COMMERCIAL LOSS CONTROL AT HANOVER: Constructing a Weighted Risk Evaluation System

MAJOR QUALIFYING PROJECT
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Abstract

Insurance companies minimize their commercial losses by reducing the probability that a loss incident will occur. Steps that insurance companies take to reduce this probability include identifying potential sources of loss, measuring consequences of a loss occurrence, and using controls such as fire alarms, sprinklers, or burglary systems to minimize actual losses. Companies must maintain objectivity to standardize risk assessment and eliminate a skewed value based on consultants' opinions.

Currently, the Hanover Insurance Group is modifying their existing system which allows consultants and underwriters to use a completely objective method for evaluating risk. Based on this study, we will develop a weighted system which will be applied to the current risk assessment survey questions. This system will allow calculation of a quantitative risk score when an underwriter is evaluating the results of the surveying process. This will reduce as much subjectivity as possible and create a heightened level of standardized evaluation criteria. The system will also reduce inconsistency between the final risk score and the initial consultant assessment.

The methodology used to construct the weighted system consisted of an electronic survey sent to underwriters and consultants, along with analysis of historical loss data for Hanover. The survey was comprised of the current property evaluation questions, and asked the employees to rank the importance of each question on a numerical scale. This allowed the team to find an average numerical importance for each question. Reviewing and analyzing the loss data illustrated where Hanover experienced the highest losses in terms of frequency and quantity. Loss categories were numerically ranked by the

frequency of loss for each category. After both sets of data were analyzed, the team created the question weights using compiled survey data and loss data category rankings.

After analyzing the survey data, the team's findings indicated that Hanover employees viewed many of the survey questions to be highly and equally important. When loss data category rankings were matched to each survey question, it was discovered that the categories with higher loss frequencies did not directly correlate with the employees' opinions on the importance of questions in each category. Integration of the loss data rankings using a multiplication method proved to be the best solution for Hanover, and offered the most dynamic question weight distribution.

Upon completion of the analysis, the team made recommendations to Hanover. The first recommendation was to implement the final weight solution for the property survey. Along with this solution, the team also suggested reconstruction of select questions and survey reformatting, as well as the application of killer questions and how to carry out the proposed methodology for other lines.

Acknowledgements

Executive Summary

The Hanover Insurance Group has been dedicated to providing quality insurance to their customers since 1852. They are highly diligent in areas including customer service, loss control and underwriting, product capability, and gaining strong partnerships with individual agents. They have a strong focus on their regional and local markets and want to provide exactly what their customers need. Hanover employees and agents are focused on providing the best services to the local and regional customers.

In recent years Hanover has improved their company structure to be more financially stable and to operate on a higher level, by using new organization and teamwork techniques. They have focused on becoming a "world class" property and casualty company. This new initiative has molded the company into one who is able to serve local and regional communities and companies across the United States.

In order for Hanover to keep improving their performance, they are currently reevaluating some of their loss control practices. Loss control is defined as actions taken by an organization to reduce or mitigate the potential for future losses. In the insurance industry, loss control is vital to determining premiums for clients. Those who are less likely to incur an incident pay less, while those who have a higher risk of losses pay more. The purpose of the loss control department within an insurance carrier is to avoid providing coverage to clients who are likely to require payouts from the company. Loss control is implemented through training, past data analysis, and physical evaluation.

At The Hanover Insurance Group, loss control plays an integral role in the profitability of the organization. Losses can be avoided through prevention techniques

such as educating employees on the use of equipment that could potentially be hazardous or implementing controls that mitigate potential hazards caused by a product or service offered by a client. Property surveys that consultants currently perform emphasize the necessary controls that companies may use to prevent potential losses. Evaluations conducted by loss control consultants are forwarded to underwriters who review the reports and decide whether or not to insure a client, and for what price.

It is impossible for an insurance carrier as large as Hanover to completely avoid loss. Accidents happen daily and some incidents cannot be prevented, however, the goal of the loss control department at Hanover is to make sure that clients are doing all they can to avoid catastrophic losses due to controllable circumstances. Clients can do this by educating their employees and taking appropriate measures to ensure any potentially hazardous materials, processes, or services are adequately monitored and controlled.

Hanover Insurance experiences losses from a variety of risk categories associated with the property line. Currently, the only assessment of a client's risk potential Hanover can construct stems from comparing historical loss data to the property report that field agents complete. The process is subjective and does not provide an accurate risk outlook for Hanover to use. The quality of risk assessments as it stands now is not acceptable for Hanover managers including Chris Beckman and Mike Billings.

The ARIES system that Hanover currently uses to maintain property reports does not provide a quantitative measure of risk. The company is transitioning to a new system, AuSum, which has a scoring feature that quantifies the risk of providing coverage to clients. This feature determines an overall risk score through the use of a question weighting

system. The assigned risk score, calculated by the weighted system, can be changed to account for fluctuations in property conditions. Hanover Insurance is looking for a method to develop the question weight system, which will objectively quantify the results of their property reports. The creation of this system will incorporate both historical loss data and the field agents' evaluation of current survey questions.

The weighting system will ideally become a model for implementing an assessment to other divisions of loss control, namely workers' compensation. Property data is available and plentiful and will provide an excellent example for the methods that can be employed for other sectors of loss control at a later date.

The weighted system will also reduce subjectivity in the loss control process as well as identify areas that are particularly susceptible to bias. Comparing the loss data and the property report evaluations will highlight areas of inconsistency to Hanover managers. Potential origins of subjectivity include employee training, the property evaluation report, and the loss control process. Identifying trends in the loss data will also enable Hanover to pinpoint areas of the property report that could be adapted to better correlate with the loss data.

We apply two methodologies in the process to develop a new weighted system. The first was a survey method, where field consultants and underwriters were asked to participate. A pilot survey was sent to upper management teams of the Loss Control and Underwriting departments. The purpose of conducting the pilot survey was to test our methodology and extract any unnecessary questions. After a few modifications this process was then carried out for the whole survey population.

The second method integrated into our process was analysis of historical loss data. This data provided by Hanover, detailed property loss occurrences by frequency as well as magnitude. Each survey question was matched to a category for the loss data, falling into seven categories overall. These categories were then ranked 1 to 7 and represent the categories from the highest loss frequency/magnitude to the lowest.

Upon receiving completed surveys back from Hanover, our group created initial weights for each question. The survey method by itself produced largely similar responses indicating that most questions were equally important. To integrate the loss data analysis, the group used a multiplication method. This created a percentage weight for each question on the property survey. Using the multiplication method, the entire weighted system expanded question weights to better differentiate from each other.

After constructing the question weights, the team was able to make several suggestions for further action to Hanover Insurance. A number of questions can be eliminated from the property report by using a box plot and removing the lowest quartile of questions. The survey content can be adjusted to reduce the subjectivity of the report and satisfy the field agents who complete it. These adjustments include utilizing open-ended comment boxes or logic questions, eliminating redundant questions, or use of question clustering. The property survey can be streamlined and simplified through a variety of applied methods. The final suggestion outlines how to apply the process to other lines of insurance. This application will create a more streamlined loss assessment process that benefits the operations of both the loss control and underwriting departments.

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Authorship

1. Introduction

The Hanover Insurance Group, based in Worcester, Massachusetts, is a national provider of Property and Casualty insurance. Hanover's products serve individuals, families and businesses nationwide. Hanover employs over 4,000 people, 2,000 of which are independent agents who work closely with clients to determine the line of insurance that best suits their needs.

The insurance industry provides an important service to its customers. By purchasing an insurance policy, customers reduce the potential that they will be unable to pay for any damages that may occur from a loss incident. Risk associated with loss incidents is distributed partially to the insurance company. Taking on risk associated with specific customer's means that managers at Hanover find it essential to develop a competitive method for assessing risk associated with insuring each client. By identifying loss patterns, Hanover can make their risk assessment and loss control process more efficient.

Risk assessment is a subjective process that requires human input on multiple levels, which is conducted at Hanover by employees that have experience in loss control consulting and policy underwriting. Initially, a consultant conducts a field survey of a property to determine the likelihood that a loss event will occur. After completing the survey, the consultant writes a report and uploads it to an online database called the ARIES system. An underwriter uses the consultant report to determine whether or not the property is satisfactory to insure and calculates a premium for the prospective client. The human involvement in the current process does not allow for an objective and standardized method for assessing and managing risk.

Hanover is switching from the ARIES system to the AuSum system to reduce the subjectivity involved in the risk management and loss control process. The AuSum system incorporates a scoring feature that allows each question to have a different weight of importance. A standardized risk score can be calculated based upon the questions answered in the consultant report. Consultants and underwriters will have a more objective method for determining risk when the calculation of a total risk score based on the individual question weights is used. This report will provide Hanover with a suggested method for determining the weight of each consultant report question.

The project team's suggested method is intended to reduce subjectivity within the loss control process at Hanover. Employees within the Loss Control and Underwriting departments were surveyed to gather a numerical understanding of each question importance. The survey consisted of the current consultant field evaluation report questions. The participants were asked to weigh the importance of each report question. After each participant completed the survey, results were compiled to determine a weight for each question.

Hanover provided data that detailed where the largest and most frequent losses occur. Analysis of this data was used as a complementary approach to determine an appropriate weight for each question. The survey results, combined with the data analysis, produced a final proposal for appropriate question weights to be used in the risk score calculation completed through use of the AuSum system. Our proposal provides Hanover with a more objective and standardized survey evaluation process.

2. Background Research

In order to understand the depths of this project as it applies to the insurance industry, and specifically Hanover, research was conducted regarding some key topics. A brief history of the insurance industry is outlined, prior to today's current practices. Industry standards and regulations are defined, as well as current practices used by insurance companies to reduce risk of commercial loss. Detailed explanations of loss control and underwriting standards are given to ensure creation of a solution that will make the process more efficient. Next Hanover is explored in depth, to gain an understanding of their company ideals and how this project correlates with these ideals. It is necessary to understand each of the commercial lines served by the company. Reviewing this information will allow our team to explore a variety of solutions and will give us a baseline for evaluating the potential advantages for each solution.

2.1 Insurance Industry

2.1.1 History of the Insurance Industry

The insurance industry is built upon the idea of distributing risk between numerous of players. This tactic is not a new approach to avoiding loss. Traders from China and Babylon in the third millennia BC, whose caravans were in danger of robbery and destruction by the natural elements, would divide their cargo between several crafts to avoid a total loss. If one vessel was taken, the majority of the cargo was still safe (Ungarelli 1984, 57). Without knowing it, merchants in the Middle East and China had just laid the groundwork for centuries of insurance practices.

The first written insurance policy can be located in the Code of Hammurabi from 1790 B.C.E (Ungarelli 1984, 57). One law dictated that if for some uncontrollable reason a

man lost his crop, he was protected from having to pay back his debts. The law ensured that the man could recover without the burden of the previous year's misfortunes. This was the first instance of a protection created for the masses to ensure their continued survival.

Underwriting blossomed because a number of individuals in the shipping business would sign a single insurance policy to distribute risk. Each signer would indicate underneath their signature how much financial risk they were willing to accept and the term "underwriting" was conceived. Lloyd's of London was originally a popular coffee house and meeting place where merchants, ship owners and seamen gathered to discuss current shipping news. As the first insurance policies for ship owners were signed in the back rooms of Lloyd's, it became the center for the creation of underwriting (Koehn 2001, 208).

The creation of two mathematical tools in the middle 17th century allowed Blaise Pascal and Pierre de Fermat to better quantify risk and estimate how probable a loss was to occur. Pascal and de Fermat were first able to express probabilities in 1654 which consequently allowed them to understand risk levels (Jvanovic 2004, 5). Pascal's Triangle, the second tool, was published in 1665 and led to the first mortality tables in 1693. These newly designed tables were used once life insurance policies became popular to calculate an appropriate insurance premium for individual clients. Depending upon how individuals conducted their daily activities, actuaries could estimate the expected length of a person's life and charge premiums accordingly. Clients who would more likely require a payout paid larger premiums. (Ament 2006).

Although underwriting was created for marine purposes, the insurance industry expanded to cover other potential losses at the time of the Great Fire of London in 1666. A five day fire destroyed a quarter of the city of London because of dry weather conditions and the narrow layout of wooden city structures. Nearly 14,000 buildings were destroyed and the city was devastated. As survivors began to rebuild, an economist named Nicholas Barbon identified a market for fire insurance, and he opened an office and began selling policies (Insurance Hall of Fame). He was joined by a number of other businessmen who scrambled into competition once the opportunity was spotted. London, during this time, was evolving into the trade center of the world and the concept of life insurance was also born (Ungarelli 1984, 58).

Benjamin Franklin was the first to issue insurance in the United States after fires similar to those in London ravaged Philadelphia in 1752 (Contributionship 2010). He created The Philadelphia Contributionship for the Insurance of Houses from Loss by Fire with several colleagues. The Contributionship refused to insure houses they saw as a fire risk so new standards in the construction of buildings evolved. In 1759 he furthered the insurance industry in America by creating the first life insurance firm in the country, the Presbyterian Minister's Fund (Majewicz 2008, 2). Several dozen companies got into the business of selling insurance over the next eighty years, but competition was strong and less than half a dozen were able to sustain their business. This competitive market was the setting that The Hanover Insurance Group entered in 1852.

2.1.2 The Insurance Industry: A Current Overview

The insurance industry is built around the concept that paying small increments in the present will save policyholders when an incident or disaster may occur in the future. By

purchasing an insurance policy, the holder can receive reimbursement for losses. The industry gains a profit because not every policyholder will need to submit a claim. The premiums of one customer are put toward company investments and the repayment of other customers' claims. Most insurance carriers are large companies that maintain a portfolio of various clients and employ agencies and brokerages to sell policies to these clients. Brokerages are unaffiliated with a specific company and therefore sell policies from numerous carriers at once. Varieties of insurance have expanded to presently include, among others: life, disability, fire, property-casualty, and liability. Umbrella policies can cover thousands of people at one time and are usually found in large corporations or unions.

Compared to previous years the insurance industry has recently been in a decline. This is due to the economic recession and the inability of various policyholders to pay their premiums. For example, AIG reported over $13 billion in losses in the first six months of 2008, making them unable to meet the obligations of their policy holders, which resulted in the largest bailout of a private company in United States history (De La Merced 2008). Predictions state that many firms will continue to experience declining revenues, investment losses and higher interest rates. Carriers have expanded their services in an attempt to attract more business and a wider client base and may now offer bank and securities products. The insurance industry had 2.3 million wage and salary jobs in 2008. Most carriers' home offices are situated in urban centers, with a number of regional offices in smaller cities and rural areas to service the surrounding community (Bureau of Labor Statistics June 14, 2010).

2.1.3 Importance of Loss Control in the Insurance Industry

The loss control division of an insurance company is central in handling risk. This department attempts to reduce the frequency and severity of incidents that can incur losses, particularly in businesses and properties. Through evaluation of the property, training of personnel, and suggestion of controls and procedures, insurance companies hope to prevent a number of incidents from occurring. For each incident that is prevented, the client avoids operational downtime, losing employees, having to pay additional wages for overtime, and other non-monetary costs. The insurance company, at the other end of the spectrum, can maintain lower premiums and costs, and the savings can be passed on to the customer. Perpetuating even prices helps a company retain their business (Safety Library n.d.)

'Basic causes' are the underlying reasons why an incident is able to occur, and set the stage for 'immediate causes' which are the unsafe act or condition that directly causes an incident. Immediate causes can include improper equipment use, defective tools, and inadequate guards, among others. The losses associated with these incidents are extensive and can cost a great deal of time and money. Not only can property or a product be damaged, costly environmental pollution can occur, and workers involved in incidents can become injured or die. Any work that needs to be made up because of a production line shut down would cost overtime. A company could potentially receive bad press for an especially distressing or neglectful incident. Loss of efficiency is a great concern, as is employee morale for those involved in traumatic loss incidents (Safety Library n.d.).

Through property evaluations, property owners can learn where weaknesses, dangers or lapses in control occur on their property, in order to resolve issues before they

cause an incident. By properly training employees, the human error factor is reduced. Implementing safety checks greatly reduces potential hazards, and instituting employee involvement in all proactive safety efforts means a number more vigilant observers aiming to avoid incidents.

The loss control division also uses the information gathered during property evaluations for the underwriting process. Some issues with a property are immediately identified as relatively minor, resolvable infractions, while other problems are not repairable or are too severe to cover. Underwriters can stipulate that repairs or improvements must be completed on a property before an insurance policy is issued, or can opt to deny coverage based on the severity of flaws. For all properties, underwriters estimate the likelihood that a loss incident requiring reimbursement will occur and can adjust premium prices accordingly (Safety Library n.d.).

