CHAPTER

16

Financing a Company's Financial Needs

In this chapter you learn about financial instruments that can be used to provide the necessary cash for a construction company's operation. You also learn to compare debt instruments with different conditions and how loan provisions and closing costs can increase the effective interest rate on a loan or line of credit. An understanding of these principles helps you reduce borrowing costs and determine the best way to provide the cash needed to operate a construction company. Success in obtaining financing for a company can allow the company to take on additional projects, whereas failure to obtain financing can spell the doom of a company.

In Chapter 14 we found that the construction company in Examples 14-1 through 14-5 needed an additional \$60,000 to \$100,000 in cash to finance the construction work that it had scheduled for the upcoming year. Raising the required cash could be done through equity financing, the sale of assets, or debt financing. If it were to raise the needed cash through equity financing, the existing owners would need to provide the additional cash or they would need to allow additional owners to invest in the company. Alternately, it could sell surplus assets to generate the cash. Another option is to obtain more cash through debt financing. The company could increase its use of trade financing—the use of subcontractors and its cash—to finance its operations or it could take out a short-term loan, a long-term loan, or a line of credit from a bank or other financial institution.

In this chapter you learn about five common ways of using debt financing to meet a company's cash needs, including loans, lines of credits, leases, trade financing, and credit cards. You also learn to compare debt instruments with different interest rates and provisions. If you were to go from lending institution to lending institution looking for a loan to finance a piece of heavy equipment for your construction company, you would find that the interest rates and provisions of the loans vary from institution to institution. These provisions include the costs associated with setting up the loan and requirements to maintain other accounts with the institution. The comparison of debt instruments will be made by determining the effective annual interest rate (i_a), which incorporates the costs of the instrument's provisions into the interest rate. The effective annual interest rates may then be easily compared. Before we can compare debt instruments we must first understand the basic principles of interest.

INTEREST

Interest may be broken down into two types, simple interest and compound interest. Simple interest does not pay interest on the previous period's interest, whereas compound interest pays interest on the previous period's interest.

Simple Interest

Simple interest is calculated using the following formula:

$$I = P(i)n \tag{16-1}$$

where

I = Interest
P = Principal
i = Interest Rate per Year
n = Number of Years

Because simple interest ignores the effects of compounding interest, simple interest is seldom used for loans with terms longer than one year. Because simple interest is most commonly used for loans with a term of shorter than one year, Eq. (16-1) may be written using days in lieu of years as follows:

$$I = P(i)D/365 \tag{16-2}$$

where

I = Interest
P = Principal
i = Interest Rate per Year
D = Length of the Loan in Days

Example 16-1: Determine the interest due on a \$100,000 short-term loan, with a term of 245 days and a simple interest rate of 10%.

Solution: Using Eq. (16-2) we get the following:

$$I = \$100{,}000.00(0.10)245/365 = \$6.712.33$$

The interest on the loan for the 245 days would be \$6,712.33.

Compound Interest

Compound interest may pay or collect interest at different intervals or compounding periods. The most common compounding periods include annually, semiannually, quarterly, monthly, and daily. A financial instrument that pays interest on a quarterly basis is said to be compounded quarterly.

Compound interest rates are most commonly quoted as nominal interest rate (r), which is also referred to as the annual percentage rate or APR. The nominal interest rate ignores the effects of compounding and is determined by summing the periodic interest rates (i) for all of the compounding periods in one year. To use the nominal interest rate to calculate the interest, the nominal interest rate must be converted to the periodic interest rate. There are two primary methods to perform this conversion. The first method divides the nominal rate by number of compounding periods in a year (c) and pays this interest rate for each of the periods. This conversion method uses the following formula for the periodic interest rate:

$$i = r/c \tag{16-3}$$

where

i = Periodic Interest Rate
r = Nominal Interest Rate per Year or Annual Percentage Rate (APR)
c = Number of Compounding Periods in a Year where $c \geq 1$

Example 16-2: Determine the quarterly interest rate for a loan that charges an annual percentage rate of 12%. The loan charges interest quarterly.

Solution: In this example, the number of compounding periods per year is 4. Using Eq. (16-3) we get the following:

$$i = 0.12/4 = 0.03$$

or 3% interest is paid each quarter.

Example 16-3: Determine the monthly interest rate for a loan that charges an annual percentage rate of 12%. The loan charges interest monthly.

