OBJECTIVES

fter studying this chapter, you should be able to:

- understand the various options that firms have to collect payments from customers.
- differentiate between the various collection systems, and choose that system best suited to the company's situation.
- collect the basic data necessary for a lockbox study.
- understand how a lockbox model works.

Once a firm has sold a product on credit, the financial manager's attention is turned to receiving cash payment as soon as possible. The credit period offered by the seller is a key source of delay in receiving payment. However, important delays occur even after the customer places the check in the mail. This chapter discusses the types of delays experienced from the time the remittance is mailed until cash is received at the depositing bank. We develop a model approach to designing a system to accelerate the receipt of cash and then design a cash collection system to accelerate the receipt of cash.

FINANCIAL DILEMMA

How Can a Firm Accelerate Its Cash Collections?

Your firm continually experiences a shortage of cash. You offer the same credit terms as your competitors, yet they don't seem to be experiencing the same liquidity problems. As you survey your industry, you discover that all your competitors use a different method of collecting receivables than you do. Your firm uses a very simple system. Invoices are sent with the orders, and a remittance envelope is included. The corporate headquarters' address is preprinted on the remittance envelope with the credit department's post office box number. Mail is delivered to the credit department once each day at about 11:00 A.M. Several clerical employees open the envelopes and key the invoice data and payment amount into your accounts receivable information system. If the payment agrees with the invoice data, the check is separated from the invoice and placed in a stack to be deposited. If the check amount does not reconcile with the invoice data, the check remains with the invoice and another clerical employee begins the reconciliation process. Once the problem is resolved, the check is separated from the invoice and prepared for deposit. By 3:30 P.M., a deposit ticket is prepared for the growing stack of checks, and a deposit is made at a nearby branch of your firm's bank. Although this system has seemingly worked well for the last twenty years, you wonder why your competitors have adopted what is referred to as a lockbox collection system and whether this could have any impact on your cash flow.

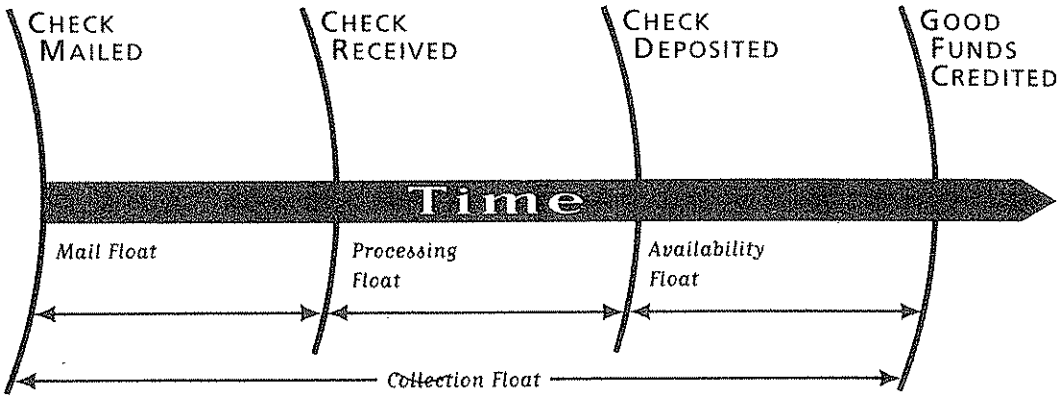
THE CASH FLOW TIMELINE AND CASH COLLECTION

Exhibit 9–1 displays the cash flow timeline detail related to the cash collection problem. As the exhibit shows, three types of delays can occur between the date the check is placed in the mail and the date the deposited check is cleared and cash is actually available in the bank account. The sum of these three types of delays is referred to as **collection float. Float** is the time lag between events.

The first delay is the mail time it takes for a check to arrive at its destination. This is referred to as **mail float,** and the length of the delay is obviously related to the physical distance between the two points. It is also related to holiday periods, weekends, the efficiency of the postal system, and the weather.

Exhibit 9–1

Cash Flow Timeline Related to Cash Collection Float



The second delay is **check processing float**. Once the check is received, it must be processed. That is, the envelope must be opened, the check prepared for deposit, and then the check must be physically deposited in the firm's bank.