2.1.4 The Process of Insurance Underwriting

The underwriting process is carried out by underwriters and consultants, in order to determine an appropriate premium for the risk associated if insurance is to be provided to the customer. The process can be visualized in the chart below.
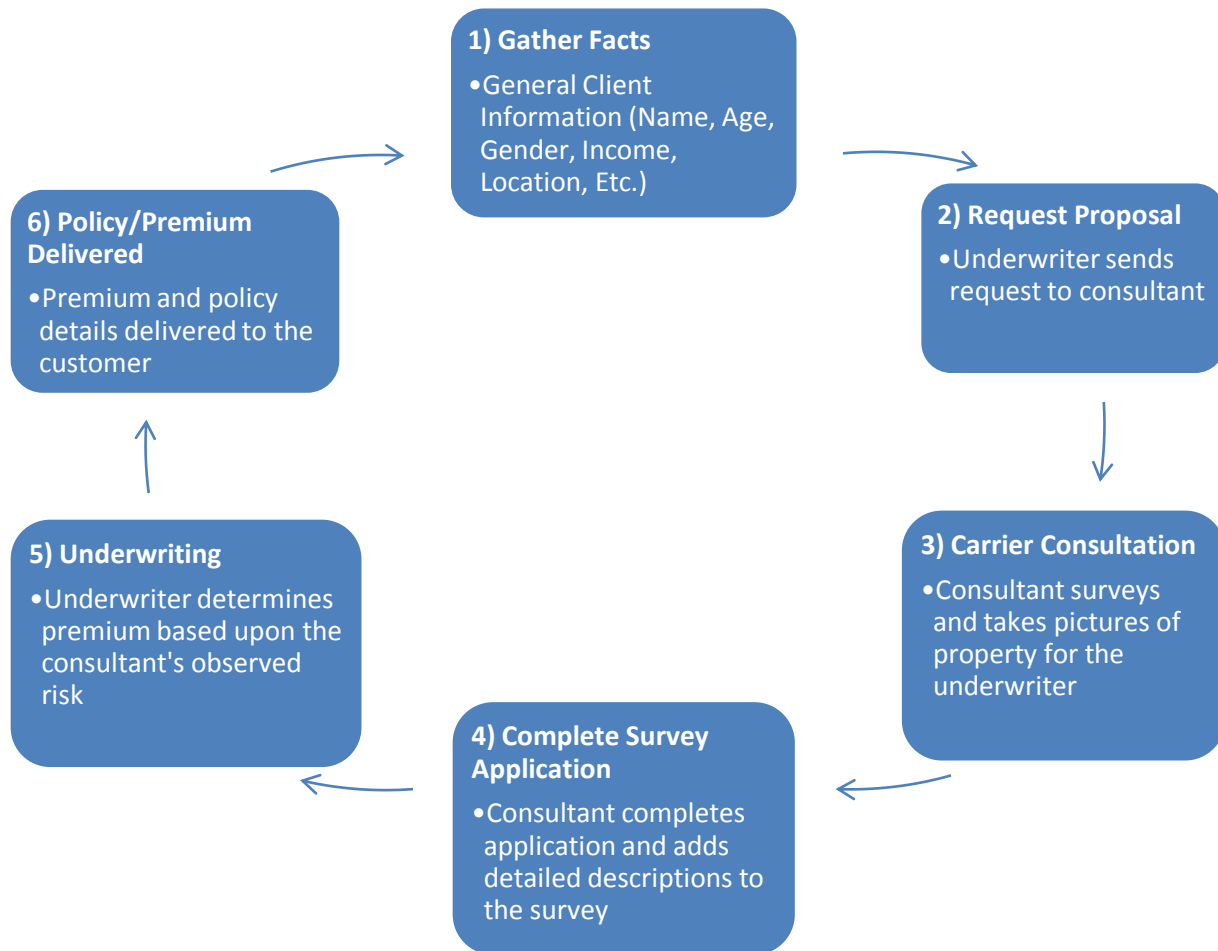
Figure 1: The Underwriting Process

At the start of the underwriting process, after a request is sent from an underwriter, consultants must go into the field and evaluate the risk associated with giving insurance to the customer. Currently at Hanover Insurance they are using the ARIES system to keep track of each evaluation. Once the consultant has completed an evaluation, they will enter the answers to the questions in the designated field in the software system. Examples of such questions on the consultant property survey include:

- 'Is area adequately secured against burglary and vandalism?'

- 'Did you observe any temporary wiring in the electrical room?'

- 'Are sprinkler valves open and secured?'

Once answers to these questions are entered into the system the underwriter can look at the conditions set forth by the consultant, in order to determine associated risk.

Insurance underwriters evaluate the surveys, also known as applications for insurance policies. They ultimately assess the degree of risk that will be taken on by the insurance company if the customer is in fact a valid candidate for receiving insurance. An insurance risk can be defined as the probability that the applicant will have to collect under the terms of the policy (Insurance Underwriter Job Description 2010). The financial status of the company lies greatly in the hands of the underwriter. Taking on a high risk customer may result in losses for the insurance company. If underwriters evaluate risks in a stringent manner, the company will not get all the business possible, but if they are too lenient, the company may experience a large amount of associated losses.

An underwriter does not assess risk based solely on the application or survey. They also take into account previous losses associated with the customers' profile, as well as losses associated by customers with similar accounts. Researching all of this information is important so that the underwriter gains a thorough understanding of the potential risk.

The importance of underwriting is large for a company like Hanover. As listed in one of the company's five main goals, they strive to constantly improve their underwriting process by making it more efficient. By completing proper research, staying on top of current underwriting software, and undertaking projects such as changing their risk evaluation system, Hanover will be able to create a company underwriting standard that can apply to all of the regions they serve across the United States.

Recently, there has been research completed about the possibility of automated insurance underwriting. In an automated system, the client's needs would be evaluated and then processed through a series of algorithms. These can be defined as evolutionary algorithms that will automatically calculate the potential increase in risk for the account over time. Using these algorithms would eliminate the "fuzzy decision making," or human error, associated with the underwriting process (Bonissone et al. 2002). While a system like this is very complex, it would help any insurance company to gain a far more accurate understanding of the risk associated with any potential account. Computer-generated underwriting would retrieve data based on consultants' surveys and generate a logic-based risk evaluation. This evaluation could be used to determine whether or not to insure a customer, and a proper premium if insurance is provided. Currently many of these systems are being used in loan underwriting processes. Hanover does not currently have intentions of automating their whole process, but may consider this option in the future.

2.1.5 Industry Regulations

Industry regulations have a great effect on people and businesses searching for adequate insurance coverage. There are some regulations and general codes of conduct that are followed by insurance companies to maintain a professional relationship with their customers. In each state regulations may differ, however there is one presiding value followed by all companies in the industry. When the insurer and the policy holder bind in a contract for insurance, they are entering an exclusive and honest relationship, which should remain that way at all times.

One focus of insurance law is regulating the companies involved in the insurance business. Regulating this part of the industry is practiced through official documents such

as state legislatures and through administrative boards which vary from state to state. In Massachusetts, this branch of regulation is carried out by the Massachusetts Division of Insurance. The Massachusetts Division of Insurance (2010) mission reads:

> ...to monitor the solvency of its licensees in order to promote a healthy, responsive and willing marketplace for consumers who purchase insurance products. Protection of consumer interests is of prime importance to the Division and is safeguarded by providing accurate and unbiased information so consumers may make informed decisions and by intervening on behalf of consumers who believe they have been victimized by unfair business practices.

Legal doctrines are the second focus of insurance law, and are used to regulate the relationship between an insurer and its policyholder. This type of literature outlines proper codes of conduct when engaging in this formal relationship. Different statutes have been created as different cases arise, giving more detail to the requirements and regulations set forth in the insurance industry and for start-up insurance companies. These include detailed requirements for making periodic reports to state officials, avoiding certain types of investments, and maintaining minimum levels of capitalization and reserves (Virginia 2010).

2.1.6 Current Industry Practices

Risk evaluation is an essential function of an insurance company. Insurance companies employ evaluation procedures that determine the cost of risk and the ability of the company to underwrite it. Risk managers assess the quality of risk, the likelihood of its occurrence and the potential cost to policy owners (Financial Web 2010).

When an insurance company underwrites risk, they look for ways to keep premiums low for existing policy owners. This is completed by a risk evaluation process that is undertaken by the insurance company (Financial Web 2010). Some companies hire outside consultants to assist with the process of risk evaluation. The consultants help the insurance company determine the potential cost and impact of a loss occurrence for the insurer. Another method used by the insurer to evaluate risk compares statistics for similar types of risk as a basis for its evaluation process (III 2010).

Insurance companies frequently document their practices associated with risk evaluation, creating a formula that can be used company-wide to evaluate risk (Financial Web 2010). Data collection and documentation also allows an insurance company to create a pricing strategy or model. Once the insurance company develops an understanding of the nature of each risk and the potential impact that it may have on the company, they can create a competitive model. Pricing risk is important because if it is priced too high, the insurance product becomes unsellable. Low pricing will result in a loss for the insurer (III 2010). At the Hanover Insurance Group the ARIES system is used for data tracking and compiling information useful in determining a pricing model.

2.2 Hanover

2.2.1 Hanover Insurance: Dedicated to Serving Customers

The Hanover Insurance Group, Inc. was founded in 1852 in New York City. Businesses and homeowners facing the common 19th century hazard of fire would be protected by Hanover Insurance (The History of the Hanover Insurance Group 2010). Since the 1800's, the company has evolved to serve a wide range of customers, offering various lines of insurance. They hold regional and local offices in 28 locations across the United

States, serving communities from three regional hubs located in Massachusetts, Michigan, and Georgia. They operate in the financial sector with a current market cap listed at $2.1 billion and a P/E ratio of 15.47 (The Hanover Insurance Group 2010).

Hanover operates with over 4,000 employees and 2,000 independent agents nationwide. The company provides insurance across four distinct regions in the United States; Midwest, Northeast, Central, and Southeast, however; Hanover primarily focuses on operations in four states: Michigan, Massachusetts, New York, and New Jersey. Hanover works diligently to keep their customers satisfied on a personal level. Publicity is developed within the smaller community as a practice which allows Hanover to capitalize on smaller accounts for personal and small business insurance. The lines of insurance offered by Hanover include: Business Owner's Policy, Commercial Package, Worker's Compensation, Inland Marine, Bond, Auto, Commercial Auto, Home, Renter, Condo and Dwelling Fire, Umbrella, Boat, and Specialty insurance.

Hanover has a set of company goals and ideals that allows them to strive for a high customer satisfaction rate. While most companies reward employees for diligence, strong focus, and speed of performance, Hanover also strives for consistent quality in their underwriting process, offering innovative products, new technologies, and responsive service (About The Hanover Insurance Group 2010)

Hanover set forth a list of key strategic goals for the company. These goals are:

1. Attracting, Retaining and Developing the Best People

2. Maintaining a Financially Strong Company

3. Partnering with Winning Agents

4. Building a World Class Underwriting and Product Capability

5. A Bright Future (The Hanover Insurance Group-Our Goals 2010)

To develop and retain the best employees, the company relies on a dynamic leadership style. Every employee strives to help each other. The Hanover Group also invests in a high level of employee training to build leadership skills and develop their strengths as assets to the company. Maintaining the financial status of the company is a difficult task, but Hanover publically promises that they will remain financially stable. Over the past three years they have shown strength in their financial ratings, receiving many A/A- grade ratings in 2008 and 2009 (The Hanover Insurance Group—Investor Relations 2010). Hanover has a great understanding of their agents' needs and communication with agents helps Hanover develop an idea of what the customers want. The company has set forth the vision, "to become a world class regional property and casualty insurance company." This is attainable if they follow their other four goals and envision a successful future.

The fourth goal of 'Building a World Class Underwriting and Product Capability' is the most relevant to this project. Focusing on the underwriting process allows Hanover to give the customers accurate and realistic premium prices. Maintaining underwriting practices creates a consistent level of feedback, and allows Hanover to develop innovative products for their customers. Speaking on expansion of underwriting and loss control capabilities, Frederick H. Eppinger, Chief Executive Officer at Hanover, stated:

This is an exciting time for us. Six years ago, we set out to be the best partner for growing, independent agents. Today, we are delivering on that promise, having

strengthened our company in every way–improving our financial strength, product

offerings, operating model and service technologies, while building one of the best

field teams in the industry. These talented professionals will help us bring

significant scale to our westward expansion and enable us to be even more

responsive to our agent partners, helping them to grow and win in a very

challenging marketplace. (The Hanover Insurance Group-Strengthening Field

Operations, Underwriting, and Loss Control Capabilities 2010)

This excitement shown by the CEO will carry throughout the company and will allow

Hanover to strive for similar success for years to come.

2.2.2 The Loss Control Process at Hanover

The loss control department at Hanover Insurance established three objectives for

working with its clients. These objectives guide the department's operations and strategies

so that the best business experience for customers is created. Without a positive customer

experience, a potential repeat client base would evaporate rapidly. Secondly, Hanover tries

to differentiate their company from the competition. Being unique means having the ability

to better penetrate new markets. Last, Hanover works hard to convey consistent delivery

to both agents and policyholders to create a strong, long-lasting relationship. This objective

follows the Five Guiding Principles for the loss control department's conduct.

The Hanover loss control department values employee-organization and client-

organization relationships. They strive for professionalism in dealing with both employees

and clients as it is the number one differentiator between Hanover and other companies.

This is exemplified in the organization of the loss control website. While many similar

websites are full of facts, figures and information that is difficult to sort through, loss

control at Hanover promotes the functionality of their website while being a useful resource for employees and policyholders. Policyholders utilizing the loss control website will find added value in the company while stronger clientele bonds are created. Agents can utilize the website resources to help lower loss exposures and improve controls to reduce losses (Hanover Loss Control website).

The loss control department at Hanover creates measures that allow loss control consultants to evaluate a property during a consulting survey. During the visit the loss control consultant observes each aspect of the policy coverage and evaluates all of the processes that would be included in that coverage to find weaknesses, substandard circumstances and potential issues. The consultant considers what controls are currently in place to prevent losses and incidents and any improvements that could be made to those controls. The consultant takes into account previous incident claims that the property owner has made in order to evaluate for a premium. Criteria from these incidents include the outcome of those occasions, whether the policy holder strove to correct any issues that were present at the time of the incident, or if the same circumstances still exist. All of these factors allow consultants to provide reliable reports to the underwriters, who then determine a premium for the customer.

2.2.3 The ARIES System for Loss Control

The current computer system that the Hanover uses for loss control processes is the ARIES system. ARIES is operated and maintained by IMTI systems, a premium technology service provider to the commercial insurance industry. IMTI prides itself on providing technological solutions for insurance companies in the areas of underwriting and claims, with a specific focus on field employees that actually conduct evaluations. The ARIES

system is an example of a product that IMTI offers, which allows loss control engineers to have the tools necessary to collect and relay data in real time (IMTI 2010).

The ARIES system is an online database of insurance information for Hanover. ARIES allows users to access and view completed insurance reports, and the system is used mainly to allow underwriters access to crucial information in their decision making process. Currently, consultants conduct field evaluations with a set list of questions that are pre-determined by management staff. When the evaluation is complete, the consultant uploads the survey results to the ARIES system along with any attachments or pictures taken in the field. This is evaluated by an underwriter who determines a premium based on the subjective survey risk assessment. The ARIES system is used by Hanover to catalogue insurance reports and to provide employees with an easily accessible database of information. It is also used to streamline the loss control process to better understand how to avoid significant losses.

The field evaluations done by consultants are mostly subjective. Consultants rely on previous experience to conduct the evaluations which usually require several hours to complete. Depending upon experience, consultants may have varying opinions on certain risk factors in property or worker's compensation evaluations. For instance, one consultant may consider the electrical wiring of a property to be the most important factor involved in determining risk of loss, while another may feel an adequate sprinkler system is a more significant indicator. Underwriter's make their decisions according to the evaluations conducted by consultants thus the process of determining the premium for a client is subjective. With the implementation of a new AuSum operated system, Hanover

hopes to reduce the subjectivity involved in the processes of consultation and underwriting.

2.2.4 Commercial Lines Insured by Hanover

To ensure that a business is safe from catastrophic losses, clients can purchase, in addition to a variety of other lines, four types of insurance; all of which the Hanover Insurance group offers: Property, General Liability, Automobile, and Workers' Compensation.

Property insurance compensates a client if a property used for business is damaged as the result of various loss types, such as fire or theft. Property insurance covers not just the building or structure where operations are conducted, but also what insurers call "personal property," meaning office furniture, inventory, raw materials, machinery, computers and other resources vital to business operations. Property insurance can also provide operating money during a period of time when the business is getting back on track after a significant loss. Depending on the type of policy, property insurance can include coverage for equipment breakdown, removal of debris after a destructive event, and some types of water damage (III 2010).

People can claim that a business caused them harm as the result of a defective product, an error in service, or disregard for another's property. Someone could also allege that a business created a hazardous environment for employment. Liability insurance pays damages for which someone is found liable, up to a policy limit, as well as attorneys' fees and other legal defense expenses. Liability insurance also pays the medical bills of anyone injured during a loss occurrence. Liability insurers have two major duties: to defend and to compensate. The duty to defend is triggered when the insured is sued and turns over

defense of the claim to its liability insurer. Usually this is done by sending a copy of the complaint along with a cover letter referencing the relevant insurance policy or policies and demanding a defense (III 2010).

The duty to compensate requires the insurer to pay all sums for which the insured is held liable, up to the policy limit. Many public and product liability risks are often covered together under a general liability policy. Under a general liability insurance policy, the insurer is obligated to pay the legal costs of a business in a covered liability claim or lawsuit. Covered liability claims can include bodily injury, personal injury, and advertising injury. The insurance company also covers general damages. General liability insurance policies always state a maximum amount that an insurer will pay during the policy period, as well as a maximum amount the insurer will pay per occurrence. In the United States, general liability insurance coverage most often appears in the Commercial General Liability policies obtained by businesses, and in homeowners' insurance policies obtained by individuals (Dun & Bradstreet 2010).

A business auto policy provides coverage for autos owned by a business. The insurance pays any costs to third parties resulting from bodily injury or property damage for which your business is legally liable, up to policy limits. Depending on what kind of coverage is bought, the insurance may pay to repair or replace your vehicle because of damage resulting from accidents, theft, flooding and other significant losses (III 2010).

In all states but Texas an employer must have workers compensation insurance when there are more than a certain number of employees, varying from three to five, depending on the state. Workers comp insurance, as this coverage is generally called, pays

for medical care and replaces a portion of lost wages for an employee who is injured in the course of employment, regardless of who was at fault for the injury. When a worker dies as a result of injuries sustained while working, the insurance provides compensation to the employee's family (III 2010).

3. Company Problem

The Hanover Insurance Group is experiencing high losses in many repeating areas. The property consulting survey is not at the quality level desired by Chris Beckman and Mike Billings. They are implementing a new system in order to create a higher quality risk evaluation system. The AuSum system for loss control includes a scoring feature that can be used to develop a risk quality score for each risk assessment. These scores can roll up to an account level for multiple location accounts.

The objective of this project is to develop a model for the scoring to assure that Hanover has a consistent and valid approach for developing this score. The project team will develop the weighting of the scores for the property line of business. The project is expected to establish a methodology to develop a scoring system within the report groups in AuSum to see that each report develops a score that correlates to its opinion of risk. Inconsistencies in risk evaluation will be identified and will correspond with suggested changes for Hanover to make.

The project team will also provide Hanover with suggestions for improving their current survey. After research of survey construction techniques, the current survey will be analyzed and critiqued for change. These changes may include adjusting the survey content and/or format. Suggestions will also be made that outline a survey construction process, if the survey is ever re-written and constructed with new or different content.

3.1 Limitations of the ARIES System

One problem that Hanover has with the current use of the ARIES system is that it does not provide an automated scoring feature that allows agents to objectively determine whether or not to underwrite an insurance policy. As of now, ARIES provides a database

that can be accessed and viewed, but does not provide users with an unbiased risk assessment, or a system in which they can make personal changes. The ARIES system provides no real way to differentiate between subjective analyses, something Hanover wishes to change.