Solution: In this example, the number of compounding periods per year is 12. Using Eq. (16-3) we get the following:

$$i = 0.12/12 = 0.01$$

or 1% interest is charged each month.

The second method divides the nominal interest rate by 365 days per year and multiplies the resultant by the number of days in the billing period. This conversion method uses the following formula for the periodic interest rate:

$$i = (r/365)D \tag{16-4}$$

where

i = Periodic Interest Rate
r = Nominal Interest Rate per Year or Annual Percentage Rate (APR)

$r/365$ = Daily Finance Charge
D = Number of Days in the Billing Period

Using Eq. (16-4) results in periodic interest rates that are different for periods of different lengths. For example, a period with 30 days will have a higher periodic interest rate than a period with 28 days. The number of days in a month and if the billing date falls on a weekend or holiday can affect the number of days in the billing period. For example, a credit card may be billed on the seventh of each month except when the seventh falls on a weekend or holiday, in which case it is billed the next business day. In this case the billing periods would range from 28 days to 33 days.

Example 16-4: Determine the interest rate for a billing period with 28 days for a loan that charges an annual percentage rate of 12%.

Solution: Using Eq. (16-4) we get the following:

$$i = (0.12/365)28 = 0.0092$$

or 0.92% interest will be charged during the billing period.

Yield or Annual Percentage Yield

To compare interest rates with different compounding periods, the interest rates must be converted to a common compounding period. The common compounding period used is one year and the equivalent interest rate is known as the yield (i_a), which is also referred to as the annual percentage yield or APY. In the absence of deposits and withdrawals from an account, paying interest annually at the yield produces the same result as paying the interest each period at the periodic interest rate. In this case, the yield is equivalent to the periodic interest rate.

In the absence of instrument provisions that increase or decrease the interest rate, the yield or annual percentage yield is equal to the effective annual interest rate (i_a). The key difference between the yield and the effective annual interest rate is that the yield ignores loan provisions and closing costs that increase the effective interest rate. In this book, the terms *yield* or *annual percentage yield* are used when the cost of the provisions of the debt instruments are being ignored and the term *effective annual interest rate* is used when the cost of the provisions are included.

The yield for financial instruments is calculated by the following formula:

$$i_a = (1 + r/c)^c - 1 \qquad (16\text{-}5)$$

where

i_a = Yield or Annual Percentage Yield (APY)
r = Nominal Interest Rate per Year or Annual Percentage Rate (APR)
c = Number of Compounding Periods in a Year where $c \geq 1$

Equation (16-5) is valid only when the periodic interest rates are the same for each of the periods. This equation may be used to provide a close approximation of the effective interest rate for monthly payments where the periodic interest rates are not the same, which is the case when Eq. (16-4) is used to calculate the periodic interest rates.

It is important to note that as long as the number of compounding periods in a year is greater than 1, the yield (APY) will be greater than the nominal interest rate (APR). Placing emphasis on the nominal interest rate gives the appearance of a lower interest rate, whereas placing emphasis on the yield gives the appearance of a higher interest rate. This is why loan advertisements often place the emphasis on the nominal interest rate, whereas saving and certificate of deposit advertisements often place the emphasis on the yield.

Example 16-5: Determine the annual percentage yield for a loan that charges an annual percentage rate of 12% compounded quarterly.

Solution: In this problem, the number of compounding periods per year is 4. Using Eq. (16-5) we get the following:

$$i_a = (1 + 0.12/4)^4 - 1 = 0.1255$$

The certificate of deposit has an annual percentage yield of 12.55%.

SIDEBAR 16-1

CONVERTING ANNUAL PERCENTAGE RATE TO ANNUAL PERCENTAGE YIELD USING EXCEL

Example 16-5 may be set up in a spreadsheet as shown in the following figure:

	A	B
1	Nominal Interest Rate	12.00%
2	Compounding Periods	4
3	Yield	12.55%

To set up this spreadsheet, the following formulas, text, and values need to be entered into it:

	A	B
1	Nominal Interest Rate	0.12
2	Compounding Periods	4
3	Yield	=EFFECT(B1,B2)

The spreadsheet uses the EFFECT function to calculate the annual percentage yield. The EFFECT function is written as

=EFFECT(nominal_rate,npery)

where

nominal_rate = nominal interest rate
npery = number of periods per year

Example 16-6: Determine the annual percentage yield for a loan that charges an annual percentage rate of 12% and charges interest monthly.