The final delay is called **availability float**. The deposited check is not immediately converted into cash. Rather, the depositing bank first estimates the time it will take to deliver the check back to the bank on which the check was written. This is determined by scanning the MICR line printed at the bottom of each check. The MICR line contains the transit routing number that identifies the bank on which the check was written. The depositing bank's computers have a database that is used to assign an availability time to each deposited check. The availability time is the estimated time it will take to clear the check once it is deposited. The depositing bank is obligated to give credit to the deposited checks after the elapse of the availability date even if it has been unable to clear the check.

The problem confronting the financial manager is determining how to design a collection system that addresses each of the three components of collection float. Mail float can be anywhere from one to several days. Processing float can generally range from a few hours to one or more days. Availability float can range from immediate availability to as much as five days if weekends and/or holidays are involved. Thus, the financial manager is probably dealing with collection float from one day, at the very best, to as much as a week or more at the extreme. This may seem trivial until you begin to calculate the opportunity cost of these idle funds. For example, assume a firm has $1 million of daily receipts and these remittances take an average of seven days to clear from the date they are mailed. If the annual opportunity cost of money is 8 percent, then the annual cost is $560,000 ($1,000,000 × 7 × 0.08). This relationship indicates that the firm has an average of $7 million of uncollected funds ($1,000,000 × 7 days) at any point of time during the year. Using an 8-percent opportunity cost, the firm is losing $560,000 annually due to the collection process.

THE COST OF FLOAT

Float refers to the time lag between events. While the time lag is important to the financial manager, the dollar amount of remittances being affected by the time delay is also important. **Dollar-day float** is a measure that incorporates both the time lag and the dollar amount involved. Exhibit 9–2 presents a simple example that shows how to calculate the cost of float. In the example, there are four remittances during a given month totaling

Exhibit 9–2

A Simple Example to Calculate the Cost of Float

Remittances	× Collection float	= Dollar-day float
$ 50,000	× 2	= $ 100,000
1,200,000	× 5	= 6,000,000
500,000	× 7	= 3,500,000
1,000	× 10	= 10,000
$1,751,000		$9,610,000

Average dollar-day float = Dollar-day float/Days in month
= $9,610,000/30
= $320,333.33

Average collection float = Dollar-day float/Remittances
= $9,610,000/$1,751,000
= 5.49 days

Annual cost of float = Average dollar-day float × Rate
= $320,333.33 × 0.08
= $25,626.67

$1,751,000. The dollar-day float related to each remittance is calculated by multiplying each remittance by its associated collection float. The total dollar-day float for the month is $9,610,000. The total dollar-day float divided by the number of days in a month results in an average daily dollar-day float of $320,333.33. The remittances and collection float in the example result in an average of $320,333.33 of idle funds daily throughout the month. If the firm's opportunity investment rate is 8 percent per year, the annual cost of the collection float is $25,626.67, assuming the remittances and collection float are replicated throughout the remaining 11 months.

TYPES OF COLLECTION SYSTEMS

Once a company begins to sell to customers outside of its headquarters city, the problem of collecting payment from geographically dispersed customers becomes an important issue. Should the firm continue to have its customers remit to company headquarters, or should the firm allow its field offices to collect payments? What are the available payment collection alternatives, and what are the advantages and disadvantages associated with these alternatives? This section will discuss the two basic **cash collection systems** available for collecting customer remittances, company processing centers and **lockbox** systems. Since the discussion of company processing centers and lockbox systems focuses on the collection of checks, the section will end with a brief discussion of two alternative collection systems that do not involve checks.

Collection System Cost Factors

Collection systems incur both a fixed cost and a variable cost. Fixed costs include such items as clerical salaries, account maintenance fees, fees charged to transfer balances from the collection bank to another bank, a deposit notification charge, and a deposit charge. Variable costs include a processing charge per item, a charge for encoding each remittance

item, and a deposit charge for each item. A final cost factor is the opportunity cost of float. Equation 9.1 develops a total cost equation for a general cost model of a cash collection system.

$$\text{Total cost} = N \times [(F \times D \times i) + VC] + FC \tag{9.1}$$

Where:

N = The number of remittances processed

F = The average face value of remittances

D = The number of days it takes to clear the check

i = The daily opportunity cost of funds

VC = The variable cost charged for each remittance item

FC = The fixed cost of managing the collection system

Company Processing Center

A company may decide to do its own processing and depositing of checks. Such a system is referred to as a **company processing center**. If company processing is chosen, then management must decide whether to have a **decentralized processing system** or a **centralized processing system**. Deciding which to use depends primarily on the volume of checks processed and the dollar size of the checks.