The Hanover Insurance Group will implement a system that can provide insurance consultants with a more objective view on loss control analysis. The new system consists of a scoring feature that could be used to develop a risk quality score for each risk assessment done by a consultant. Hanover has turned to AuSum Systems to reduce or eliminate varying risks. Hanover can provide access to key employees, even customers, so that they can collectively respond to identified risk improvement tasks. For example, if a business is deemed unsatisfactory because it does not have the correct number of sprinklers installed, they will not receive coverage until that system has been improved. The human error of conducting an inspection is reduced using a weighted system, where Hanover can determine risk using objective methods.

When talking with employees in Hanover's Loss Control Division, they expressed frustration with the ARIES system. It frequently crashes and is unreliable; Ellen Halsdorff went so far as to call the system "antiquated". Also, the ARIES system does not allow for efficient management reporting or for tracking of reports once they are inputted into the system. Possibly the cause for the most frustration is the inability of Hanover employees to make changes to the ARIES system. Currently, employees have to go through a vendor if they wish to make any changes to forms within the system, such as an alteration to a property survey. The new AuSum system will have a scoring feature as well as enable

employees to make changes to the system without having to go through a third party to do so.

3.2 Changing the System: Benefits for Hanover

Our team objective is to come up with a weighted system to improve the current underwriting process. Our weighted system of questions will be integrated into the new AuSum system used by Hanover. Each question in the survey will hold an appropriate weight to be part of an overall risk score. This weight will be mathematically calculated based upon our statistical analysis of the survey methodology results and historical loss data provided by Hanover. The risk score will determine if Hanover should or should not consider providing insurance to the customer. It will also help in deciding exactly how much coverage to provide and for what price. Hanover will implement use of this system starting in the year 2011.

The use of this system brings many benefits to Hanover Insurance and their Loss Control Department. Four major benefits associated with the switch to this system include:

1. Elimination of a large percentage of subjectivity experienced in the current process.
2. A standardized system for determining an appropriate risk score.
3. A heightened level of evaluation criteria when determining to or not to provide customers with insurance.
4. Detect the inconsistency between the score and risk assessment; a tool for creating an accurate information flow.

Each of these benefits of implementing a new system will help The Hanover Insurance Group to cut down on the losses associated with the underwriting process.

In the current process the consultant plays a large role in the evaluation of risk exposures. Some surveyors may value different survey questions on a higher level than others. This subjectivity does not create a consistent outcome between surveyors. By changing to the AuSum system, Hanover will be able to put a weighted score on each survey question. Risk scores can be calculated by a formula, instead of relying solely on the opinion of a surveyor. Eliminating some surveyor subjectivity will allow the underwriters to gain a more accurate understanding of the risk and exposures of potential clients.

There is a long term benefit associated with the use of a standardized system. Using the current system, if consultants and underwriters are not precisely evaluating the questions, they may find that there are a few weak areas where they experience the most loss. The weighted system will take the most important questions and give them a higher weight in the total risk score. This way the risk score can be calculated on a more precise level, which will minimize and control losses in the long term. Weighting the questions will create a standard method for risk calculation; a method that will help in differentiating the actual risk from what a consultant may think is the risk. The standardized system will give Hanover a strong and consistent basis to assess their potential clients.

The AuSum system will be used to calculate a numerical risk score. This score will be represented by a percentage. The calculation of this percentage will consist of allocating a percentage weight, out of 100, to each survey question. Once each question has an appropriate overall weight, according to our results, the consultant's answer to that

question will determine how much of the question's given percentage weight, if any, will be factored into the overall score. The benefit of obtaining this overall percentage is that Hanover can decide a cut-off point for the score, where providing to a potential customer will be too risky. This will make the underwriting job more efficient for two reasons. First, the underwriters can choose to eliminate any clients with risk scores under a certain point, allowing them to focus on customers that do not have as much risk of experiencing a loss. The second benefit is the ability to compare different customers. They can prioritize their work so that they are serving the customers that pose an appropriate risk of loss for the company.

Managing information transfer is an important factor in the risk analysis process. Hanover recognizes the importance of the translation of a consultant's survey into an underwriter's evaluation. The translation may result in different opinions of associated risk. Use of the weighted method to calculate the risk score will result in a standardized scale of risk that can be observed throughout the process. By introducing the weighted system Hanover will allow their underwriters to gain a sufficient understanding of the severity of risk associated with a certain account. This will eliminate some of the ambiguity associated with unclear survey answers and reports, as well as unclear depictions of properties from attached pictures to the survey.

4. Methodology

The project team's proposed methodology gathered the proper data for analysis and provided a high-quality base for creating the weights of the consultant survey questions. The group decided to integrate two methods for collecting the necessary data; a survey

method and analysis of historical loss data. It was vocalized by managers at Hanover that the weighted system should not express or be altered by the opinions of just a few individuals. The survey method allowed the team to collect a comprehensive opinion on the importance of each survey question. Gathering the opinions of a range of professionals balanced out any significantly outlying opinions. This was necessary because the intent was to develop a system in an unbiased fashion.

The survey method consisted of an electronic survey that was sent to underwriters and consultants. The survey was comprised of the current property evaluation questions, and asked the employees to rank the importance of each question on a numerical scale. The team found that this method was important because it allowed for the discovery of which questions the employee population viewed as the most important.

One limitation associated with using the survey method was the potential disconnect between the responses of surveyed consultants and underwriters, which would affect the results differently than if only surveying one homogeneous population. While one population conducts field evaluations, the other utilizes the results to establish a premium rate. This might have lead to a differing opinion on which questions are the most important. Additionally this limitation was intensified by access to a restricted population size.

The second method the project team used was an analysis of previous loss data. Reviewing and analyzing this data illustrated where the company experienced the highest losses in terms of frequency and quantity. The group then determined how this data correlated with the survey results. After both sets of data were analyzed, the team based the question weights first on the survey answers and then adjusted them based on

correlation with the loss data. The analysis of loss data was beneficial because it provided real and quantitative data that illustrated where actual losses occur and reduced some of the risk associated with the survey method as discussed above.

After each of these methodologies and analysis tools were applied, the group was able to create an accurate weighted system to calculate the total risk score for providing insurance to the customer. The team also provided Hanover with a list of suggestions on how to make their current survey stronger and streamline the process for their employees.

4.1 Survey Methodology

The survey method was our first method for analysis. The group completed research to determine an appropriate population size, scales for rating each question, and tested the survey for any errors or unnecessary questions.

4.1.1 Survey Population

The survey population that was intended to receive the survey consisted of approximately 100 people. Ideally a greater population size was desirable, but the group was limited to the number of accessible consultants and underwriters at the Worcester branch of Hanover. Ample background research was completed about our population, which determined their qualifications. Pre-survey questions were asked regarding the subject's employment background. Reviewing the qualifications of the survey participants allowed the group to validate the responses. Once the survey results were gathered, the group entered them into an excel spreadsheet. Using this spreadsheet the mean result for each question was calculated, as well as a graphical representation of the range and distribution of answers. During the survey process the group first conducted a pilot survey

to gain understanding of the expected distribution of the data, and then sent the survey to the actual population.

Prior to the survey, the group completed statistical analyses determining how many participants must complete the survey in order to obtain accurate results. Using confidence intervals of 99%, 95%, and 90% the team calculated that 73 people were needed as a sample size to ensure that the answers fell within a proper range of variance from the data mean.

The recommended population size was calculated using the coefficient of variation (Creative Research Systems 2010) and is defined as follows:

$$\overline{\hspace{2cm}}$$

Using this equation and the pilot survey data, the group recommended an expanded survey population size to Hanover.

4.1.2 Rating Scale

The survey rating scale consisted of a Likert scale ranging from 1-7. The extremes of the scale represented "of lowest importance" for the number 1 and "of highest importance" for the number 7. After reviewing multiple sources, the group decided on this scale for specific reasons. One reason was to eliminate uncertainty that comes along with giving the survey population a limited range for their response and to heighten the reliability of the results. One journal source determined that "Attitude questions with more response options tended to have higher reliabilities, although there are some important exceptions. More extensive verbal labeling of numbered response options was found to be associated

with higher reliability, but questions explicitly offering "don't know" alternatives were not found to be more reliable." (Alwin and Krosnick 2010)

Since the survey population was very versed in the subject matter of the survey, use of a seven point scale would not be a problem for error. The survey participants would be able to depict the importance of each question on a more accurate level, which allowed the group to produce the best results possible. Also included was the verbal meaning of each number in the survey. This allowed the survey participants to grasp a greater understanding of the importance associated with each question.

4.1.3 Pilot Survey

After the construction of the survey it was important to employ a pilot survey method. Conducting a pilot survey of management staff predicted the distribution that could be expected from our secondary population. For the pilot survey process, the group planned to survey up to ten regional managers. After gathering the results from this pilot group any unforeseen errors would be eliminated from the process.

According to Hekman et al. (2009), the use of a pilot survey would help refine the results of a survey within an organizational context. Removal of time consuming questions proved to be very beneficial in making a survey highly reliable. In order to understand which questions were unreliable the team analyzed the pilot survey response data. One of the pilot participants was Chris Beckman, who helped determine which questions to keep or eliminate. He has worked for Hanover in the loss control department and was the creator of the current property survey that consultants use. His expertise in this field was beneficial in condensing the survey process.

4.2 Software

4.2.1 SurveyMonkey

To distribute the survey, the group used a website service called SurveyMonkey which allows users to create custom questionnaires and surveys and distribute them electronically. Hanover Insurance maintains a SurveyMonkey account and the team worked with this resource to create a survey and distribute it to the Hanover employees that were identified as the group's target population.

There were some distinct advantages to using a web service instead of distributing a paper survey. A paper distribution often requires outside personnel to administer the survey, and the cost of additional employees and facilities can be extreme when the target population is very large. Mailing costs can also be exorbitant when distributing surveys through a system such as the United Postal Service. Electronic surveys, in comparison, can be distributed quickly and efficiently through the use of email or a website link, and the number of people receiving the survey does not alter the cost of distribution. Online surveys also promote more thoughtful responses. Each respondent can complete the survey conveniently, in a familiar environment and at their own pace. As a result respondents are more willing to think about the questions asked and do not feel they need to rush through each page. The absence of a supervising employee also places the respondent at ease, since they do not feel pressured to respond in a certain manner to any of the questions asked.

The group chose SurveyMonkey specifically because it boasts a variety of functions that make it a useful tool for survey analysis and data organization. Some beneficial

functions of the website pertaining to this project include (SurveyMonkey Cost & Pricing 2010; Gordon 2002):

- an unlimited number of questions in one survey; the large question quantity stemming from the property report, the workers' compensation report, demographic questions and survey content inquiries was not a problem

- skip logic based on question response

- custom reports based on the responses gathered for each survey question; creators of the survey can specify what relationships they would like to evaluate and SurveyMonkey will cross-tabulate results based on those specifications

- compilation of survey data into appropriate charts and graphics to visualize trends

- survey storage and maintenance makes it is very easy to alter a survey and re-issue it without cost or hassle; this feature will be useful if Hanover ever wants to conduct additional research on the property report and wishes to utilize the survey what was distributed to the consultants

Survey creators can choose from fifteen different question types, including open-ended text boxes and drop down menus. Using this variety allowed the group to gather demographic information such as the participant's name, gender and years of field experience. This helped to identify trends in the data and allowed for the potential to connect participants' survey responses with the property report. As a result we attempted to identify potential discrepancies and look at the relationship between knowledge and years of experience and a variety of other useful relationships that could exist without our knowing.

4.3 Distribution

The distribution of our survey involves identifying the correct subjects to take the survey, presenting the survey to employees and following up with subjects to develop a working relationship. It is important that we distribute our survey to qualified employees and allow them to access and complete the survey on their own time.

4.3.1 Contact selection/qualification

The group contacted individual employees within Hanover that fall under the department of loss control. This includes consultants and other employees that have experience in the field and are familiar with the evaluation process.   Employees in the underwriting department were also surveyed because they have the ultimate decision on whether or not to provide insurance to a client.

The reason for distributing the survey to employees in both the loss control and underwriting departments is to gain an understanding of the importance of each question Hanover currently uses in their evaluation process. The group then compared their opinions to the actual loss data that was provided by Hanover. The group wanted to survey at least 75 consultants regarding the evaluation process involved in loss control. Though that is the minimum number the group sought for participation, the participation of underwriting employees would also be desired.

4.3.2 Distribution method

The participants were contacted via email and directed toward the survey through a link to SurveyMonkey.   This was the easiest method of distribution as it allowed subjects to take our survey at their leisure and answer questions thoughtfully and honestly. Though most questions only involved attaching a ranking of importance, it was vital to obtain honest answers to ensure survey credibility within the small population size. Honest

answers also allowed the team to average out scores and reduce subjectivity in our assessment of Hanover's evaluation procedures.

4.3.3 Post Pilot Survey Adjustments

One of the reasons for distributing a pilot survey was to collect comments from the respondents about the content of the survey and be able to alter the survey where it was unclear. Since the pilot survey participants were Hanover managers who work closely with the information being researched, the group felt they would be a great resource for improving the content of the survey. For the results of the full survey to be reliable, it was important to ensure that the consultants and underwriters who would be taking the survey understood the questions completely. Therefore, the comments from the pilot population enabled us to make several necessary changes to the survey that would be distributed to the target population.

4.4 Loss Data Analysis

4.4.1 Analysis of Loss by Type

The group received data from Chris Beckman that categorized loss by type. He suggested that a graphical and numerical analysis should be completed for only certain categories of the data. These categories are listed below:

Business Income	Equipment Breakdown	Lightning	Sprinkler	Water
Collapse	Fire	Mold	Theft/Burglary	Water-Pipe Broken or Burst
Contents	Forgery	Power Outage	Vandalism & Malicious Mischief	Weather
Copper Theft	Frozen Pipe	Power Surge	Vehicle	
Electrical		Spoilage		

The group constructed pie charts of loss data to observe the relative percentages of loss in three measures. The first measure was by frequency of loss, next by total loss, and

finally by average loss for Hanover. The team matched each category to the consultant survey questions and the observed percentages. Using this correlation, the group adjusted the weighted system to give a higher weight to questions that correlate with the higher percentage loss types.

The method for coming up with an appropriate amount to raise each question weight was based upon the percentage of loss associated with each of the above categories. After each survey question was matched, a rank for the categories was created. This rank was based upon the loss frequency percentages rather than loss by size. This was a rank from 1 to 7 because only 7 categories correlated with survey questions. Multiplying each question's average survey response by the correlating rank expanded the question weights to a more dynamic scale.

4.4.2 Analysis by Keyword

The second type of data analysis the team used was a keyword filter of the loss descriptions. Searching for keywords within the descriptions gave a numerical response of how many times a loss occurred for each word. Keyword examples included words or phrases such as 'pipe burst' 'equipment' and 'sprinkler.' Using the keyword analysis the group determined key words that, if presented in a consultant report, would signal a killer question. Killer question identification will allow the AuSum system to lower the calculated risk score accordingly, creating a higher standard of risk evaluation.

The greatest causes of loss for Hanover were fire and water related events. Within the causes of loss, fire was the cause for 549 events. Within the fire category, there were certain causes that came up frequently. A frequent cause of loss to an insured's building

occurred when an adjacent building caught on fire and there was water, smoke, soot, or fire damage to the insured's property. Of 549 events, 20 were directly related to an adjacent building catching on fire resulting in some form of damage to an insured's property. These events account for loss totals over $1 million, with the largest events usually tied to the ensuing water and smoke damage. Another cause of fire was laundry machine failures. Driers run at high temperatures and can burn clothing inside, resulting in loss events. Also, the laundry room within a building commands a substantial amount of electricity, the last frequent cause of fire.

Electrical fires were the last type of loss that occurred most frequently and are commonly the result of improperly installed infrastructure, purposeful vandalism or simply accidents. There were 13 fires caused directly by electrical malfunction, resulting in losses of $562,292. Grouping frequent loss events together such as electrical, laundry, and adjacent buildings is important in establishing a base line for the recognition of keywords that could apply to killer questions.

The water category was also frequented with similar terms, none more so than pipes freezing and bursting. A loss event involving pipes bursting occurred 145 times out of the 938 water related incidents recorded in Hanover's loss event descriptions. Combined, the events cost more than $3 million, resulting in an average loss of more than $21,000. Other than pipes freezing and bursting, most water incidents occur due to severe weather. Roofs collapse because of heavy snow loads, technically a water hazard. Additionally, high volumes of stagnant water can result in roof and ceiling collapses, compromising the integrity of a structure. For the water category, the keyword search found that pipes

freezing and bursting is the most common cause of loss, while weather related incidents followed behind that, specifically water as a flooding and collapsing agent.

4.5 Survey Enhancement

In order to accurately portray the risk associated with providing insurance to a customer, the field survey should be carefully constructed. Methods that can be used to enhance the quality of a survey include: use of certain types of questions to draw valuable information, development of the flow of survey questions, and creation of a visually neat, short, and concise survey. Each of these methods is explored below and may be used as suggestions when changing current surveys or creating new ones in the future. This research has created suggestions present in the Recommendations section on how the current survey may be enhanced using these techniques.

There are three main types of questions that can be used on a survey. These include factual, interpretive, and evaluative questions. Factual questions create a response where a respondent offers a straight forward answer based upon facts or direct observations. An interpretive question will evoke more than one possible answer but should be supported by factual or observed evidence. Lastly, an evaluative question asks a respondent to evaluate a circumstance by simply choosing to agree or disagree with the question statement. Answers to an evaluative question will be based largely upon opinions after reviewing factual or observed information.

Preliminary steps are helpful when choosing which type of question to use at any given point on the survey. First, it is important to define the purpose and objective of conducting the survey (Survey Questions 2010). Keeping this objective in mind will allow

the creator to establish meaningful and necessary questions, getting straight to the point, rather than potentially producing questions that may not be relevant or necessary for the evaluation. For any loss control department, a main objective may be to create a confirmatory research survey that will provide definite answers confirming whether or not a customer meets a preset standard to be insured. Using an exploratory approach, where no standards are preset, may lead to a biased evaluation where no definite conclusions are reached.

There are a variety of ways to present a survey question, all of which can be classified as open-ended or closed-ended questions. An open ended question is an evaluative question and can evoke a number of responses. To obtain a qualitative answer an open-ended question should be asked, where a consultant will provide feedback and observations relative to the question. This type of question may be useful on a property survey when a description of the property contents is necessary. There are also semi open-ended questions where a few answers are suggested, but there is the possible selection of an "other" category, as long as reasoning or a description is provided.