Solution: In this problem, the number of compounding periods per year is 12. Using Eq. (16-5) we get the following:

$$i_a = (1 + 0.12/12)^{12} - 1 = 0.1268$$

The loan has an annual percentage yield of 12.68%.

From Examples 16-5 and 16-6 we can see that the shorter the compounding period, the higher the annual percentage yield for a given annual percentage rate.

Example 16-7: Determine the annual percentage yield for a loan with an annual percentage rate of 18%. The loan charges interest at the end of each billing period. The billing periods end on the twentieth of each month, except for when the twentieth falls on a weekend or holiday, in which case the billing period ends on the next business day.

Solution: In this problem, the compounding periods will be of unequal lengths and will be all about one month long. The number of compounding periods per year is 12. Using Eq. (16-5) to approximate the annual percentage yield, we get the following:

$$i_a = (1 + 0.18/12)^{12} - 1 = 0.1956$$

The loan has an annual percentage yield of 19.56%. In the above example, the error introduced by the unequal compounding period is less than the errors introduced by rounding the yield.

Substituting Eq. (16-3) into Eq. (16-5) we get the following equation, which is used to calculate the annual percentage yield from the periodic interest rate:

$$i_a = (1 + i)^c - 1 \qquad (16\text{-}6)$$

where

i_a = Yield or Annual Percentage Yield (APY)
i = Periodic Interest Rate
c = Number of Compounding Periods in a Year where $c \geq 1$

Example 16-8: Determine the annual percentage yield for a loan that charges a monthly interest rate of 1% and compounds the interest monthly.

Solution: In this problem the number of compounding periods per year is 12. Using Eq. (16-6) we get the following:

$$i_a = (1 + 0.01)^{12} - 1 = 0.1268$$

The loan has an annual percentage yield of 12.68%.

Fixed versus Variable Interest Rates

Financial instruments may be divided into two classes based on whether their interest rate is fixed or variable. Instruments with a fixed interest rate guarantee the same interest rate for the term of the financial instrument. For example, a thirty-six-month loan that charges an annual percentage rate of 6% compounded quarterly will pay 1.5% at the end of each quarter for thirty-six months (12 quarters). At the end of the financial instrument's term, the financial instrument must be renegotiated.

For instruments with a variable interest rate, the interest rate varies at specified times during the life of the instrument and is tied to some financial index or measure, with the most common index being the prime rate. The prime rate is the base rate for corporate loans based on the lending practices of the nation's largest banks. The prime rate should be tied to a publication—such as the *Wall Street Journal*—for a specified publication date. For example, a loan's interest rate may be 2% above the prime rate and change every six months with the prime rate being tied to the published rate in the *Wall Street Journal* on January 2 and July 1 or the next business day. At the end of six months, if the prime rate were higher than is currently being paid on the loan, the interest rate on the loan would increase. Conversely, if the prime rate had decreased, the interest rate on the loan would decrease. On variable-rate financial instruments, the rates may vary annually, semiannually, quarterly, monthly, or daily. Some variable-rate financial instruments may defer the first rate change for a longer period than the normal time between rate changes. For example, a loan's interest rate may change at the end of the fifth year and semiannually thereafter. Loans with variable interest rates are often attractive despite the risk of the interest rate increasing because they often have a lower interest rate than fixed-rate instruments and, as a result, have a smaller monthly payment.

Loans and Lines of Credits

Loans and lines of credit are ways of borrowing money from a bank or financial institution. Each loan or line of credit comes with a set of provisions that must be met by the borrower. Borrowers should carefully read, understand, and be willing to abide by the commitments that they are making when using debt instruments. Any concerns regarding any of the provisions in the documents should be reviewed by a professional familiar with financial documents.