Decentralized Collection Systems One company processing option available to the corporation is to have its various field offices or stores around the country receive payments from the company's customers. This simple system has two major advantages. First, mail delay is minimal, since the customers and the store or field office are in the same location. Second, availability delay is minimal, since the check is more than likely drawn on a bank in the same location. It is even possible that the customers' accounts are at the same bank used by the store or field office.

The decentralized processing system also has several disadvantages. First, the store or field office staff may get busy and not deposit checks received in a timely manner. This offsets some of the mail float and availability float advantages. Second, the funds deposited will remain in the field office's or store's local bank account until they are transferred to the bank(s) used by corporate headquarters. Only then will the corporate cash manager have use of the funds.

Centralized Processing System At the other extreme is the company centralized processing system where corporate headquarters receives all customer remittances. The checks with invoices are mailed to one or two major administrative centers for processing. These centers have high-speed equipment for processing the remittance information and a staff dedicated to this task. The advantage to a centralized processing system is that the processing time is reduced compared to the field office or decentralized alternative. In addition, the corporate cash manager has more control over the system and bank account balances. The account balances, rather than being spread all over the country, are in only one or two locations. The disadvantages are that mail and availability time will generally increase. Because this alternative requires the firm to maintain costly state-of-the-art processing equipment, most consultants consider this alternative only when the monthly remittance volume exceeds 100,000 items per month.

Cost Analysis Company processing centers incur both fixed and variable costs. Fixed costs include clerical salaries, equipment rental fees, account maintenance fees, a fee charged to transfer balances from the collection bank to another bank, a deposit notifica-

tion charge, and a deposit charge. Variable costs include processing charges per item, a charge for encoding each remittance item, and a deposit charge for each item.

Suppose you have estimated the following cost data for a decentralized and a centralized company processing center. Note that the number of days it takes to clear a check, D, is less for the centralized system. In this case, the longer processing time taken by the decentralized system does not offset the longer mail time and availability time of the centralized system. The centralized system is able to incur a lower variable processing charge due to using more competitive banks. Finally, the centralized system incurs a higher fixed charge due to equipment costs and salaries for dedicated clerical staff.

	Common Data	Decentralized	Centralized
N	1,000		
F	\$1,500		
D		7	6
i	0.10/365		
VC		\$0.25	\$0.20
FC		\$100	\$600

$$\begin{aligned}\text{Total cost (decentralized)} &= 1{,}000[\$1{,}500 \times 7 \times (0.10/365) + \$0.25] + \$100 \\ &= 1{,}000(\$2.877 + \$0.25) + \$100 \\ &= \$3{,}127 + \$100 \\ &= \$3{,}227\end{aligned}$$

$$\begin{aligned}\text{Total cost (centralized)} &= 1{,}000[\$1{,}500 \times 6 \times (0.10/365) + \$0.20] + \$600 \\ &= 1{,}000(\$2.466 + \$0.20) + \$600 \\ &= \$2{,}666 + \$600 \\ &= \$3{,}266\end{aligned}$$

Thus, even though the decentralized system, in this example, incurs a longer float period and a higher variable processing cost, the lower fixed costs allow for a lower total cost compared to the centralized system.

Lockbox Collection System

A **lockbox collection system** is really a blend of the two company processing systems just discussed with the exception that a bank or third party does the processing. A lockbox system is similar to the field office collection system in that the lockbox system consists of dispersed collection sites. It is similar to the centralized collection system in that there are a limited number of collection sites and the deposited funds are transferred from the lockbox collection sites to the corporate headquarters bank on a frequent basis.

The first lockbox system was developed by Radio Corporation of America (RCA) in conjunction with its major bank, First Chicago, in 1947. The primary purpose served by the lockbox system was to allow RCA to reduce its level of bank borrowing.

A lockbox collection system initially consisted of a physical post office box serviced by a bank. The company would send out remittance envelopes with each billing with the post office box preprinted on the envelope. The bank's employees would empty the contents of the post office box several times daily delivering the contents to the bank's lockbox processing area. The remittances would be opened, the checks proofed and deposited, and the invoice material routed to the company.