Close-ended questions come in many forms and will usually be factual or interpretive questions. A multiple choice question forces a consultant to choose the best answer of all possible. This type of question is useful when trying to obtain a certain response. Multiple choice questions may have a large variety of answers or as few as two answers. Nominal multiple choice questions have two answers, usually yes or no, and will provide highly factual information. There are also categorical questions which may be helpful if the consultant should categorize which type of property they are surveying. A

Likert scale question can be asked as an evaluative or interpretive question, to gage an opinion about a certain question statement. While this may be helpful in understanding a consultant's opinion, there are limitations because the choices may not accurately depict the level risk observed. Numerical response questions usually allow the respondent to choose which range a question answer may be in. For example, if a consultant is asked how many sprinkler heads are the total number present in the building, they could answer in ranges such as 1-5, 5-10, 10-20, etc. Each of these types questions have associated pros and cons which are accurately outlined by the Instructional Assessment Resources at the University of Texas (University of Texas, 2007). A table depicting these pros and cons can be seen in Appendix 8.7.

Filter, or conditional, questions are questions where if a certain answer is chosen, a follow up question is necessary. These questions will elongate the time needed to complete a survey, especially when the follow-up question does not need to be answered. This type of question should be used sparingly in order to make the evaluation process flow more smoothly. It is suggested that when constructing a survey, the aim should be to start with one powerful question that captures factual information, and only add a conditional question if absolutely necessary (Fowler 1995). If a conditional question is necessary, organizing the layout of a printed survey will help a consultant quickly evaluate the necessary or skip over unnecessary conditional questions. Poor visual organization can cause additional reading time of the survey that is not needed. Graphical flow is highly important to streamline the survey process.

Some important ideas and tips to keep in mind when developing a survey include keeping it short and simple, asking non-leading questions which will alter an interpretation of a question, using close-ended questions with few responses, considering the order of all questions, and keeping the survey visually neat. Keeping this in mind will help to develop a strong survey and will evoke accurate and useful results. The last and most important thing to do when constructing a survey is to understand who is partaking in the survey process. It is important to use wording that all survey participants understand. For example, the level of what a consultant of ten field related work years understands is different than one who may have only been working for one or two years. When constructing the survey it is important to design each question so that no matter their experience, each consultant feels like they are answering the same question. A great way to create this equalizer is to provide definitions in or before the question statement (Fowler 1995). This may also help to create stronger questions where a conditional question will not be necessary.

While no survey length can be deemed appropriate, using these tips will help to create a streamlined survey process. Asking string and factual questions will determine accurate information in an efficient manner, and may help to reduce the survey in length and complexity.

5. Results and Analysis

The results section of this study will analyze the collected pilot survey and actual survey data as well as the results obtained from the loss data analysis.

5.1 Graphical Data Analysis

Using the loss data provided by Hanover, the group created charts to show where the most frequent losses occur. These charts were divided into categories that are relevant to the property consulting survey. The reason for analyzing this data was to integrate the loss size and frequencies observed by Hanover into our question weighting system.

Figure 2 – Total Loss by Type for Hanover
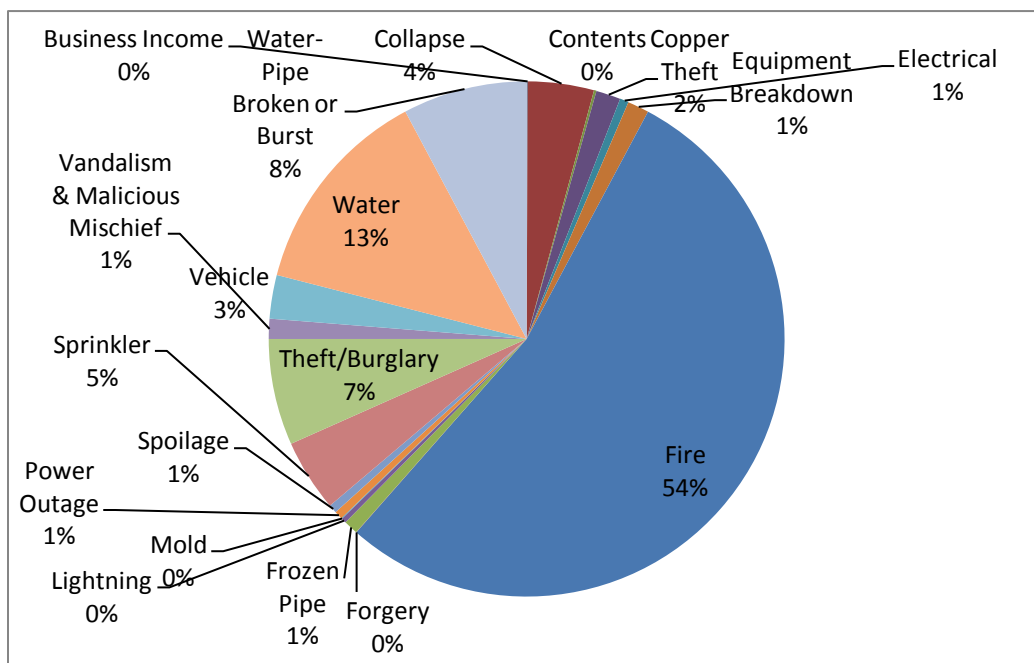
This figure shows where Hanover experiences the most total loss. It is clear that the fire category is outweighing all of the others. There is a 2:1 ratio between fire and combined water categories, representing the next largest category in total loss.

Figure 3 – Average Loss by Type for Hanover
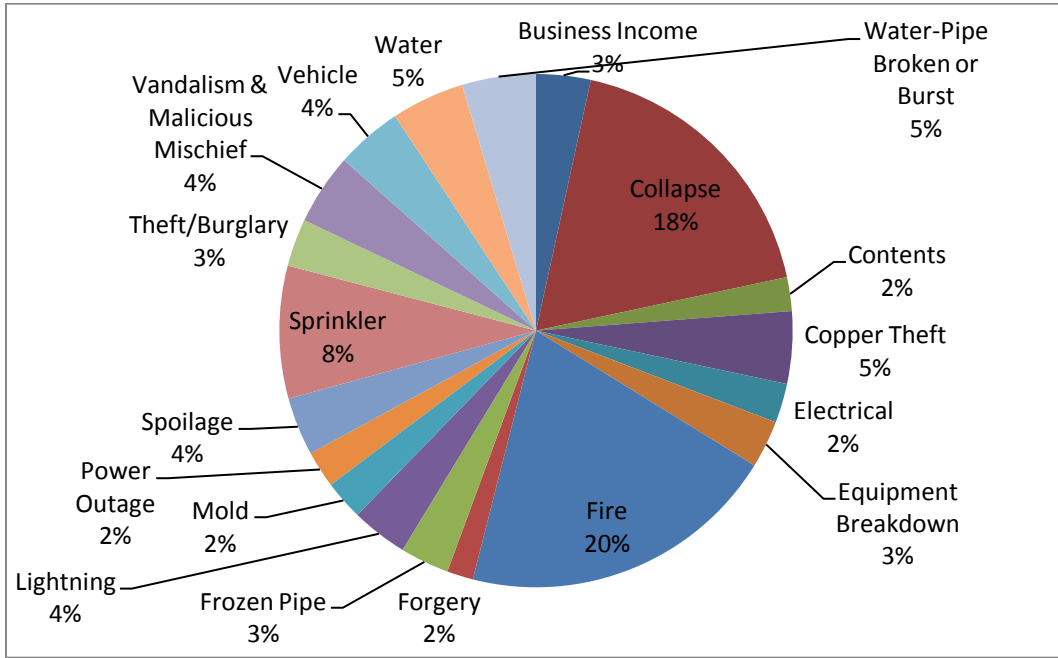
This figure shows the average losses for Hanover which denotes the total loss divided by the number of times that particular loss type has occurred. Once again, fire is one of the leading categories and followed closely by collapse.

Figure 4 – Loss Frequency by Type for Hanover
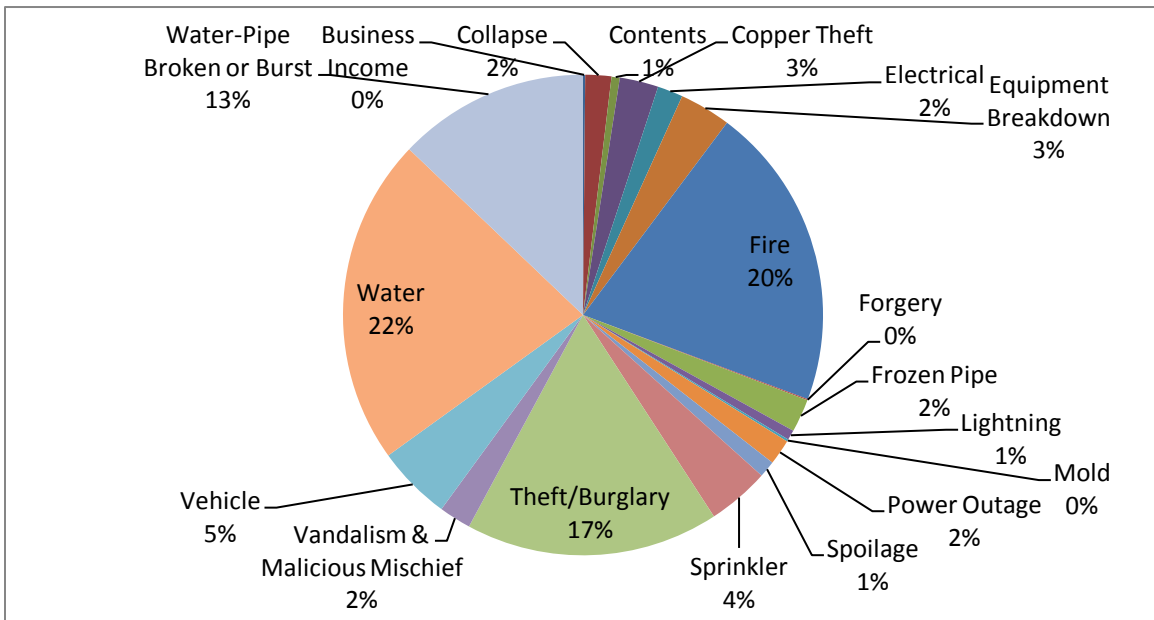
This figure shows the loss by frequency for Hanover. Upon meeting with Chris Beckman, it was determined that this most accurately displays percentages that should be used when ranking categories that associate with property questions.

After reviewing all of these charts, the group realized that some categories had a much higher effect on the losses that Hanover incurs. These categories were ranked in order of 7 at the highest to 1 at the lowest. When each category was matched to a survey question, the group used the corresponding rank to integrate the loss data trends into the question weighting methodology.

5.2 Pilot Survey Analysis

Once the pilot survey participants responded, the data and results were exported into a compiled excel file. This allowed for calculation of means, standard deviations, suggested population sizes, and construction of visuals such as charts and graphs. The ten responses to the pilot survey translated to a 77% response rate. This level of response was not ideal, but allowed the group to complete preliminary calculations that showed the distribution of the responses and created suggested survey population sizes.

After generating the spreadsheet from the SurveyMonkey account, the group observed each respondent's answers to the questions. The total response for each question and the average response for each question were then calculated. Each of the averages were added together to obtain a total sum. Each individual question average was then divided by the total sum. This process created a percentage for each question that denoted the importance of each question in the opinion of the surveyed population. This percentage was a preliminary weight for each question that would be changed based upon observed loss data trends.

The weights from the survey alone appeared to be very close in magnitude. The first reason that these weights did not have a large variation was that the survey respondents believed that each question was of high and equal importance. In graphing a histogram of all of the survey responses, a common trend of responses sat within the 6 or 7 range. The histogram of all survey responses can be viewed in Figure 5 below. The y-axis represents the total number of responses for each particular number rank.

Figure 5 – Question Rating Response Frequency
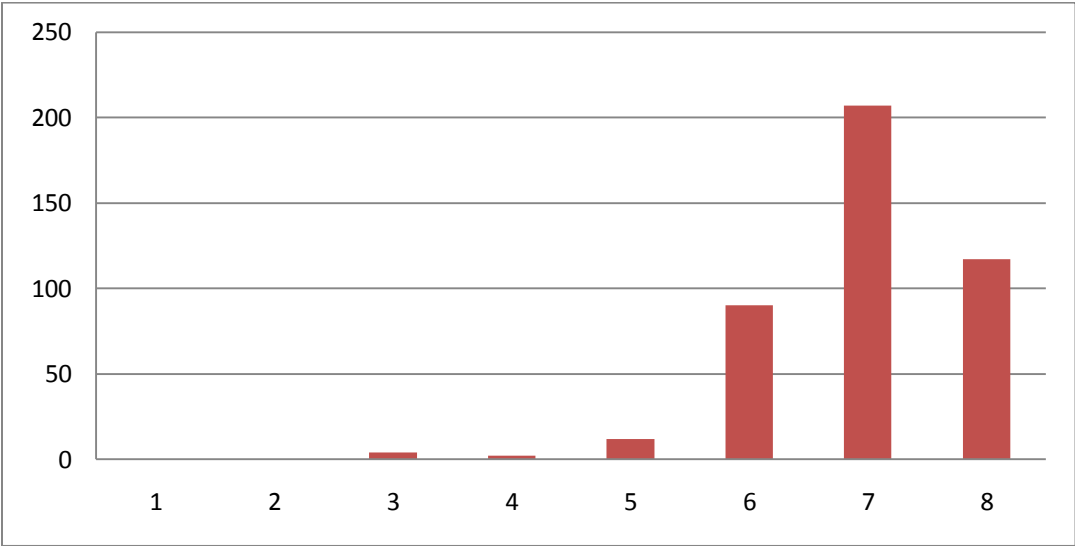
Here it can be seen that in the 7th bin (numerical response 6) has the highest frequency. Also notice that the data is skewed to the right. This means that the respondents put a high weight on the majority of questions, and the variation is not very large.

The second reason that question weights were very similar could have been the large number of questions that the survey actually includes. When determining a percentage for each question weight, the more questions that the survey includes, the more percentage that could be allocated to each question declines. This would make each question automatically equally important or unimportant. The preliminary question weights determined from the pilot data are shown in table 1. They range from 1.52% to

2.37% and have a standard deviation of 0.19%. This is a small range for the question weight differentiation that this project aims to achieve.

Table 1 – Pilot Survey Preliminary Question Weights for Property

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
1.52%	2.29%	2.02%	2.06%	2.02%	1.90%	1.90%	2.37%
Q9	**Q10**	**Q11**	**Q12**	**Q13**	**Q14**	**Q15**	**Q16**
2.37%	2.25%	1.94%	2.14%	2.10%	2.14%	2.02%	2.10%
Q17	**Q18**	**Q19**	**Q20**	**Q21**	**Q22**	**Q23**	**Q24**
2.06%	1.55%	1.87%	1.90%	1.90%	1.94%	2.14%	2.18%
Q25	**Q26**	**Q27**	**Q28**	**Q29**	**Q30**	**Q31**	**Q32**
2.14%	2.10%	2.14%	2.14%	2.18%	2.18%	2.41%	2.37%
Q33	**Q34**	**Q35**	**Q36**	**Q37**	**Q38**	**Q39**	**Q40**
2.18%	2.22%	2.18%	1.67%	2.29%	2.18%	2.14%	2.06%
Q41	**Q42**	**Q43**	**Q44**	**Q45**	**Q46**	**Q47**	**Q48**
2.18%	2.10%	2.06%	1.94%	2.22%	2.10%	2.02%	2.14%

The data categories correlating with each of these questions can be viewed in Appendix 8.3.

After reviewing these weights, the group applied two potential methods for integrating the loss data. The first step in this process was to create category rankings using the loss data from the frequency of loss occurrence. The frequency of loss occurrence was used based upon advice from Chris Beckman, Assistant Vice President of Loss Control at Hanover. The ranks determined are listed in Table 2 below.

Table 2 – Category Rankings

weight	category
7	water and special hazards
6	fire
5	theft
4	electric
3	vacancy
2	collapse
1	business income and contents

The first method used to calculate final weights added the question rankings from the loss data to each correlating survey question average. This method meant that each half of the methodology, data analysis and survey responses, was attributing to 50% of the overall weight. Adding the loss data created a new question weight range of 1.08% to 2.81% and had a standard deviation of 0.45%. This range was larger than the range observed in the preliminary weights determined using only the survey responses. The questions correlating with a higher percentage of loss by frequency, such as water or fire, were now weighted as slightly more important than those correlating with categories like business income or collapse.

The second method used to calculate final weights involved multiplying each survey question average response by the correlating question category ranking. This method also provided an equal use of the data and the survey results, but created a higher level of differentiation in question weights. After completing this last method, the finalized question weights ranged from 0.33% to 3.77% and had a standard deviation of 0.99%. This range was much greater than the previous two and allowed for a larger variation of question weights throughout the survey. The finalized question weights using this method can be seen in Table 3 on the next page.

Table 3 – Final Pilot Question Weights Using Multiplication Method

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
0.34%	3.07%	2.71%	1.38%	1.35%	1.28%	1.28%	1.59%	1.59%	1.51%
Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
0.87%	0.95%	1.88%	1.91%	1.81%	1.88%	2.76%	2.08%	2.92%	2.98%
Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
2.98%	3.04%	3.34%	3.40%	3.34%	3.34%	2.86%	2.92%	2.92%	3.77%
Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40
3.18%	2.92%	2.97%	2.92%	2.24%	3.07%	2.43%	2.39%	2.30%	2.43%
Q41	Q42	Q43	Q44	Q45	Q46	Q47			
2.34%	0.46%	0.43%	0.49%	0.47%	0.45%	0.48%			

The data categories correlating with each of these questions can be viewed in Appendix 8.5.

