Velocity Management was introduced indicating that the contractors were focusing on charging CSL for all jobs to try and recover their costs. The number of OSTVBs decreased as the planners were not focused on using these as filler jobs that were planned for repair gangs that were standing with no planned work that could be carried out, but as a last resort to keep gangs occupied. In effect the planning process had become more efficient and targeted. This was as a result of the refocusing that Velocity Management brought on all parts of the repair chain with the emphasis on repairing leakage and income generating repairs to the detriment of other types of repairs. These reductions were not sustained during 2006/7 due to Velocity Management not being supported at the senior level to ensure it had become fully embedded within CSL. This was coupled with the movement of personnel within CSL and the lack of ownership by their replacements.

6.4 Megalitres Per Day Saved

In terms of MLD saved, there was an increase from 96 MLD to 142 MLD between 2005/6 and 2006/7 which dropped to 113 MLD in the last year of records which shows that Velocity Management did lose some of its effectiveness, primarily due to having lost the champions within the CSL team during the 2007/8 period.

Of all the measures, the MLD saving is the most significant as this is the key area that the Company are judged on by OFWAT; for CSL to be able to increase these savings contributed to the success of the Company and enabled them to meet their leakage targets for the first time in 7 years. The rise of MLD savings in the first year when Velocity Management was introduced showed what was possible from a performance improvement technique. The biggest challenge for any performance improvement process is to ensure that they are supported long enough for them to become embedded within the organisation which would allow a continued level of delivery in both repairs, MLD, income, backlogs and efficiencies now and into the future. This did not occur in the long term, and this was shown by the number of the key markers in 2007/8 though not below the 2005/6 benchmark.

6.5 Income

Income increased by £1M the year that Velocity Management was introduced into CSL which was a 24% increase, proving that the hypothesis of can the principles of Velocity Management be introduced to the repair chain of a utilities monopoly is correct. In the third year of data income decreased by £1.95M or 48%, but this was primarily due to the loss in commercial income (the major contributor of income for CSL). Although these dramatic movements of income affected the CSL business unit in terms of income predictions, they did not have a significant effect. This is because they were focused on leakage in terms of repairs and MLD savings and these numbers were higher in the years after Velocity Management was introduced than before it was introduced. What the variations do highlight is that new processes and procedures need to be sustained so that they are embedded in the organisation in the long term. The movement of the CSL manager and their second in command (who was the CSL commercial manager) within a matter of months and the long delay to replace them resulted in Velocity Management having no champion within CSL and its effect started to fade.

6.6 The age of the Backlog

For the principles of Velocity Management to be introduced to the repair chain of a utilities monopoly to be proven for backlogs, the amount of backlogs over 365 days needed to be resolved; which in term would reduce the number of customer complaints received, and the time to carry out the repair. To reduce the average time, the backlogs need to be resolved. Backlogs are linked to the number of repairs carried out by CSL in the month and as such this must be taken into account when assessing them. The average number of monthly repairs carried out by CSL increased by 39% or 500 repairs monthly in the year that Velocity Management was introduced, which coupled with the reduction of three staff (or 11% of personnel from the CSL Team) shows a significant improvement in this area. Of the 1,617 customer repairs that were over 365 days old during the three years of data, 49% or 794 repairs were carried out in the year that Velocity Management was introduced which was when the largest amount of repairs were carried out by CSL during the three year period. This compared to only 14% or 228 repairs being carried out in the first year of data and 37% or 595 repairs that were carried out during the third year of data. What Velocity Management did was to focus on these issues and to resolve them as part of the continuous improvement cycle; and proves that the principles of Velocity Management can be introduced to the repair chain of a utilities monopoly.

6.7 The average age of all reportable repairs

The average age of repair indicates the age and amount of repairs carried out during the three years and is an indicator as to where the pressure is on the CSL repair chain. Factors that affect the average age are: the age of the backlog, amount of repairs that are carried out and staff manning; the lower the amount of repairs the lower the average age should be. For the hypothesis of can the principles of Velocity Management be introduced to the repair chain of a utilities monopoly to be proven correct, then these factors need to be managed and the data show this.