Today, most banks have a **unique ZIP code** for their lockbox operation and instead of a box, the mail sorted to that ZIP code is bagged and held in a designated area of the post office. Since most of the mail sorting is done at night, the bank staff will make several trips daily to the post office, seven days a week, to retrieve the bags of mail. The

FOCUS ON PRACTICE

The Impact of a Retail Lockbox: The Scotts Company

The Scotts Company, historically a company providing lawn maintenance products for the "do-it-yourselfer," started up Scotts Lawn Service for the "do-it-for-me" customer. The new service experienced rapid growth and quickly began operations in 60 of the nation's top 100 lawn service markets in the United States. However, the rapid growth created a highly decentralized cash collection system with each branch opening up its own bank account for daily deposits. The system was heavily labor intensive, chewing up a large number of man-hours that included the following activities:

- making daily trips to the post office and bank;
- sorting mail manually;
- opening, extracting, and sorting the remittance contents by payment type;
- removing customer comment cards;
- preparing a deposit slip and endorsing each check;
- obtaining credit card authorizations;
- batching payments for cash application and manually posting receipts to customer accounts; and
- correcting payment errors.

Weekly, corporate treasury would then contact each bank for balances and enter automated clearinghouse transactions into bank software for concentration purposes. As a result, significant idle balances remained in the field banks for days at a time. At the time, Scotts' decentralized cash collection system was processing 50,000 items per month, with a projected 250,000 collection items based on growth estimates. A retail lockbox system was the solution. Local bank accounts were eliminated, saving $90,000 annually. Processing float and mail float were reduced, which allowed the company to reduce its amount of borrowing resulting in an immediate annual interest expense savings of $100,000. Significant personnel costs were also saved that could be redirected to customer service matters.

Source: "Scotts' Retail Lockbox Trims Millions in Processing Costs," *AFP Exchange* (July/August 2003), pp. 48–49.

remittances are then processed in batches as received, with the heaviest amount of processing being done by 7:00 A.M. This early morning processing schedule allows the bank to meet same-day settlement deadlines and other check clearing deadlines that accelerate availability of the deposited items.

Types of Lockbox Collection Systems There are two basic types of lockbox collection systems. The **retail lockbox system** is structured to handle a large volume of standardized invoice materials, and the remittance checks have a relatively low average dollar face value. The standardized remittance information is a requirement in this system because it allows the bank to reduce its cost of handling the item. Cost reduction is essential, since the average dollar face value per item is low and therefore the value of the float is low. Most consumers receive a standardized monthly invoice resulting from phone calls, gasoline purchases, credit card purchases, etc. Companies with a large consumer base, such as AT&T, Shell, or VISA, send a standardized invoice with a machine readable scan line at the bottom of the remittance ticket.

Contrast a retail lockbox system with a **wholesale lockbox system.** The wholesale lockbox system is designed to process smaller volumes and larger average dollar items with nonstandard remittance information. For example, the average wholesale lockbox receives

400 to 500 payments monthly, valued at $25 to $35 million.[1] Whereas retail lockbox systems are used by companies receiving large volumes of remittances from consumers, wholesale lockboxes are used for business-to-business trade payables.

COST ANALYSIS Lockbox processors charge both a fixed cost and a variable cost. Fixed costs include an account maintenance fee, a fee charged to transfer balances from the collection bank to another bank, a deposit notification charge, and a deposit charge. Variable costs include a lockbox processing charge per item, a charge for encoding each remittance item, and a deposit charge for each item. The other variable cost is not directly bank related. It has to do with the opportunity cost of float.

Suppose you have approached two different lockbox processors, Citibank and Chase, and gathered the following data:

	Common Data	Citibank	Chase
N	1,000		
F	$1,500		
D		6	5
i	0.10/365		
VC		$0.45	$0.50
FC		$225	$275

$$\begin{aligned}\text{Total cost (Citibank)} &= 1{,}000[\$1{,}500 \times 6 \times (0.10/365) + \$0.45] + \$225\\ &= 1{,}000(\$2.466 + \$0.45) + \$225\\ &= \$2{,}916 + \$225\\ &= \$3{,}141\end{aligned}$$

$$\begin{aligned}\text{Total cost (Chase)} &= 1{,}000[\$1{,}500 \times 5 \times (0.10/365) + \$0.50] + \$275\\ &= 1{,}000(\$2.055 + \$0.50) + \$275\\ &= \$2{,}555 + \$275\\ &= \$2{,}830\end{aligned}$$

Thus, even though Chase charges a higher variable processing cost and a higher fixed cost, the shorter check clearing time provides enough opportunity cost savings to generate a lower total cost. Indeed, the lockbox system offered by Chase is cheaper than the decentralized company processing system alternative analyzed earlier.