Figure 6 - Final Question Weight Histogram
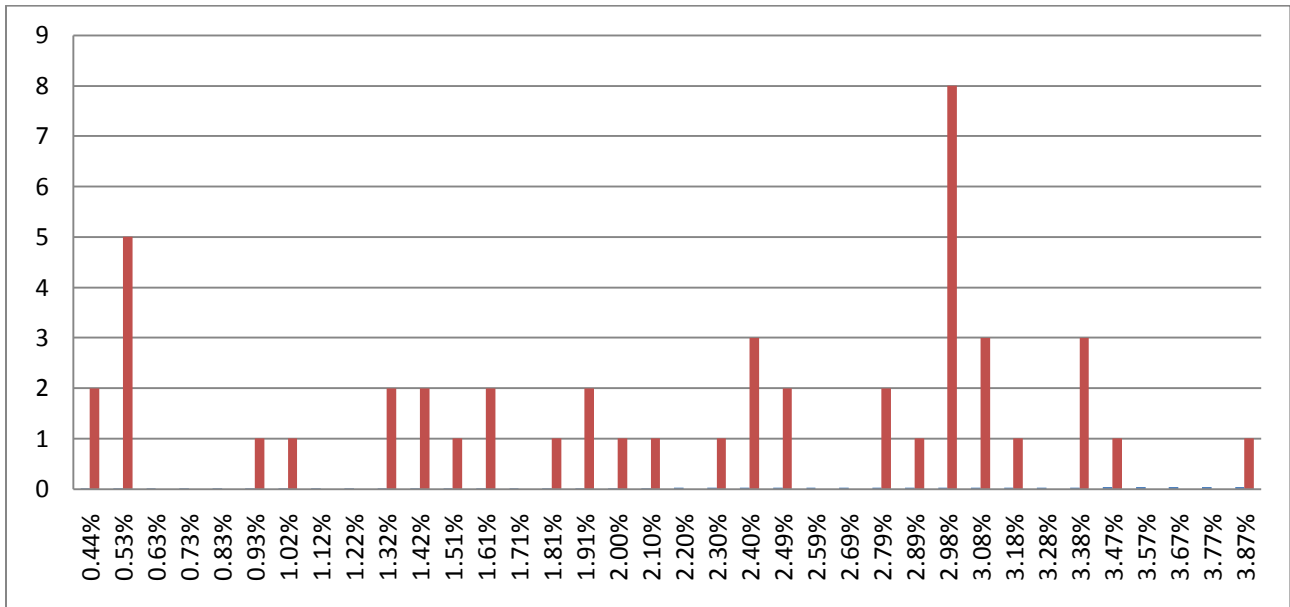
Figure 6 shows the final distribution of all of the multiplied question weights. The wide and even distribution shows that question weights vary throughout the survey and not all questions are of equal importance.

After this methodology was carried out using the pilot data, the team determined that the multiplication method would be used to determine the actual question weights when all survey responses were collected. Figure 6 shows that the goal was reached of having a greater weight for important questions instead of having an equal weight for all

questions. Figure 7 graphs the average question weight by category. The graph shows that the method of multiplying the data ranking with the survey response created higher weights for the most severe categories of loss, such as water or fire, and reduced the importance of areas where little loss occurs, such as collapse or building contents.

Figure 7 – Average Question Weight by Loss Category
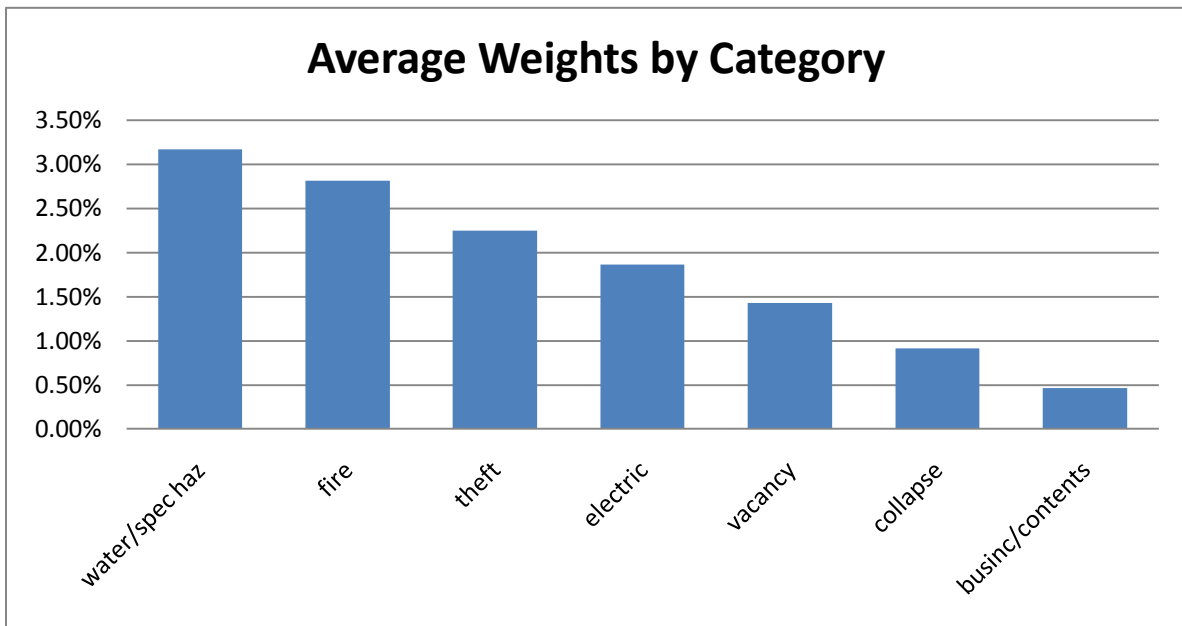
The trend in this graph directly correlates with the loss data ranking. This correlation means that the final question weights are closely aligned with the categories where Hanover has experienced the most loss historically.

There were two main reasons for using the multiplication method. The first was that the reliability of the loss data could be factored into the final weights on a greater level when multiplying. This was important because the loss data shows historical loss trends and because no subjectivity is factored into the data. This helped to accomplish a weighted system where less human bias was involved in the process. The second reason was because the distribution of question weights is expanded when using the multiplication method. A

greater distribution of weights magnifies the importance of vital questions and allows Hanover to potentially eliminate unnecessary questions that are in a lower weight range.

5.3 Adjustments Made

Comments were gathered from the pilot survey allowed the team to make adjustments to the content of the actual survey, which created a streamlined layout. Design of a smoother survey provided the team with a higher and more accurate response from respondents.

The property and workers' compensation reports were altered to include subheadings to separate related questions into categories. Previously, these subheadings were not included to reduce unneeded length. The team received comments that the questions asked were confusing without the context of the entire report. The subheadings were replaced to give the questions enough scope to be understood.

Additionally, some questions from the report were very short and non-descriptive. In these cases, examples of potential answers or causes were included at the end of the question on the property report to provide better understanding of what the question was asking. These examples were removed from the questions to preserve length. However, based on respondent comments about the questions being vague, the examples were re-introduced to clarify the question meanings.

The pilot survey was distributed over four pages. The number rating descriptions were included at the top of each page. One of the comments received was that the respondent became confused further down on the page, forgetting the meanings of the

corresponding numbers. To reduce confusion, the headings for each number were reproduced every ten questions.

Finally, there was concern about the demographic information requested at the beginning of the survey. Among other items, the team asked for the name of the survey taker, which matched survey responses to the participant in order to identify potential biases that individuals might contribute to the loss control process. The respondents voiced discomfort at being asked this information and suggested it be removed from the survey. The team decided to include a line on the demographic page stating that responses were optional but would aid the group in recognizing trends and validating the data, and would not be used for identification purposes. The managers of Hanover insurance would not be able to connect the respondent's answers to their report record.

5.4 Survey Analysis

Invited to participate in our final survey were 65 loss control consultants and 50 Marine underwriters. Our final survey response as of November 29, 2010 was 70 respondents. These respondents make up 63.6% of the population that the survey was sent to, but come close to the ideal 75 participants that we had hoped for.

The group completed the same process using the multiplication method of survey responses and loss data ranking for the actual survey as it did the pilot survey. The final question weights can be seen in Table 4 below. The questions along with their weights and category classifications are presented in Appendix 8.5.

Table 4 – Final Question Weights

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
0.33%	2.94%	2.76%	1.49%	1.50%	1.43%	1.36%	1.56%	1.59%	1.57%
Q11	**Q12**	**Q13**	**Q14**	**Q15**	**Q16**	**Q17**	**Q18**	**Q19**	**Q20**
0.88%	0.91%	1.79%	1.74%	1.81%	1.64%	2.68%	2.36%	2.80%	3.08%
Q21	**Q22**	**Q23**	**Q24**	**Q25**	**Q26**	**Q27**	**Q28**	**Q29**	**Q30**
2.87%	3.33%	3.33%	3.06%	2.79%	3.32%	2.84%	2.89%	2.87%	3.70%
Q31	**Q32**	**Q33**	**Q34**	**Q35**	**Q36**	**Q37**	**Q38**	**Q39**	**Q40**
3.03%	3.02%	3.00%	3.05%	2.66%	3.00%	2.41%	2.35%	2.42%	2.78%
Q41	**Q42**	**Q43**	**Q44**	**Q45**	**Q46**	**Q47**			
2.28%	0.46%	0.45%	0.46%	0.48%	0.48%	0.45%			

These final question weights created a dynamic range for implementation into the AuSum system. The 47 question weights are widely distributed. The weights ranged from 0.33% to 3.70%, which was very similar to the pilot data. The standard deviation is 0.98%. Looking at the final weight distribution there were three clear peaks. The peak closest to the left of Figure 8 correlated with some of the lower ranked categories such as business income or collapse. The middle peak was associated with the middle range loss categories such as electrical issues and vacancy or theft. Finally, the peak all the way to the right would correlate to the fire and water categories, where Hanover experiences the most loss.

Figure 8 – Distribution of Final Question Weights

Final Question Weight Distribution
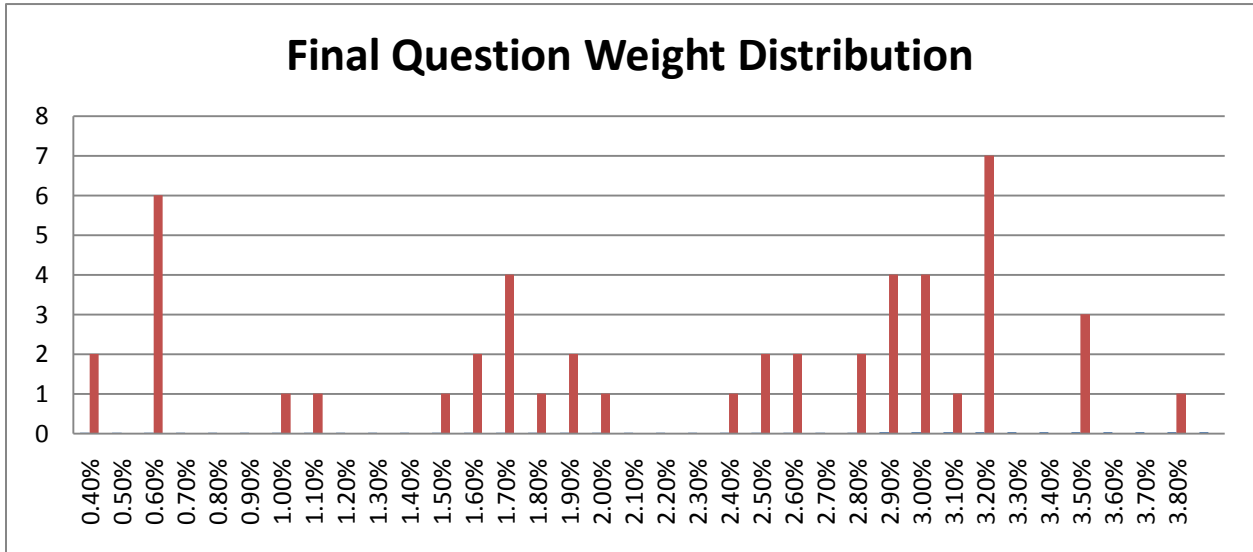
This chart shows the distribution of question weights. On the x-axis is each bin which accounts for weights within 0.1% of each other. On the y-axis is the number of questions with a weight in each range.

In figure 9 the average question weight for each category is shown. These averages have a similar trend to the pilot data where the categories with the highest loss according to the data are weighted the highest on average.

Figure 9 – Average Final Weights by Category
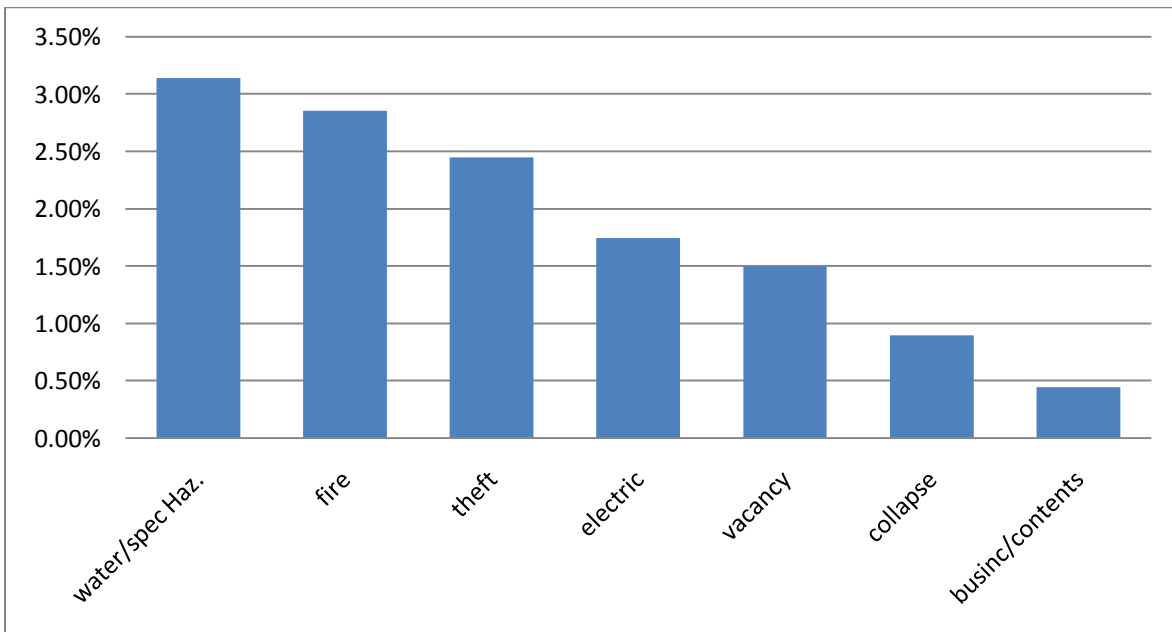
Here on the x-axis is each loss category, and on the y-axis is the average percentage weight.

It is important to note here that there was a discrepancy between the popular opinion of the survey population and the loss data. The loss data by frequency shows that water categories account for the highest loss. The rankings based upon the data put water just ahead of fire, ranking them with importance of 7 and 6 respectively. After a chart that is similar to chart 6 was created using only the survey data average question response, the result showed that fire questions were of higher importance than water. Likewise, the categories of theft and vacancy were both evaluated to be higher than fire and water. This discrepancy could account for the way employees are trained to evaluate properties based upon the loss categories. Since employees value categories that do not have the highest loss frequencies, new training or emphasis on fire protection systems and water related areas may reduce loss. Figure 10 shows the final survey average responses by category. Factoring in the loss data created a dynamic system where the objectivity of the survey was of equal importance as the loss data.

Figure 10 – Average Survey Response by Category
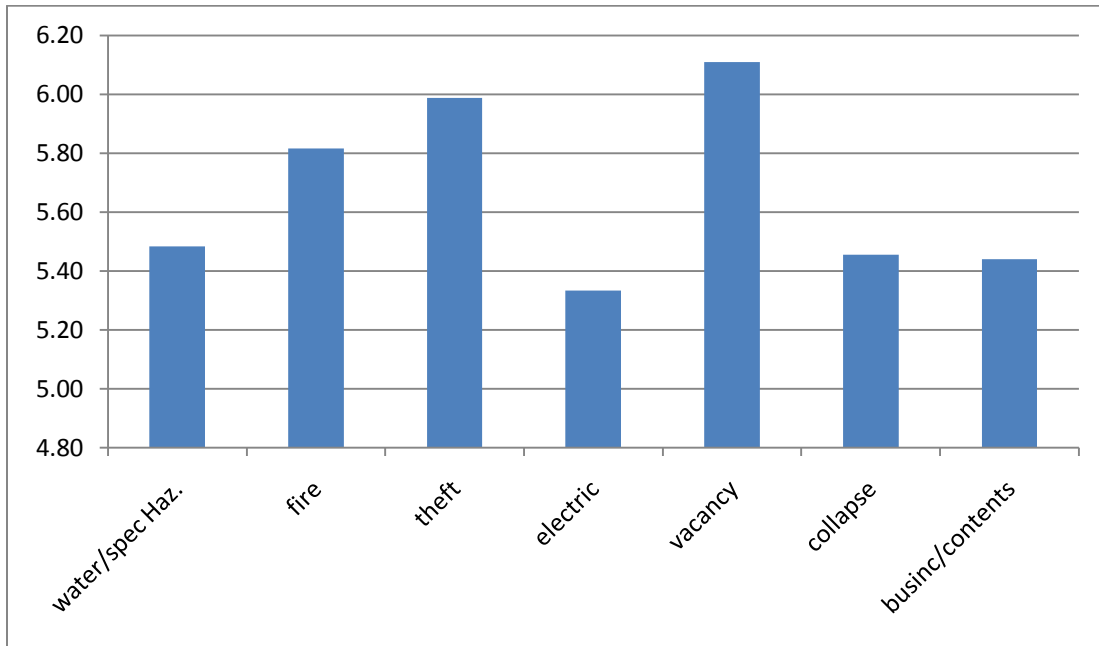
This figure shows the average survey response by category. According to the survey popular opinion, vacancy and theft are the most important categories to evaluate on a field consultation.

Upon completion of the final weighting system, the group achieved two specific goals. First was the goal of creating a wider distribution of question weights for important or unimportant questions. This will allow Hanover to base their risk analysis and risk scoring on meaningful survey questions that also correlate with the highest amounts of loss. The second goal achieved was to offer Hanover a detailed process for creating question weights for other lines of insurance. The team was also able to provide a comparison of the survey population opinion with the loss data information. Discrepancies here may help Hanover implement new evaluation ideas where frequent loss categories are taken into stronger consideration,

6. Conclusions and Recommendations

Upon concluding the methodology and analysis of the results, there are a few recommendations that the project team suggests for The Hanover Group. These recommendations include: the final weights for each question on the property survey, the consideration of re-wording some questions to make them stronger, the potential elimination of some unimportant survey questions, the suggestions for survey reconstruction, the application of killer questions and the recommendation to carry out the proposed methodology for other lines.

It is important to validate the methods used throughout this project before implementing the recommendations that are discussed below. Apply the newly constructed weights to future loss data and analyzing the ensuing increase or decrease in losses. This may be an adequate indicator of the accuracy of the weights and their applicability to the data.