A common provision in a loan or line of credit is that the borrower pledges specific assets as security for the loan or line of credit. In the event the borrower defaults on the debt, the lender has the right to sell the asset to recover the borrowed money. A loan or line of credit with this type of provision is known as a secured instrument or secured debt. With secured debt the borrowers are prohibited from selling or disposing of the asset without using the proceeds to pay off the debt. They are often prohibited from using the same assets as security on additional debt. Real estate is often used as security for mortgages. Where real estate is used as the security for a loan, a copy of the loan documents is filed with the county recorder's office or other public office, where they become available for public inspection. By doing so, the public is put on notice that the real estate has been used as security for a loan. When equipment and vehicles are used as security for a loan, the lending institution often holds the title to the equipment or vehicle until the loan has been paid off, thus preventing the borrower from selling the asset. When assets are used as security for a loan, the lending institution requires that borrowers maintain minimum amounts of insurance on the asset and that the lending institution is often named as an additional insured on the policy. Naming the lending institution as an additional insured under the policy requires the insurance company to notify the lending institution should the insurance be canceled for any reason.

Loans or line of credits that are not secured with assets are known as unsecured instruments or unsecured debt. Should the borrower fail to pay off the debt, the lender is left to recover the debt from the assets remaining after all of the secured debts have been paid. Most loans and lines of credit require some form of security.

Another common provision in a loan or line of credit is that this debt must be paid off before any other debts are paid. This is known as subordinating debt, in that all other debts become subordinate to the debt identified in the instrument. A subordinate debt clause in a loan or line of credit may make it difficult to finalize the debt because all existing lenders must agree for their debts to be subordinated to the new debt. Additionally, having a subordination clause in an existing debt instrument may make it difficult to obtain financing on new assets because the lender will want to use the new assets as security without its debt subordinate to that of any other debt instruments. For example, a construction company has an existing line of credit that has a subordination clause. The company wants to purchase a new piece of equipment using a new loan. The lender wants to use the new piece of equipment as security for the loan, but the new debt may become subordinate to the line of credit. Should the construction company become bankrupt, the new piece of equipment may only be used as security for the loan after the line of credit is paid off. Should the new piece of equipment be sold to satisfy the line of credit, the new lender would be left without security on the loan. It is unlikely that the new lender will make the loan if there is a chance that the debt will become subordinate to any other debt instrument. For these reasons, subordinating debt should be avoided if at all possible.

Another common provision is a third-party guarantee or personal endorsement. Under a third-party guarantee, a company or person other than the borrower becomes a third party to the loan and uses assets to guarantee the loan. This provision is very common when the borrower is seen as a poor credit risk or does not have a credit history. The third party may also be referred to as a cosigner. Under a personal endorsement, the owner or owners of a company pledge personal assets to pay the debts of the company should the company fail to pay the debts. A personal guarantee is almost always required when credit is extended to a small company. A third-party guarantee or personal endorsement is desirable to the lender because it increases the assets available from which to recover the debt should the lender fail to pay the debt. Conversely, these provisions are undesirable from a borrower's perspective because assets other than the company's assets are at risk. Where possible, a third-party guarantee or personal endorsement should be avoided. If it cannot be avoided the third party or personal endorser should try to place a monetary limit on his or her personal liability. Where there are multiple third parties or personal endorsers, they should try to limit their individual liabilities to a percentage of the total liability. For example, if there were two personal endorsers on a loan they should try to limit their individual liability to 50% of the total liability. This is to prevent one of the parties from having to cover the entire liability him- or herself. When signing documentation for a loan or line of credit as an officer of the company, make sure that you are signing as an officer and not as a personal endorser.

Short-term financing should be used to finance short-term financial needs. Long-term financing should be used to finance long-term financial needs. Matching the term of the financing to the length of the financial need is known as maturity matching. For example, if a new piece of equipment with a useful life of five years were purchased with a four- or five-year loan we would say that their maturities match. The key point in maturity matching is that the financing must give the asset time to generate enough cash to pay off the principal and interest from the financial instrument and the financial instrument must be paid off before the end of the useful life of the equipment.

Short-term financing should not be used to finance long-term assets. By using short-term financing, such as a line of credit, to purchase a large piece of equipment, the borrower takes the risk that he or she will be able to renew the short-term financing or find a new source of financing when the short-term financing expires. One exception to this rule is on a real estate development where lending institutions provide a short-term construction loan during construction and then provide a long-term mortgage at the completion of the construction. When developing real estate it is wise to obtain both the construction loan and the long-term financing before beginning the project. Because the long-term financing will not be finalized until construction is complete, it is important to have a written commitment for the financing.