The average age over the three years of data began at 94 days and dropped to the low of 90 days before slowly rising to 97 days when it held steady for most of the remaining time before topping out at 100 days in the last few months. Most of the movement of the average age was during the period when Velocity Management was introduced into the repair chain. Yet the year when Velocity Management was introduced resolved 49% of those repairs over 365 days that were resolved during the three years placing a lot of pressure on the average age; combined with an extra 500 repairs being carried out a month than in the year previously (which is an additional 25 repairs being carried out daily); plus CSL has reduced their staffing number by 11% or three staff. Velocity Management had in effect managed to resolve a number of outstanding issues for CSL whilst holding down the average age of repairs. For the last 12 months of data there was a reduction in the amount of repairs being carried out from the highs when velocity management was being used, with only an extra 391 a month when compared to the benchmark. During this period, 37% of the total repairs that were over 365 days old that were resolved.

6.8 Personnel

The key to success in any business improvement and transformation project is staff. The staff proved the hypothesis of can the principles of Velocity Management be introduced to the repair chain of a utilities monopoly as correct. The CSL Team were put at risk at the start of the 2006/7 reporting year which coincided with the time when Velocity Management was introduced to CSL. Even though they were all at risk, they increased the amount of repairs carried out by CSL which in turn increased the MLD savings for CSL and generated additional revenue. All of this was carried out with the loss of three of the planning staff and the uncertainty of their roles.

The CSL personnel were engaged in the introduction of Velocity Management, but were not supported by senior management to allow the processes, procedures and lessons learnt to be fully embedded within CSL and spread to other parts of the organisation. The time it takes to get staff on board to support new techniques and practises cannot be undervalued and the lack of support and championing of Velocity Management led to its gradual decline in performance in the year after it was introduced. The end result will be that the next time a concept is introduced into CSL, staff will be resistant to change as they will have strong memories of the lack of support that they were given the last time they supported a business improvement initiative. Without the staff buy-in the hypothesis of can the principles of Velocity Management be introduced to the repair chain of a utilities monopoly could have quite possibly be proven wrong.

6.9 Limitations

There are limitations to all research. For this, the limitations were that the base data covered only three years of the company's performance. A longer period of time would show the ability to sustain a performance improvement technique resulting in it being incorporated fully into the organisation. The research is limited to only one utility company, if there was a wider spread, this would take into consideration regional variations which may or may not be a factor in this research. The research only covered CSL not mains repairs, so it was a small sample within the company and other supporting data such as customer service performance as a result of velocity management were not available during this research. These are areas that could be further developed for further research.

6.10 Future research

Although Velocity Management did not solve all of the problems encountered by CSL, it affected the key indicators to bring the areas previously out of control into a manageable level. Examples of this include backlogs over 365 days old; and addressing the key areas that were focused on which were the increase in repairs carried out with a leaner team, increased revenue in the year that Velocity Management was introduced and supported, and increased levels of MLD saved. The challenge now is to be able to introduce these measures into a utility monopoly which can be sustained over the long term.

Future research would be beneficial to assess which of the tools and techniques that were used can be embedded across other organisations, and how long there life is before additional training is required to sustain the performance over the long term. None of this research assessed the value for money for the organisation, which would be beneficial when deciding the priorities for the business in both actual cost and cost avoidance. Three years is a short time to determine success over the long term and having access to data over a five to ten year period would allow a much better understanding of the improvement of an organisation as it develops both tactically and strategically.

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Appendix A to
Mike Shannon's Thesis
Dated August 2013

CSL Summary Data 1 April 2005 to 31 March 2008

		2005								
		02 April 2005	01 May 2005	05 June 2005	03 July 2005	07 August 2005	04 September 2005	02 October 2005	06 November 2005	04 December 2005
	Year & Week Number	2005-14	2005-18	2005-23	2005-27	2005-32	2005-36	2005-40	2005-45	2005-49
	Count of jobs in week	552	661	764	766	957	1200	1405	1589	1112
Average	Time Detection to Repair	94.01	94.91	89.82	86.65	95.39	87.53	91.01	80.74	92.01
Average	Rolling Average of time to repair	94.01	94.46	92.91	91.35	92.16	91.38	91.33	90.01	90.23
Average	Time Detection to Raised Act	65.36	67.10	68.20	69.56	73.85	60.45	64.16	56.46	64.55
Average	Rolling Average Time Detection to Raised Act	65.36	66.23	66.89	67.55	68.81	67.42	66.95	65.64	65.52
Average	Time Raised Act to Repair	28.65	27.81	21.62	17.09	21.53	27.08	26.85	24.27	27.46
	Rolling Average Time Raised Act to Repair	28.65	28.23	26.03	23.79	23.34	23.97	24.38	24.36	24.71
Total	Time Detection to Repair	51894	62733	68625	66375	91284	105037	127871	128293	102312
Total	Time Detection to Raised Act	36077	44352	52106	53284	70676	72536	90143	89721	71776
Total	Time Raised Act to Repair	15817	18381	16519	13091	20608	32501	37728	38572	30536