6.1 Question Weights

The final weights for each question can be viewed in Table 4, and have a range of 0.33% to 3.70%. Each weight was formed by integrating actual loss data and professional opinions from survey responses. The weights provide underwriters with information on a property's overall risk score, and can be used to determine an account score for multiple properties of the insured. Because of the dual method approach, the team was able to develop weights for individual questions that may reduce the subjectivity of conducting a survey. The weights correlate to different categories of loss, which the group ranked according to real world loss data.

One benefit of the AuSum system that Hanover will be transferring to is that it includes a scoring feature that can be used to develop risk quality scores for each risk

assessment. Essentially the team has provided Hanover with a weighting system that could be used for the Property line of insurance when developing a risk score. The methods the group used in determining an overall weight have the potential to be extrapolated to other lines of business such as Worker's Compensation and General Liability. The team feels that the integration of both professional opinions and real world data is the best method of determining a weight that can be used to determine an overall risk score.

6.2 Professional Feedback

A number of adjustments to the property survey have the potential to streamline the evaluation process without losing necessary information for the loss control and underwriting departments. The most frequent complaint from the people surveyed was that the property evaluation is lengthy, and is an inconvenience for the field agents. Some of the following suggestions could aid in shortening the length of time required to complete the evaluation.

A variety of the comments indicated an abundance of closed-ended answer selections in the property report. Some field agents would like a set of default question answers already filled out, so only those answers that deviate from the default must be changed. Other agents suggested logic questions to eliminate unnecessary questions. Additionally, using comment boxes as opposed to radio buttons will allow agents to describe specific circumstances or communicate information they believe to be useful to either the underwriting or loss control department.

A number of survey participants claimed that various questions on the report are redundant, as they are asked in other locations, and can be removed without any negative effect to the report. Others indicated that some clusters of questions that all belong to one category could be reduced to one question to eliminate unnecessary questions and shorten the report.

It was clear that the survey respondents recognized a disconnect between the loss control and underwriting departments. Loss control and underwriting utilize the property report differently, and the evaluation as it currently stands is not as useful to underwriting as it is for loss control. This is because the underwriting staff does not require as much in-depth information regarding the property as loss control. Instead, underwriting utilizes a general overview of the property condition to determine the appropriate risk assessment.

It was also mentioned several times that having to switch between windows and leave the property report for additional information is inconvenient. The survey respondents would like an all-in-one evaluation that allows for information retrieval inside the form itself. A number of other comments that did not identify a trend were also collected from the survey and may be useful in applying additional adjustments to the property evaluation. All comments received from the survey are included in Appendix 8.2.

6.3 Question Elimination Suggestion

Shortening the length of the property report is one of the main suggestions the team is proposing for improving the usability of the evaluation. Without eliminating important questions, reducing the number of items on the property evaluations that require a

response minimizes the amount of time the loss control agent requires to complete the evaluation. This allows the underwriter to gain an accurate understanding of the property conditions without excess information. Using graphical means may allow Hanover to establish a baseline weight where all questions with a weight below that point are eliminated from the property evaluation.

A box and whisker plot uses the data, along with five boundary points, to illustrate the dispersion of the data. These plots also show outliers, which are points that appear to deviate from the normal diffusion of the data set. . A method to quickly eliminate questions whose importance has been deemed low through the surveying and loss analysis process is to graph the box and whisker plot and choose a boundary as an elimination point.
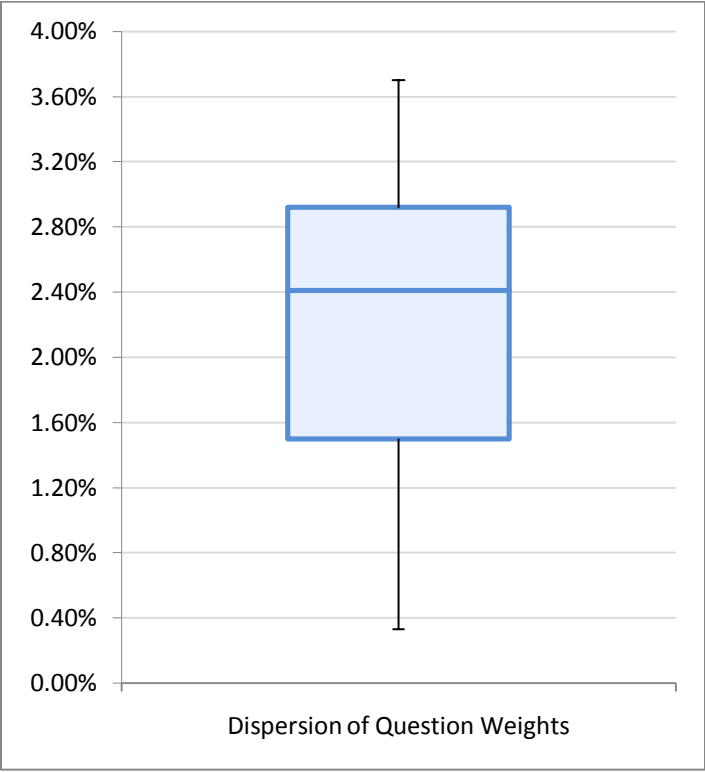
Figure 11: Box and Whisker of Final Question Weights

Figure 11 shows the box and whisker plot that was created to represent the data of the final question weights, which ranged from .33% to 3.70%. There were no outlying questions in the data that could immediately be removed from the property report. If there had been outlying questions only those found below the bottom whisker would have been eliminated. Since the data represents weights of importance regarding the property report questions, the outliers at the top of the graph would represent the most important questions and would therefore not be eliminated.

All points below the lower limit of the box are in the 25th percentile of data points. The 25th percentile, when correlated with the data, represents a weight of 1.5%. If all of the questions that fell below this point were eliminated, the property evaluation would be reduced by twelve questions. Appendix 8.6 illustrates which questions would be eliminated through this method. The majority of these questions are in the business income, collapse, or vacancy categories. To eliminate the business income, collapse, and vacancy categories completely from the evaluation, the lowest 16 questions would be removed.

The number of questions in the property survey influences the weight for each individual question, as the cumulative weight for the property evaluation is 100%. The weights for each question must be recalculated every time questions are added or removed from the evaluation, using the method described by the team. After the suggested 16 questions are eliminated from the evaluation, 3 out of 7 loss categories have been removed. The elimination of entire categories changes the multiplication method. To adjust the weights for the remaining questions, each preliminary weight would now be multiplied by

a number 1 through 4 instead of 1 through 7, in accordance with the question's loss category. The newly adjusted weights are listed in Appendix 8.7.

Using the multiplication method illustrates differences between the opinions of loss control and underwriting employees and the loss data. Through the survey the Hanover employees rated collapse among the lowest importance, and the ultimate weight would lead to the question being removed from the evaluation. In reality, collapse due to water is one of the most significant causes of loss for Hanover. Comparing the question weights to the loss data highlights instances where employee evaluation of the importance of property data does not equate with the information that is most important to reduce losses for Hanover. This is another example of where standard practices in loss control should be reexamined to ensure that field agents are receiving the most up-to-date and evaluative training.

6.4 Killer Question Suggestions

The Vice President of Loss Control, Mike Billings, expressed interest in the possible creation and application of "killer" questions. Killer questions would be questions with weights that automatically set off a warning to lower the risk score for a certain evaluation. After conducting a keyword search of the loss data, it is clear that killer questions can be developed for the two most frequent and costly causes of loss, water and fire.

The fire category of loss accounts for the greatest dollar amount of loss that Hanover experiences. From 2008-2010, fire related events resulted in $101,710,622 of paid loss. As stated in section 4.4.2, a keyword search was done to determine whether or not there were

frequently occurring catalysts for fire events. Within the fire category three frequent causes were found; a fire in an adjacent building that either transferred to an insured's property or resulted in smoke and water damage to an insured's property, heat from laundry room as a catalyst, or electrical systems malfunctioning and starting fires. Adjacent buildings are hard to control if they are not insured by Hanover because the same preventative measures may not be taken at that property. However, because adjacent properties cause losses for insured persons at Hanover, an indication on a report that a neighboring building has flammable contents should be used to identify a killer question. If an adjacent building has flammable contents the risk score should be adjusted to account for that danger.

The next killer question that could be identified would concern electrical systems within insured properties. Any questions on the property evaluation that indicate previous electrical system malfunctions or improperly installed electrical infrastructures should automatically be weighted to account for the potential danger of electrical fire. Prevalence of exposed or faulty wiring would warrant higher risk for Hanover. The last fire starter that was frequently recognized was laundry rooms. Laundry rooms are typically hot and also require a large amount of electricity. A number fires result because of burnt material or electrical failure in laundromats and laundry rooms. If a property survey indicates the presence of a laundry room, a consultant should ensure that the proper controls are in place to avoid a fire.

There are 145 mentions of pipes bursting in the loss data, and burst pipes have accounted for over 3.5 million dollars in loss from 2008 – 2010. Pipes most commonly

burst in attics and basements. Questions regarding exposed pipes would be marked as a killer question if the field agent discovers improperly insulated pipes on the property. This is especially important in cold climates where the likelihood of an incident is heightened.   After burst pipes, water related incidents were most frequently caused by the weather. A potential killer question might relate to the tendency of snow, ice, or high volumes of water to build up on the roofs of properties. A property survey indicating the potential of ice, snow or water to collect on a roof should indicate a killer question that deems the property more of a risk due to the prevalence of collapse under those conditions.

Killer questions would be weighted differently on the property evaluation based on previous loss causes. Indications of electrical malfunction, flammable contents within adjacent buildings, and laundry rooms should either warrant further investigation by a Loss Control Consultant or the adjustment of the risk score for a property based on the dangers those indicators present. Freezing and bursting pipes as well as weather related incidents pose threats as water related events.   Killer questions that automatically indicate a high level of risk based on previous data can be helpful in avoiding large losses in the future as a result of previously known danger.

6.5 Suggestions for Survey Reconstruction

The current survey used to evaluate properties does not contain or follow some of the suggested points for creating a strong survey. The current survey can be seen in

Appendix 8.1. Other than eliminating the questions with a low weight, suggested in section 6.3, there are some adjustments that can be implemented to create a stronger survey.

The first suggestion is to eliminate the conditional questions by using one stronger question, or to make the conditional questions more visually recognizable. Currently the conditional questions on the survey are blended in to the format and appear to look like any other question. The use of phrases such as "if yes then…" or "if no then…" signifies the difference between a conditional question and the rest of the survey. These questions do not stand out in the survey and may create extra time for a consultant to complete the process if they have to look over unnecessary conditional questions. If the questions are altered to be a single strong question, or the conditional part is visually separated, the survey process will be a great deal more efficient.

The second suggestion is to make survey language more universal and less subjective. Current questions sometimes use the word "You" in the question statement. This wording allows the consultants to take ownership in answering the question, using a more opinionated approach rather than an objective and factual approach. Eliminating this factor and using strong, but universal, wording will create an approach where consultants determine question answers on an equal and factual basis. As mentioned in the methodology section, it may also be helpful to add more definitions before question statements, in order to create an equal understanding of all questions between consultants of different experience.

The last suggestion is to continue incorporating yes or no questions and questions with a pre-determined answer set. These questions will allow the consultants to provide

strong and factual information. These types of questions can be used to give underwriters a better impression of what risk will be associated with the surveyed property.

6.6 Application of Method to Other Lines

After completion of this study, a clear method for determining field survey question weights has been defined. The process of applying this method can be used for any insurance line by following the steps outlined below.

The first step in the process is to gather all of the necessary tools and information. In order to complete the creation of question weights the following data and tools will be necessary: access to a SurveyMonkey account, MS Excel spreadsheet for calculations, historical loss data for the insurance line separated into categories, and a desired survey population. After collecting the necessary tools, you can proceed with the methodology.

The beginning step is to complete the data analysis. The procedure for this is as follows:

1. Determine which data category each survey question falls under.
2. Create a pie chart of the frequency of loss for all categories that correlate to survey questions.
3. Determine a rank order of categories based upon the relative frequency percentages.

The second step in the methodology is to complete the survey analysis. The procedure for this step is outlined below.

1. Input all survey questions into a SurveyMonkey survey, using a 7 step Likert scale.

2. Create a pre-survey page asking necessary demographic questions, to validate the user responses.

3. Create a post-survey page asking open-ended questions about what the survey user thinks about the current survey and process.

4. Send the survey to a group of pilot users.

5. Analyze the pilot results.

   a. Input all of the results into an excel spreadsheet.

   b. Calculate each question average response.

   c. Multiply this average by the correlating loss data ranking from above.

   d. Divide each question average by the sum of all averages to obtain each question weighted percent.

   e. Review user comments and adjust the survey accordingly.

6. After adjustments send the survey to the whole population. Complete steps 5a through 5d for the second survey population to obtain the final weights.

7. Apply these final weights in the AuSum system.

This methodology was developed using a method that the project team has created, and like many similar procedures of data collection, there are some associated limitations. These limitations include having a smaller than ideal population size, using a 1 to 7 Likert scale where the survey users may not find an appropriate rating answer, having a lengthy survey that may not yield the most accurate results, and using a multiplication method, where the survey and data analysis methodologies are multiplied so the weights appear greater in importance.

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8. Appendix

8.1 Property Survey

Report Key	Bldg Num Key	Loc Num	Bldg Values	Co Insurance %	100% Bldg Values	MSB Values	ITV Percentage	Contents Values	Contents Pct Cov
Pre fill	Pre fill	Pre fill	Pre fill by request	Pre fill by request	Calc	Entered by LC	Calc		
Building Name/ address	Bldg Num Key	Loc Num	Year Built	Number of Stories	Area sq Ft	Sprinklers %	ISO Class 1	ISO class 2	ISO Class 3	ISO Class 4	ISO class 5	ISO Class 6
Pre fill	Pre Fill	Pre fill				Triggers AS forms?						

Building Construction Information: (Historic registry, elaborate finishes or other issues that would aggravate loss size. Use of EIFS on the building.)

LEED certification for this location?　　　　　　　Yes ● No ● Comment on certification level

Multiple fire divisions at this location?　　　　　　Yes ● No ● <mark>IF yes then next section is conditional</mark>

　　　　　Select the best description for each fire wall/fire barrier between divisions –

> ● indicates a radio button – you can choose only one response

　　　　　☐ 1- Wall is properly rated, and the integrity of the wall, any penetrations and protected openings, is good.

　　　　　☐ 2 - Wall is properly rated, and by completion of reasonable recommendations that do not require a capital expense, the integrity of the wall, any penetrations and protected openings, can be restored from fair to good.

　　　　　☐ 3 - Wall is improperly rated and/or the integrity of the wall, penetrations and protected openings cannot be restored to good without significant capital expense investment.

Diagram is required for locations with multiple fire divisions

　　　　　Is any part of this building vacant or not in active use by the risk?　Yes ●　No ●

If yes, then add these questions

How much of the building is vacant?　　　　Square feet

% of total area (can we calculate this from the value entered in the square foot Value from the BL10 Table?)

How long has the areas been vacant?

Are there realistic prospects for occupancy within 90 – 180 days? Yes ●　No ●

Are utilities maintained to prevent freeze losses?　Yes ●　No ●

Are sprinklers, alarm systems, lighting and other protective systems maintained during this period of vacancy? Yes ●　No ●

If no, comment box for description

Is the area adequately secured against burglary and vandalism?　Yes ●　No ●

How often does the risk visit this location?

Roof

Comments on roof: Multiple levels subject to snow loading, roof top mounted equipment, condition of curbs, condition of edge coping or flashing, presence of skylights, evidence of past leakage

Roof Age   ●1–10 years   ●11-15 years ●16-20 years ● over 20 years-

Roof Type   ● Concrete fill ● Metal sheathing ● Single ply membrane ● Built up roof

                   ● Normal shingle (55 mph) ● Concrete or clay tiles ● Wood shingle ● Rated shingle

Roof maintenance and inspection program

        ● Formal with contractor ● In house documented ●Informal/not documented ●None

Roof condition observed?   ● Yes ● No

Common Hazards

Electrical: (Predominate type of wiring at this facility, what is the over current protection, is wiring in conduit or exposed, any history of problems, missing covers - box cover, panel cover, use of extension cords etc. Describe who maintains systems and maintenance activity)

Have you noted any recurring problems, such as blown fuses, tripped breakers, flickering lights or overheated appliance cords?
                         Yes ● No ●

Have there been any recent changes to the electrical system (i.e., loads added or relocated, equipment upgraded, or equipment failures)?
          Yes ● No ●

Did you observe any missing covers on junction boxes, panels, switches and receptacles? Yes ● No ●

Did you observe any temporary wiring in the electrical room?   Yes ● No ●

Did you observe any combustible material in the electrical room? Yes ● No ●

Did you observe any evidence or moisture or excessive dirt or dust on the outside of the electrical equipment?   Yes ● No ●

Is electrical system older than 30 years?   Yes ● No ●

Most recent update: (Year)

Is there a formal EPM program in place?   Yes ● No ●

Aluminum branch circuit wiring exposure: Yes ● No

Heating: (Describe predominate comfort heating system in place, fuel for system, type of heating units, maintenance of adequate clearance to combustibles.)

Any exposure to temporary or supplemental heating equipment? Yes ● No ●

Comments

Any comfort heating boilers?   Yes ● No ●

Most recent update to heating system: (Year)

Plumbing / Water Damage: (Describe extent and scope of plumbing system, any specialized water treatment or pollution control systems? Any history of back up of sewers and drains? Describe cold weather preparation and precautions to prevent freezing.)

Most recent update to plumbing system?   (Year)

Any sump pump systems?   Yes ● No ●

       Back up power for sump pumps? Yes ☐ No ☐ (CONDITIONAL ON YES TO PRIOR QUESTION)

Is this a residential or habitational risk? ● Yes ● No If yes then the following would appear"

Are washing machines located above the basement level?   ● Yes   ● No

Do washing machines have steel braided water supply hoses?   ● Yes   ● No

Are there any automatic shut offs for water supply to washers?   ● Yes   ● No

Is there a safety pan under the washing machine?   ● Yes   ● No

Are dryer vents and lint filters being cleaned and maintained? ● Yes   ● No

Any occupancy in basement/ lower level that is particularly susceptible to flood or water damage? Yes ● No ● If Yes,

Water lines or sprinklers in unheated attics, overhangs or concealed spaces? Yes ● No ● If Yes,

Is there a history of flooding at this location? Yes ● No ● Comment

Are there potential water bodies exposing this risk to flooding? Yes ● No ● Comment

Smoking, Housekeeping, Maintenance: (Describe building and equipment maintenance, smoking controls and contractor control programs in effect. Is housekeeping effective and appropriate for the occupancy?)