Now assume that there are 100,000 checks and a face value of $15 per check (note that the total dollar value is the same).

$$\begin{aligned}\text{Total cost (Citibank)} &= 100{,}000[\$15 \times 6 \times (0.10/365) + \$0.45] + \$225\\ &= 100{,}000(\$0.0247 + \$0.45) + \$225\\ &= \$47{,}470 + \$225\\ &= \$47{,}695\end{aligned}$$

$$\begin{aligned}\text{Total cost (Chase)} &= 100{,}000[\$15 \times 5 \times (0.10/365) + \$0.50] + \$275\\ &= 100{,}000(\$0.0205 + \$0.50) + \$275\\ &= \$52{,}050 + \$275\\ &= \$52{,}325\end{aligned}$$

With the increased number of checks and lower face value, Citibank provides the lower total cost because the float savings are less significant when the dollar value of the check is small. In such a case, the processing costs are the more significant factor in determining total cost.

[1] Richard J. Poje, "The Death and Birth of Wholesale Lockbox," *AFP Exchange* (March/April 2003), p. 61.

from published individual bank availability schedules. This source is the most accurate but also the most troublesome to obtain. Most banks, though, are willing to make their availability schedules available for lockbox study purposes.

FINANCIAL DILEMMA REVISITED

In trying to resolve the Financial Dilemma mentioned at the beginning of this chapter, suppose the cash manager decides to bring in a consulting group to study the firm's cash collection system. The consultant, after reviewing the remittance information, determines the following remittance characteristics.

Customer Group	Number of Remittances	Average Face Value	Mail and Availability Float	Processing Float
1	25	$ 75,000	7 days	2 days
2	10	100,000	2	2
3	5	150,000	8	2

Variable processing cost per item: $0.35
Monthly bank account fixed cost: $125

As the sample shows, there are three geographically dispersed customer groups. As the data are analyzed, the consultant finds that customer group 2 is composed of most of the company's original customers and that groups 1 and 3 are customers that have been added more recently as the company has grown and attracted a more geographically dispersed product demand. The consultant determines that remittances take an average of two days to process before they are deposited at the company's bank. The consultant further indicates that this processing delay can be substantially reduced if not completely eliminated by allowing a bank to handle the processing. Currently, all customers mail their remittances to corporate headquarters. The total monthly cost of the current collection system using Equation 9.1 is:

$$\begin{aligned}\text{Total cost} &= [25 \times \$75{,}000 \times 9 \times (0.10/365)] \\ &\quad + [10 \times \$100{,}000 \times 4 \times (0.10/365)] \\ &\quad + [5 \times \$150{,}000 \times 10 \times (0.10/365)] \\ &\quad + [(25 + 10 + 5) \times \$0.35] \\ &\quad + \$125 \\ &= \$7{,}913\end{aligned}$$

The total monthly cost of the float and processing charges amount to $7,913. For a year, this would equal $94,956 ($7,913 × 12).

In the next section, the consultant will estimate the cost of using a lockbox system to collect the company's remittances to see if a lockbox system is cost effective.

THE LOCKBOX MODEL

Once all the data have been gathered through the lockbox study, the data are entered into a **lockbox optimization model.** Such a model determines the optimal number of lockboxes and their locations. In addition, the model will allocate the customers among the selected lockbox sites.

Complete Enumeration

A **complete enumeration model** analyzes all possible lockbox sites to determine the optimal combinations that maximize shareholder wealth. For example, if a firm wanted to

find the optimal combination of lockbox sites out of a sample of three potential sites, the complete enumeration model would first find the best 1-bank site by comparing the total cost (Equation 9.1) for each of the potential lockbox sites. Then, the model would find the best 2-bank combination. Finally, the model finds the best 3-bank combination. In all, given three possible lockbox locations, seven comparisons are made to determine the site combination with the lowest total cost. In general, the number of different lockbox combinations is $2^n - 1$, where n is the number of different sites. The possible combinations for $n = 3$ are shown below.