		2006											
		01 January 2006	05 February 2006	05 March 2006	02 April 2006	07 May 2006	04 June 2006	02 July 2006	06 August 2006	03 September 2006	01 October 2006	05 November 2006	03 December 2006
	Year & Week Number	2006-1	2006-6	2006-10	2006-14	2006-19	2006-23	2006-27	2006-32	2006-36	2006-40	2006-45	2006-49
	Count of jobs in week	1320	1498	1655	1532	1815	1664	1634	2028	1767	1590	1602	1198
Average	Time Detection to Repair	86.94	84.10	92.64	104.73	102.57	106.19	116.29	121.49	104.87	104.97	121.48	93.65
Average	Rolling Average of time to repair	89.90	89.37	89.65	90.81	91.65	92.62	94.09	95.71	96.22	96.68	97.92	97.71
Average	Time Detection to Raised Act	60.50	57.86	57.91	74.53	72.44	77.95	83.74	77.26	70.06	75.36	80.92	73.61
Average	Rolling Average Time Detection to Raised Act	65.02	64.37	63.83	64.65	65.21	66.06	67.16	67.76	67.88	68.28	68.91	69.13
Average	Time Raised Act to Repair	26.44	26.24	34.73	30.20	30.13	28.24	32.55	44.23	34.81	29.60	40.56	20.05
	Rolling Average Time Raised Act to Repair	24.88	25.01	25.82	26.15	26.44	26.56	26.93	27.95	28.33	28.40	29.01	28.58
Total	Time Detection to Repair	114755	125982	153320	160447	186160	176695	190018	246388	185299	166896	194605	112197
Total	Time Detection to Raised Act	79857	86673	95838	114179	131474	129709	136831	156682	123797	119825	129627	88182
Total	Time Raised Act to Repair	34898	39309	57482	46268	54686	46986	53187	89706	61502	47071	64978	24015

		2007												2008		
		01 January 2007	01 February 2007	01 March 2007	01 April 2007	02 May 2007	01 June 2007	01 July 2007	01 August 2007	01 September 2007	01 October 2007	01 November 2007	01 December 2007	01 January 2008	01 February 2008	01 March 2008
	Year & Week Number	2007-1	2007-5	2007-9	2007-13	2007-18	2007-22	2007-26	2007-31	2007-35	2007-40	2007-44	2007-48	2008-1	2008-5	2008-9
	Count of jobs in week	1490	1489	1665	1389	1266	1439	1781	1846	1551	1715	1530	1311	1614	1327	1406
Average	Time Detection to Repair	102.55	113.71	97.19	94.39	96.09	89.57	93.72	104.65	99.62	103.44	104.39	106.20	122.87	124.92	108.50
Average	Rolling Average of time to repair	97.93	98.62	98.56	98.39	98.30	97.98	97.83	98.06	98.12	98.29	98.48	98.71	99.42	100.15	100.38
Average	Time Detection to Raised Act	76.40	68.24	64.17	63.88	70.11	55.63	55.83	68.25	71.17	74.52	69.24	75.11	76.10	85.04	78.60
Average	Rolling Average Time Detection to Raised Act	69.46	69.41	69.19	68.98	69.02	68.53	68.07	68.08	68.18	68.39	68.41	68.62	68.84	69.30	69.56
Average	Time Raised Act to Repair	26.15	45.47	33.02	30.51	25.99	33.94	37.89	36.40	28.45	28.92	35.14	31.09	46.77	39.88	29.90
	Rolling Average Time Raised Act to Repair	28.47	29.21	29.37	29.41	29.28	29.45	29.75	29.98	29.93	29.90	30.06	30.10	30.59	30.85	30.82
Total	Time Detection to Repair	152796	169307	161827	131111	121653	128890	166914	193184	154511	177394	159711	139222	198314	165774	152554
Total	Time Detection to Raised Act	113829	101602	106847	88726	88754	80056	99427	125985	110382	127799	105940	98465	122831	112848	110518
Total	Time Raised Act to Repair	38967	67705	54980	42385	32899	48834	67487	67199	44129	49595	53771	40757	75483	52926	42036