Identified deficiencies in: Maintenance ☐ Smoking Controls ☐ Contractor Controls ☐ Housekeeping ☐ If checked comment would be required

Special Hazard Exposures and Controls

☐ NO SPECIAL HAZARDS PRESENT At THIS LOCATION

☐   Text block to identify hazard   Scale: ● Small ● Large

                                                            Superior ● Satisfactory ● Significant Deficiencies ●

                                                            Details (quantify hazard, location of hazard, major control elements)

Public Protection

Are there hydrants within 1000 feet or our risk?   Yes ● No ●   If No, Comments

Any impediments to FD access or response?   Yes ● No ●   If Yes, Comments

Sprinkler Analysis <mark>(this section would appear for locations with greater than 75% AS)</mark>

Only one of the analysis sections below would remain. The unchecked one would disappear or you could choose the analysis report

☐ Light Hazard or Ordinary Hazard –

         Valves open and secured? Yes ☐ No ☐

         Sprinkler Alarm ● Acceptable ● Improvement Needed   ┌─────────────────┐
                                                                            │ Questions Appear │
         Sprinkler ITM Excellent   │ based on Choice of│
                                                                            │ Light OH or Storage│
                                                                            └─────────────────┘
         Water Supply adequate (Drain test residual greater than elevation + 20 psi?) Yes ☐ No ☐

         Comments on sprinkler protection

☐ Storage, extra hazard detailed analysis performed (Use sprinkler worksheet, ASP, Hydrograph to do analysis – report on results here)

         Valves open and secured? Yes ☐ No ☐

         Water supply Excellent

Sprinkler Design ● Appropriate for the hazard ● Not appropriate for the hazard

Sprinkler Alarm   ● Acceptable ● Improvement Needed

Sprinkler ITM Excellent

Comments on sprinkler protection:

Fire Extinguishers

Are adequate size, type and number of fire extinguishers available throughout? ●Yes ● No

          Comments

Fire Alarm / Detection System Present ● Yes ● No – If no then the following would not appear.

% coverage   Smoke Alarms Hardwired

% Coverage   Smoke alarms battery

% Coverage   Heat Detection

% Coverage   Manual Pull stations

Off premises monitoring of system: None - Local

UL Certificated alarm system: ☐ Yes   ☐ No

Comments:

Burglar Alarm / Security

Describe security / burglary exposure: (Commodity handled, stored or manufactured at this risk. Theft attractiveness of this commodity – location related exposures. Describe three rings of protection for the location- site, building, and objects- Extent of alarm coverage – CCTV coverage and recording)

Target commodities for theft present at this risk? Yes ☐ No ☐ Commodities:

Are security features of Building consistent with occupancy? Yes ☐ No ☐ Comments

Effective burglar alarm system in service at risk?   Yes ☐ No ☐ The next two questions are conditional upon this being yes

Off premises monitoring of system: None - Local

UL Certificated alarm system: ☐ Yes   ☐ No

Business Income / Interruption

Describe BI Exposures and Controls (Bottleneck is production flow, foreign produced or long lead time replacement equipment, interdependencies between locations, raw materials concerns, dependency on vendor or subcontractor, anticipated time for restoration presence of recovery plan)

Are bottleneck / special equipment exposures present? Yes ☐ No ☐ If Yes,

Is there an interdependency issue with another location? Yes ☐ No ☐ If Yes, what location

Is BI / recovery plan in place? Yes ☐ No☐

Are there uncontrolled exposures for this coverage? Yes ☐ No☐

Catastrophe Large Loss Exposures

Do any of the large loss / catastrophe exposures exist at this risk?

Coastal/ Wind ☐ Contamination ☐ Large loss contents ☐ Other ☐ None ☐

Describe large loss catastrophe exposures: (Coastal or wind exposures, interior contamination exposures from asbestos, PCBs etc. Is stock susceptible to condemnation i.e. food, pharmaceuticals, consumer goods)

Internal and External Exposures

What exposure hazards have an adverse impact on this risk? ☐ Internal ☐ External ☐ None

Describe internal exposures at the risk. (Adjacent tenants in multi tenant building that are higher hazard than our risk)

Describe External Exposures at the risk. (Adjacent buildings that could cause a loss at our risk from a fire or event.)

Overall Evaluation

Condition and upkeep of building: Superior ● Satisfactory ● Significant Deficiencies ●

Control of ignition sources: Superior ● Satisfactory ● Significant Deficiencies ●

Combustible loading rating from Table: Can be pre filled from request

Is this consistent with observed conditions?   Yes ● No ● Comments

Continuity of combustibles: Light ● Ordinary ● High ●

Opinion of risk as a sprinklered location: Grading

Opinion of risk as a non-sprinklered location: Grading

8.2 Survey Respondent Comments

Respondent #	Are there any questions on the property report that you feel are particularly subjective? (Please list):
2	Questions concerning effective fire barriers/walls, since Hanover has not issued specific guidelines to use when answering those questions. How much of the property is vacant and for how long is very subjective when one surveys a shopping mall and the contacts are unwilling to provide the exact s.f. of vacant area. Also, what constitutes adequate protection of a vacant building against theft or burglary, when it is adjacent or near to another building occupied by the insured? The roof condition and inspection programs are also subjective because it can be a matter of opinion if a built up roof is in good condition, when it looks weathered but does not leak. The aluminum branch circuit wiring exposure question cannot always be answered definitively because the wiring may be buried in walls and inside electrical box covers. Policyholders may be offended if one asks them to remove such covers. The result is that one has to take their word for it or guess, based on the age of the building. The comfort heating boiler question is redundant, since one already

	describes the building's heating system in the answer to another question. Unless, there is another meaning for comfort heating boilers? The answer to the most recent update to the plumbing system question is subjective, since changing a plumbing fixture could be considered an update or is the question asking if new water supply and sewer lines have been run for these New fixtures?
18	all questions are subjective. This forms seem to take a great deal of time.
49	Adequate security/fire system(s) depends on the operations/contents and should be explained instead of just a check box so the UW can get a good picture of what is going on.
61	I feel a lot of the questions can be answered in the narrative vs a check box and comments. There is a a lot of redundancy on the part of the bottleneck questions- those should only be answered if we have a significant BI exposure- then added as a drop down. Most of the section can be condensed on exposures and focus should be on protection and commodities classification. I think most of the questions can be combined for the electrical and a general comments on the pm maintenance, age, infra red, age etc can all be on one section.
64	Houskeeping Maintenance PML
66	Assessing the general condition of common hazards, heating, plumbing, electrical etc. can be a subjective science.. Age and appearance may be misleading..
68	Opinion of risk
69	Struggle with answering the catastrophe exposure and uncontrolled business interruption questions. LEED might warrant a comment or using the quality of construction variable on the MSB property estimator to address RC exposure? Unless I am able to access the roof (rarely) most of my evaluation will be looking up for obvious water leakage or damage, and or discussion with someone who knows something about it, I also think housekeeping and any overhanging or abraiding vegetation are factors to be strongly considered and noted.
70	Questions such as: Security features of Building consistent with occupancy; Effective burglar alarm system in service at risk; Area Secured Against Burglary and Vandalism; Condition and upkeep of building; Control of ignition sources. These are appropriate subjective questions that rely on the consultant's experience and training.

Respondent	Are there any questions on the property report where the wording

#	makes you feel obliged to answer a particular way? (Please indicate questions):
2	The special hazards general question and specifically the question concerning transformers, especially dry transformers which are present in or near 99% of buildings I survey. Since an evaluation of dry transformer related hazards is almost always done when evaluating common electrical hazards, the question is redundant.
5	continuity of combustibles- always seem to get ordinary rating
7	There are many times where an exact answer is not available (i.e. "aluminum wiring present"), but it forces the user to say a given condition is or is not present.
20	All of them, if the question is on the report, I believe it is important that you respond to it.
69	The susceptibility combustiblty ranking is many times imprecise or does not match the exposure. How is this used by underwriting? I oftentimes feel that I must explain or deviate away from the definitions and descriptions provided.

Respondent #	Please include any comments you have about the content of the property report.
1	Better than the previous report.
2	I believe the new property report is a big improvement over the old one in Aries, considering the type and size of property risks typically written by this insurance company. However, I(have the following comments I'm submitting to help with improving it. The questions asking for a description of the electrical and plumbing systems are not needed, since the answers are always the same. The question should be rewritten in a manner that asks for anything out of the ordinary concerning electrical or plumbing systems or for hazardous conditions identified with each of these common hazards, giving the writer the option of leaving the question blank, if nothing unusual or hazardous is identified during the survey. Also, better descriptions of what constitutes small versus large scale special hazards and better descriptions of what specifics are needed in the description and evaluation of the special hazard. Some special hazards listed in the Table of Contents do not have specific descriptions or entries in the Special hazards Guide.
3	The report could be shortened by just asking if an area is considered adequate and to ask for comments. For example, electrical has many questions which could be

	reduced to (Is the system adequate?) (Age) (Last update). I would also ask the underwriters what are the key questions that they look at when reviewing a report and I suspect they would help reduce this and other reports down to a much shorter report.
5	need a property short from separate from prospective account form
6	Much better than the old property report.
7	Overall, I think it does a good job of covering the most important aspects of a property exposure.
8	Need to direct the consultant to observe more operational activities and not just fire protection systems evaluations.
11	Prefilling all of these questions with the default answerers would speed up the process of completing the report, but still provide the consultant with reminders of things that should be considered. The consult then needs to only change the few that are not the default answers and add comments.
13	Many times a simple yes or no does not apply, there should be a "see comments" button.
18	It is a problem when you have a leased building and the risk occupies a small amount of the building. Usually you cannot get all the information to fill out this form.
20	I would like to see a report where there is more exception reporting. We are much more valuable to the company and our insured's in the field, not in an office doing paperwork.
42	On the underwriting side we must produce a PML. Frequently reports does not include a PML or if there is a PML shown, there's no information to show how the surveyor developed the PML.
46	I think every question you presented is very important in its own way.
53	Electrical questions aren't needed. They should be addressed in the narrative section if observed during the survey.
56	Could cut down the number of questions in specific area- example: body of water exposing risk & history of flooding? Seems answering one would address both. Electrical has some of the same redundancy.
58	The property section is too lengthy in questions of minor obvious nature that the Loss Control Representative would address if a negative issue is present. Removal of minor questions should be considered and an option (drop down) available.

	Replacement with a fill the check box concept is just as lengthy and should be avoided as well. Examples may include are sprinkler valves locked or tamper alarms provided? If there was a discrepancy this would be a recommendation. Underwriting is probably not interested in Loss Control standards.
59	Use of building may weigh report. for example will an office building get a better grading than a warehouse because of what it is rather than the condition of property. for example we could have a poor office building but because it is a lighter hazard grade the report grading may be better than a good warehouse.
61	I think the special hazards section should be expanded and High pile storage worksheet should be completed. A separate form such as a short form should be applicable for residential exposures since the vary so much from commercial and do to several new segment- habitation is more and more common.
63	Off all our forms, the property forms have had the most updating and are therefore in the best shape.
64	Certain sections should have a link that take you to the appropriate forms to obtain the additional information such as the sprinkler, TIV. You should not have to come out of the report to do an additional form.
66	Lengthy form considering the number of buildings, locations and multiple coverage lines we must evaluate. Please consider that this is only one coverage line.. We spend too much time writing reports and oftentimes provide superfluous information not needed by the u/w. They want a general assessment, not a laundry list of things that are ok.. We should streamline the report and retain a short form for smaller premium accounts and those of lower risk grade.
68	The property report does not have the location visited easily identifiable. If the report showed the location visited at the front end, then the UW could identify it with ease.
69	what is a comfort boiler? Do you mean a boiler for space heating such as a dormitory? I am familiar with package boilers used in food manufacturing and other applications; these are often times similar pieces of equipment: low-pressure, steam tube, gas or oil fired boilers.

8.3 Question with Category Breakdown

1	LEED certification for this location?	X
2	Multiple fire divisions at this location?	Fire

3	Select the best description for each fire wall/fire barrier between divisions	Fire
4	Is any part of this building vacant or not in active use by the risk?	Vacancy
5	How much of the building is vacant?	Vacancy
6	How long has the areas been vacant?	Vacancy
7	Are there realistic prospects for occupancy within 90 – 180 days	Vacancy
8	Are utilities maintained to prevent freeze losses	Vacancy
9	Are sprinklers, alarm systems, lighting and other protective systems maintained during this period of vacancy?	Vacancy
10	Is the area adequately secured against burglary and vandalism	Vacancy
11	Roof condition observed?	Collapse
12	Roof maintenance and inspection program	Collapse
13	How important do you believe the electrical observation questions on the property report are to the risk assessment?	Electrical
14	Aluminum branch circuit wiring exposure	Electrical
15	Is electrical system older than 30 years?	Electrical
16	Is there a formal EPM program in place?	Electrical
17	Any exposure to temporary or supplemental heating equipment?	Fire
18	Any comfort heating boilers?	Fire
19	Most recent update to plumbing system?	Water
20	Any occupancy in basement/ lower level that is particularly susceptible to flood or water damage?	Water
21	Any sump pump systems?	Water
22	Is there a history of flooding at this location?	Water
23	Are there potential water bodies exposing this risk to flooding?	Water
24	Is this a residential or habitation risk?	Water
25	How important do you believe habitation water damage exposure questions on the property report are to the risk assessment?	Water
26	Water lines or sprinklers in unheated attics, overhangs or concealed	Water

	spaces	
27	Is housekeeping effective and appropriate for the occupancy	Fire
28	Are there hydrants within 1000 feet or our risk?	Fire
29	Any impediments to FD access or response?	Fire
30	Are there special hazards present at this location?	Special Hazards
31	Sprinkler valves open and secured (ordinary/light hazard)?	Fire
32	Sprinkler Alarm acceptable (Any hazard type)?	Fire
33	Water Supply adequate (any hazard type)?	Fire
34	Sprinkler Design appropriate for hazard?	Fire
35	Are adequate size, type and number of fire extinguishers available throughout?	Fire
36	Fire Alarm / Detection System Present?	Fire
37	Target commodities for theft present at this risk?	Theft
38	Are security features of Building consistent with occupancy	Theft
39	Effective burglar alarm system in service at risk?	Theft
40	Off premises monitoring of alarm system (if present)?	Theft
41	Are bottleneck / special equipment exposures present?	Theft
42	Is there an interdependency issue with another location?	Business Income
43	Is Business Income / recovery plan in place?	Business Income
44	Are there uncontrolled exposures for this coverage?	Business Income
45	Do any of the large loss / catastrophe exposures exist at this risk?	Business Income
46	Is stock susceptible to condemnation? (i.e. food, pharmaceuticals, consumer goods)	X
47	What exposure hazards have an adverse impact on this risk (Internal/External)?	Contents

8.4 All Questions with Final Weights

Ordered by Question

1	LEED certification for this location?	0.33%
2	Multiple fire divisions at this location?	2.94%
3	Select the best description for each fire wall/fire barrier between divisions	2.76%
4	Is any part of this building vacant or not in active use by the risk?	1.49%
5	How much of the building is vacant?	1.50%
6	How long has the areas been vacant?	1.43%
7	Are there realistic prospects for occupancy within 90 − 180 days	1.36%
8	Are utilities maintained to prevent freeze losses	1.56%
9	Are sprinklers, alarm systems, lighting and other protective systems maintained during this period of vacancy?	1.59%
10	Is the area adequately secured against burglary and vandalism	1.57%
11	Roof condition observed?	0.88%
12	Roof maintenance and inspection program	0.91%
13	How important do you believe the electrical observation questions on the property report are to the risk assessment?	1.79%
14	Aluminum branch circuit wiring exposure	1.74%
15	Is electrical system older than 30 years?	1.81%
16	Is there a formal EPM program in place?	1.64%
17	Any exposure to temporary or supplemental heating equipment?	2.68%
18	Any comfort heating boilers?	2.36%
19	Most recent update to plumbing system?	2.80%
20	Any occupancy in basement/ lower level that is particularly susceptible to flood or water damage?	3.08%
21	Any sump pump systems?	2.87%
22	Is there a history of flooding at this location?	3.33%

23	Are there potential water bodies exposing this risk to flooding?	3.33%
24	Is this a residential or habitation risk?	3.06%
25	How important do you believe habitational water damage exposure questions on the property report are to the risk assessment?	2.79%
26	Water lines or sprinklers in unheated attics, overhangs or concealed spaces	3.32%
27	Is housekeeping effective and appropriate for the occupancy	2.84%
28	Are there hydrants within 1000 feet or our risk?	2.89%
29	Any impediments to FD access or response?	2.87%
30	Are there special hazards present at this location?	3.70%
31	Sprinkler valves open and secured (ordinary/light hazard)?	3.03%
32	Sprinkler Alarm acceptable (Any hazard type)?	3.02%
33	Water Supply adequate (any hazard type)?	3.00%
34	Sprinkler Design appropriate for hazard?	3.05%
35	Are adequate size, type and number of fire extinguishers available throughout?	2.66%
36	Fire Alarm / Detection System Present?	3.00%
37	Target commodities for theft present at this risk?	2.41%
38	Are security features of Building consistent with occupancy	2.35%
39	Effective burglar alarm system in service at risk?	2.42%
40	Off premises monitoring of alarm system (if present)?	2.78%
41	Are bottleneck / special equipment exposures present?	2.28%
42	Is there an interdependency issue with another location?	0.46%
43	Is Business Income / recovery plan in place?	0.45%
44	Are there uncontrolled exposures for this coverage?	0.46%
45	Do any of the large loss / catastrophe exposures exist at this risk?	0.48%
46	Is stock susceptible to condemnation? (i.e. food, pharmaceuticals, consumer goods)	0.48%
47	What exposure hazards have an adverse impact on this risk (Internal/External)?	0.45%