- Best 1-Site
  Choose from: Bank A, Bank B, or Bank C
- Best 2-Site Combination
  Choose from: Bank A–Bank B, Bank A–Bank C, or Bank B–Bank C
- Best 3-Site Combination
  Bank A–Bank B–Bank C

The optimal solution is the site combination that provides the lowest total cost. We develop the complete enumeration model through an application of the Financial Dilemma data collected earlier.

As part of the lockbox study, the consulting group presented the following remittance data and collection float data for a sample of three banks. Bank A is the current corporate headquarters' bank. Notice that the variable processing costs and fixed costs are higher for Bank A using a lockbox system compared to the company's current system because of the additional costs incurred related to the lockbox processing activity. Also, days of float include only mail and availability float because a lockbox system essentially eliminates processing float.

Customer Group	Number of Remittances	Average Face Value	Days of Float		
			Bank A	Bank B	Bank C
1	25	$ 75,000	7	3	1
2	10	100,000	2	5	3
3	5	150,000	8	2	4
Variable processing costs			$0.45	$0.35	$0.75
Fixed costs			$275	$200	$150

The next table shows the total cost matrix for the three customer groups and the three banks. Total cost is calculated using Equation 9.1. The numbers calculated for each combination of customer group and bank represent variable costs computed using the opportunity cost of float and the variable processing costs. The total variable cost for each bank plus the respective bank fixed cost represent the total cost of processing the indicated customer groups for that particular bank. For example, allocating all customers to Bank A generates a monthly total cost of $6,080, compared to the monthly cost of $7,913 computed earlier using your corporate headquarters as the collection site and Bank A for deposit services only. The optimal 1-lockbox system is Bank C, with a monthly cost of only $2,337. This represents a significant saving from the current system.

Customer Group	Bank A	Bank B	Bank C
1	$3,607	$1,550	$ 532
2	552	1,373	829
3	1,646	413	826
Fixed costs	275	200	150
Total cost	$6,080	$3,536	$2,337

The next step is to compute the total cost for all combinations of two sites. The allocation of customer groups to specific banks is based on the very simple goal of minimizing variable costs. For example, look at Combination 1 below. Customer group 1 is assigned to Bank B because its variable costs of $1,550 are less than the variable costs of $3,607 if it was assigned to Bank A.

Customer	Combination 1		Combination 2		Combination 3	
Group	Bank A	Bank B	Bank A	Bank C	Bank B	Bank C
1		$1,550		$ 532		$ 532
2	$552		$552			829
3		413		826	413	
Variable costs	$552	$1,963	$552	$1,358	$413	$1,361
Fixed costs	275	200	275	150	200	150
Total cost		$2,990		$2,335		$2,124

The optimal 2-site system is Combination 3, which includes Bank B and Bank C, with a total cost of $2,124. Customer groups 1 and 2 are assigned to Bank C, and customer group 3 is assigned to Bank B. Since the total cost for a 2-site system is less than the total cost for a 1-site system, we conclude that a 2-site system is preferred.

We now analyze a 3-site system. If the minimum cost for a 2-site location exceeded the minimum cost for a 1-site location, then the analysis could end at this point.

	Combination 1		
Customer Group	Bank A	Bank B	Bank C
1			$ 532
2	$552		
3		$413	
Variable costs	$552	$413	$ 532
Fixed costs	275	200	150
Total cost			$2,122

A 3-site solution offers the minimum monthly total cost of $2,122, which beats the best 2-site solution by $2, the best 1-site solution by $215, and the current system by $5,791. It's no wonder that the firm has been losing some competitive advantage due to the significantly higher costs related to the centralized company processing cash collection system.

Other Solution Techniques

The problem with the complete enumeration model is the computational requirements for large problems. It is not uncommon for a lockbox problem to analyze a set of 50 different collection sites and possibly hundreds of different customer locations. Analyzing all possible combinations of bank and customer sites is indeed a large problem. This has led researchers to develop models that find the best combinations of sites without having to analyze all possible combinations. Lockbox models have gone through significant development since the early 1970s. The most popular model used today is the The Collection Model (sometimes referred to as the 5.1 Model or the "Duke" model because of the author's former affiliation with Duke University). The Collection Model is an optimization model that runs on the Windows platform and represents the most advanced collection modeling technology available.[2] The Collection Model used by Phoenix-Hecht is a pro-

[2] *Measuring, Modeling & Monitoring Your Lockbox*, Phoenix-Hecht (1997), p. 19.