8.5 All Questions with Weights and Categories

Ordered by Weight

30	Are there special hazards present at this location?	3.70%	Special Hazards
22	Is there a history of flooding at this location?	3.33%	Water
23	Are there potential water bodies exposing this risk to flooding?	3.33%	Water
26	Water lines or sprinklers in unheated attics, overhangs or concealed spaces	3.32%	Water
20	Any occupancy in basement/ lower level that is particularly susceptible to flood or water damage?	3.08%	Water
24	Is this a residential or habitational risk?	3.06%	Water
34	Sprinkler Design appropriate for hazard?	3.05%	Fire
31	Sprinkler valves open and secured (ordinary/light hazard)?	3.03%	Fire
32	Sprinkler Alarm acceptable (Any hazard type)?	3.02%	Fire
33	Water Supply adequate (any hazard type)?	3.00%	Fire
36	Fire Alarm / Detection System Present?	3.00%	Fire
2	Multiple fire divisions at this location?	2.94%	Fire
28	Are there hydrants within 1000 feet or our risk?	2.89%	Fire
29	Any impediments to FD access or response?	2.87%	Fire
21	Any sump pump systems?	2.87%	Water
27	Is housekeeping effective and appropriate for the occupancy	2.84%	Fire
19	Most recent update to plumbing system?	2.80%	Water
25	How important do you believe habitational water damage exposure questions on the property report are to the risk assessment?	2.79%	Water
40	Off premises monitoring of alarm system (if present)?	2.78%	Theft
3	Select the best description for each fire wall/fire barrier between divisions	2.76%	Fire
17	Any exposure to temporary or supplemental heating equipment?	2.68%	Fire
35	Are adequate size, type and number of fire extinguishers available throughout?	2.66%	Fire

39	Effective burglar alarm system in service at risk?	2.42%	Theft
37	Target commodities for theft present at this risk?	2.41%	Theft
18	Any comfort heating boilers?	2.36%	Fire
38	Are security features of Building consistent with occupancy	2.35%	Theft
41	Are bottleneck / special equipment exposures present?	2.28%	Theft
15	Is electrical system older than 30 years?	1.81%	Electrical
13	How important do you believe the electrical observation questions on the property report are to the risk assessment?	1.79%	Electrical
14	Aluminum branch circuit wiring exposure	1.74%	Electrical
16	Is there a formal EPM program in place?	1.64%	Electrical
9	Are sprinklers, alarm systems, lighting and other protective systems maintained during this period of vacancy?	1.59%	Vacancy
10	Is the area adequately secured against burglary and vandalism	1.57%	Vacancy
8	Are utilities maintained to prevent freeze losses	1.56%	Vacancy
5	How much of the building is vacant?	1.50%	Vacancy
4	Is any part of this building vacant or not in active use by the risk?	1.49%	Vacancy
6	How long has the areas been vacant?	1.43%	Vacancy
7	Are there realistic prospects for occupancy within 90 – 180 days	1.36%	Vacancy
12	Roof maintenance and inspection program	0.91%	Collapse
11	Roof condition observed?	0.88%	Collapse
46	Is stock susceptible to condemnation? (i.e. food, pharmaceuticals, consumer goods)	0.48%	X
45	Do any of the large loss / catastrophe exposures exist at this risk?	0.48%	Bus Inc
44	Are there uncontrolled exposures for this coverage?	0.46%	Bus Inc
42	Is there an interdependency issue with another location?	0.46%	Bus Inc
47	What exposure hazards have an adverse impact on this risk (Internal/External)?	0.45%	Contents
43	Is Business Income / recovery plan in place?	0.45%	Bus Inc
1	LEED certification for this location?	0.33%	X

8.6 Potential Eliminated Questions

9*	Are sprinklers, alarm systems, lighting and other protective systems maintained during this period of vacancy?	1.59%	Vacancy
10	Is the area adequately secured against burglary and vandalism	1.57%	Vacancy
8	Are utilities maintained to prevent freeze losses	1.56%	Vacancy
5	How much of the building is vacant?	1.50%	Vacancy
4	Is any part of this building vacant or not in active use by the risk?	1.49%	Vacancy
6	How long has the areas been vacant?	1.43%	Vacancy
7	Are there realistic prospects for occupancy within 90 – 180 days	1.36%	Vacancy
12	Roof maintenance and inspection program	0.91%	Collapse
11	Roof condition observed?	0.88%	Collapse
46	Is stock susceptible to condemnation? (i.e. food, pharmaceuticals, consumer goods)	0.48%	X
45	Do any of the large loss / catastrophe exposures exist at this risk?	0.48%	Bus Inc
44	Are there uncontrolled exposures for this coverage?	0.46%	Bus Inc
42	Is there an interdependency issue with another location?	0.46%	Bus Inc
47	What exposure hazards have an adverse impact on this risk (Internal/External)?	0.45%	Contents
43	Is Business Income / recovery plan in place?	0.45%	Bus Inc
1	LEED certification for this location?	0.33%	X

* Questions in blue would not be removed from the survey unless the entire Vacancy category was eliminated

8.7 Adjusted Question Weights after Question Elimination

1	Eliminated - LEED certification for this location?	
2	Multiple fire divisions at this location?	3.55%
3	Select the best description for each fire wall/fire barrier between divisions	3.34%
4	Eliminated - Is any part of this building vacant or not in active use by the risk?	
5	Eliminated - How much of the building is vacant?	
6	Eliminated - How long has the areas been vacant?	
7	Eliminated - Are there realistic prospects for occupancy within 90 − 180 days	
8	Eliminated - Are utilities maintained to prevent freeze losses	
9	Eliminated - Are sprinklers, alarm systems, lighting and other protective systems maintained during this period of vacancy?	
10	Eliminated - Is the area adequately secured against burglary and vandalism	
11	Eliminated - Roof condition observed?	
12	Eliminated - Roof maintenance and inspection program	
13	How important do you believe the electrical observation questions on the property report are to the risk assessment?	1.08%
14	Aluminum branch circuit wiring exposure	1.05%
15	Is electrical system older than 30 years?	1.10%
16	Is there a formal EPM program in place?	.99%
17	Any exposure to temporary or supplemental heating equipment?	3.24%
18	Any comfort heating boilers?	2.85%
19	Most recent update to plumbing system?	3.86%
20	Any occupancy in basement/ lower level that is particularly susceptible to flood or water damage?	4.26%
21	Any sump pump systems?	3.97%
22	Is there a history of flooding at this location?	4.60%
23	Are there potential water bodies exposing this risk to flooding?	4.60%

24	Is this a residential or habitational risk?	4.22%
25	How important do you believe habitational water damage exposure questions on the property report are to the risk assessment?	3.85%
26	Water lines or sprinklers in unheated attics, overhangs or concealed spaces	4.58%
27	Is housekeeping effective and appropriate for the occupancy	3.44%
28	Are there hydrants within 1000 feet or our risk?	3.50%
29	Any impediments to FD access or response?	3.47%
30	Are there special hazards present at this location?	5.11%
31	Sprinkler valves open and secured (ordinary/light hazard)?	3.67%
32	Sprinkler Alarm acceptable (Any hazard type)?	3.66%
33	Water Supply adequate (any hazard type)?	3.63%
34	Sprinkler Design appropriate for hazard?	3.68%
35	Are adequate size, type and number of fire extinguishers available throughout?	3.21%
36	Fire Alarm / Detection System Present?	3.63%
37	Target commodities for theft present at this risk?	2.33%
38	Are security features of Building consistent with occupancy	2.28%
39	Effective burglar alarm system in service at risk?	2.34%
40	Off premises monitoring of alarm system (if present)?	2.69%
41	Are bottleneck / special equipment exposures present?	2.21%
42	Eliminated - Is there an interdependency issue with another location?	
43	Eliminated - Is Business Income / recovery plan in place?	
44	Eliminated - Are there uncontrolled exposures for this coverage?	
45	Eliminated - Do any of the large loss / catastrophe exposures exist at this risk?	
46	Eliminated - Is stock susceptible to condemnation? (i.e. food, pharmaceuticals, consumer goods)	
47	Eliminated - What exposure hazards have an adverse impact on this risk (Internal/External)?	

These new weights were calculated after eliminating 16 questions from the evaluation instead of the original 12.

8.8 Question Creation Chart

Survey Question Types

Question Type	Uses	Advantages	Disadvantages	Examples
Open-ended (essay or short-answer)	• Discover relevant issues • Obtain a full range of responses • Explore respondents' views in-depth	• Identifies issues most relevant to respondents • Generates new ideas about topic • Clarifies respondents' positions • Provides detail and depth	• Requires more time, thought, and communication skill to complete • Requires time-consuming data entry • May generate incomplete or irrelevant data • Complicates data summary and analysis	1. Describe the steps you took to prepare for your last exam. 2. What did you enjoy most about this course?
Close-ended (multiple-choice or yes/no)	• Ask many questions in a short time period • Assess learning or attitudes when issues are clear • Measure knowledge or ability	• Fast and easy to complete • Enables automated data entry • Facilitates data analysis and summary of data	• Limits response options • May omit a preferred answer • Requires moderate knowledge of the topic to write appropriate questions and responses • Lacks detail and depth	1. Which aspect of the course do you feel is most effective (mutually exclusive)? a. Lecturing by instructor b. In-class interactive exercises c. Assigned readings d. In-class videos 2. Which aspect of the course is effective (not mutually exclusive)? a. Lecturing by instructor b. In-class interactive exercises c. Assigned readings d. In-class videos
Partial open-ended (multiple-choice with 'other' option)	• Ask many questions in a short time period • Assess learning or attitudes when issues are clear and identifiable • Discover relevant issues	• Enables respondents to create their own response if choices do not represent their preferred response • Generates new ideas about topic • Fast and easy to complete	• Requires moderate knowledge of the topic to write appropriate questions and responses • Lacks detail and depth • Complicates data analysis and summary	Which aspect of the course do you feel is most effective? a. Lecturing by instructor b. In-class interactive exercises c. Assigned readings d. In-class videos e. Other (specify) ____
Scaled	• Determine the degree of a response, opinion, or position	• Provides a more precise measure than yes/no or true/false items • Fast and easy to complete • Enables automated data entry	• Requires moderate knowledge of the topic to write appropriate questions	Re-reading the text improves my performance on exams. a. Strongly agree b. Agree c. Neutral d. Disagree e. Strongly disagree
Ranking	• Determine the relative importance to respondents of various options • Choose among various options	• Allows respondents to indicate the relative importance of choices • Enables automated data entry	• More difficult to answer • Limits number of response options • May omit a respondent's preferred answer	Rank the following activities in this course by how engaging you found them to be (1 = the most engaging) __Reading the textbook __Listening to the instructor lecture __Watching videotapes in class __Writing the term paper

Commercial Loss Control at Hanover: Constructing a Weighted Risk Evaluation System

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John Mulhern, MGE WPI '11
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Sponsors at the Hanover Insurance Group: Chris Beckman, Mike Billings, Richard Tackett

Faculty advisors: Justin Wang and Wanli Zhao

December 15, 2010

Agenda

- Introduction
- Methodologies
- Limitations
- Analysis
- Results
- Recommendations

Introduction

Introduction

- Problem:
  - High losses in many repeating areas
  - Property consulting survey is not at the quality level desired
  - ARIES system has no feature to calculate a total risk score
- Solution:
  - Implement a new system to create a higher quality risk evaluation system
  - The AuSum system used to develop a risk quality score for each risk assessment
  - Our team has developed a weighted system to score each property consulting survey question

Methodologies

SURVEY

DATA ANALYSIS

CONSTRUCTING A STRONG SURVEY

FINAL WEIGHT CONSTRUCTION

Approaches

Survey Methodology	Data Analysis

○ Survey Construction
○ Pilot Survey
○ Adjustments
○ Actual Survey
	○ Loss by Type
	  × Frequency
	  × Quantity
	○ Keyword Filter
	  × Loss Summary
	○ Rank by Category

Weight Construction

- Weights from Survey
- Weights adding
- Weights multiplying

- Differences in distribution and range

Constructing a Strong Survey

- Factual, interpretive, and evaluative questions
- Determine objective
- Universal language
  - Every question interpreted the same no matter consultant experience
  - Use definitions prior to question statements
- Open-ended vs. Close-ended questions
- Filter or Contingency questions
- Question order and visual flow

Limitations

- Population Size
- Question Rating Scale
- Survey Length
- Correlation of category rank with popular opinion
- Multiplication
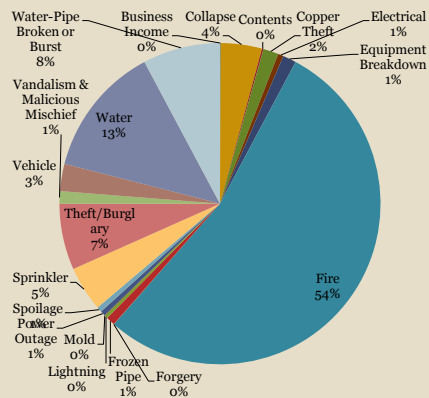
Analysis

GRAPHICAL ANALYSIS
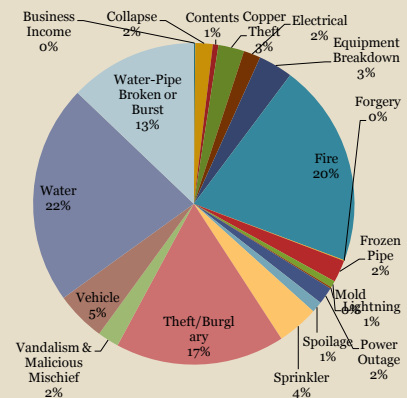
SURVEY ANALYSIS

Graphical Analysis

- Graphical Analysis
  - Loss by type, frequency, and size
  - Frequency – Water accounts for more categories
- Rank: 7- water and special hazards
  6 - fire
  5 - theft
  4 - electric
  3 - vacancy
  2 - collapse
  1 - business income and contents

Loss Data Charts
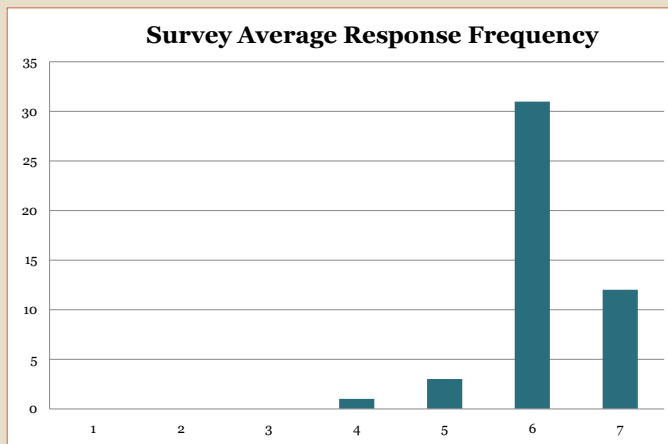
Total Loss

Loss Frequency

Survey Response

- 70 responses for a 60% response rate
- Originally wanted 73 out of 75 responses
- Compile responses in excel
  - Calculate average response for each question
  - Distribution did not vary as seen on next slide
- Made adjustments based on user feedback

Response Frequency

Survey Average Response Frequency

Results

FINAL WEIGHTS

DISTRIBUTION

Final Question Weights

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
0.33%	2.94%	2.76%	1.49%	1.50%	1.43%	1.36%	1.56%	1.59%	1.57%
Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
0.88%	0.91%	1.79%	1.74%	1.81%	1.64%	2.68%	2.36%	2.80%	3.08%
Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
2.87%	3.33%	3.33%	3.06%	2.79%	3.32%	2.84%	2.89%	2.87%	3.70%
Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40
3.03%	3.02%	3.00%	3.05%	2.66%	3.00%	2.41%	2.35%	2.42%	2.78%
Q41	Q42	Q43	Q44	Q45	Q46	Q47			
2.28%	0.46%	0.45%	0.46%	0.48%	0.48%	0.45%			

Results - Distribution

Final Question Weight Distribution
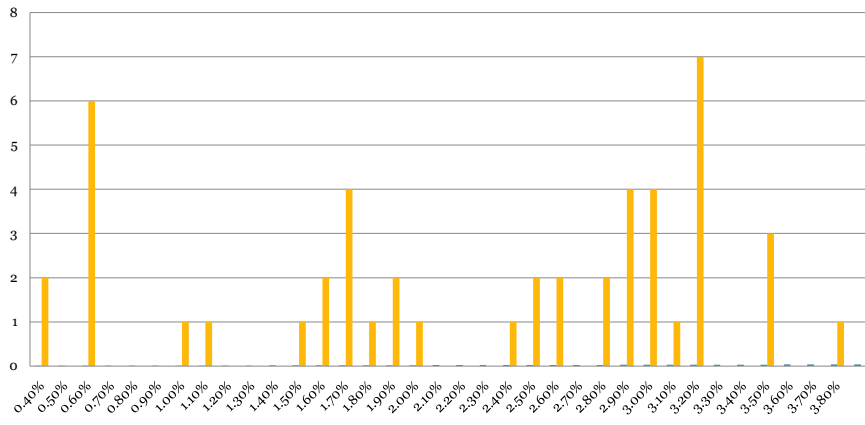
Recommendations

USER FEEDBACK

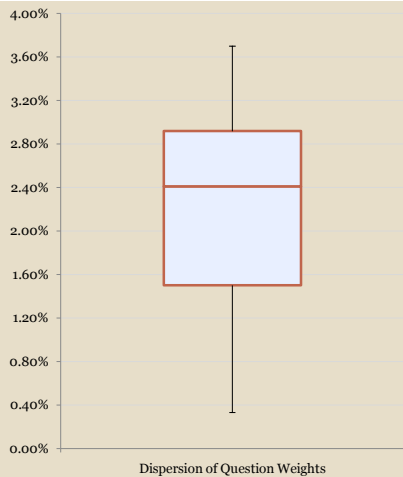**REDUCE SURVEY LENGTH**

KILLER QUESTIONS

APPLYING METHODS TO OTHER LINES

User Feedback

- Answer Options
  - Default Answers
  - Logic Questions
  - Comment Boxes
- Redundant Questions, Question Clusters
- Loss Control, Underwriting disconnect
- Streamlining Form
  - Outside information-retrieval

Length Reduction

- Lower boundary, Q1
- 1.5% cutoff
- 12 questions eliminated

Dispersion of Question Weights

Killer Questions

- Analysis of loss data through keyword filter
- Keywords for main loss categories looked at
- Water
  - Insulated/Uninsulated, Leak
- Fire
  - Adjacent buildings, electrical room

Applying Methods to Other Lines – Data Analysis

- Categorize each report question

- Chart frequency of loss by category

- Rank categories by frequency
  - 1 for lowest frequency

Applying Methods to Other Lines – Survey Analysis

- Create survey with report questions and 1-7 Likert scale
- Include pre- and post-survey for demographic information and content feedback
- Distribute survey to selected pilot group
- Analyze Pilot Results
- Adjust; Redistribute; Analyze finished survey
- Apply final weights in AuSum

Questions?