LOANS

Loans typically consist of a fixed amount of money, known as the principal, which is borrowed at the beginning of the loan and is paid back with interest at some point in the future or over a period of time by making periodic payments.

Short-term loans are loans with a term of one year or less. Long-term loans are loans with a term of more than a year. Short-term loans may allow that both the principal and interest may be paid off at the maturity of the loan or the loan may require that the interest be paid at regular intervals with the principal being paid at the end of the loan. Long-term loans usually require periodic payments covering both interest and principal, thus reducing the principal over time.

Long-Term Loans

Long-term loans range in length from a few years for equipment and vehicle loans to thirty years for real estate loans. Long-term loans require monthly payments. The proceeds from the monthly payments are first used to pay off the interest on the loan due during the period and then the remaining proceeds are used to reduce the principal or the amount borrowed.

The following equation is used to calculate the monthly payments for loans with a uniform monthly payment and a fixed interest rate:

$$A = P[i(1 + i)^n]/[1 + i)^n - 1] \qquad (16\text{-}7)$$

where

P = Principal
i = Periodic Interest Rate for One Month
n = Duration of Loan in Months

You should recognize this formula as the uniform-series capital-recovery factor from Chapter 15. This is because payments on a loan are equivalent to the principal at the periodic interest rate.

This formula excludes funds included in the payment that are placed in escrow for payment of hazard insurance and property taxes. When using this formula be sure to use the periodic interest rate rather than the annual percentage rate (APR) or annual percentage yield (APY) and be sure to use the number of months rather than the number of years. Ignoring the closing costs, the amount of interest paid over the life of the loan is determined by the following formula:

$$I = An - p \qquad (16\text{-}8)$$

where

I = Total Interest Paid
A = Monthly Payment Determined by Eq. (16-7)
n = Duration of Loan in Months
P = Principal

This formula ignores the rounding of the payment and the interest to whole cents and as a result there will be small differences between the results of this formula and the actual amount of interest paid.

SIDEBAR 16-2

DETERMINING MONTHLY PAYMENTS FOR A LOAN USING EXCEL

The payment for Example 16-9 may be set up in a spreadsheet as shown in the following figure:

	A	B
1	Annual Interest Rate	9.00%
2	Monthly Interest Rate	0.75%
3	Years	30
4	Months	360
5	Loan Principal	150,000.00
6	Balloon Payment	0.00
7	Payment	-1,206.93

To set up this spreadsheet, the following formulas, text, and values need to be entered into it:

	A	B
1	Annual Interest Rate	0.09
2	Monthly Interest Rate	=B1/12
3	Years	30
4	Months	=B3*12
5	Loan Principal	150000
6	Balloon Payment	0
7	Payment	=PMT(B2,B4,B5,B6)

The spreadsheet uses PMT function from Sidebar 15-4 to calculate the monthly payment. To calculate the payment, the nominal interest rate and the duration of the loan in years is entered into the spreadsheet. The spreadsheet calculates the monthly interest rate and the duration of the loan in months. A balloon payment, a payment at the end of the loan, may also be used in the calculation of the loan payment.

Example 16-9: A $150,000 office building is to be purchased with a thirty-year loan with an annual percentage rate of 9% compounded monthly. Determine the monthly payments and how much interest is paid over the life of the loan.

Solution: In this example, the compounding period is one month, with 12 compounding periods per year and 360 compounding periods during the life of the loan. Using Eq. (16-3) to find the monthly interest rate we get the following:

$$i = 0.090/12 = 0.0075 \text{ or } 0.75\%$$

Using Eq. (16-7) to find the monthly payments we get the following:

$$A = \$150.000[0.0075(1 + 0.0075)^{360}]/[1 + 0.0075)^{360} - 1]$$
$$A = \$1{,}206.93$$

Using Eq. (16-8) to find the total interest paid during the life of the loan we get the following:

$$I = \$1{,}206.93(360) - \$150{,}000 = \$284{,}494.80$$

Example 16-10: The office building in Example 16-9 is to be purchased with a twenty-year loan with an annual percentage rate of 9% compounded monthly. Determine the monthly payments and how much interest is paid over the life of the loan. What is the difference in the monthly payments for the twenty-year and thirty-year loan in Example 16-9? How much would the company save in interest charges by using the twenty-year loan over the thirty-year loan?

Solution: In this example the compounding period is one month, with 12 compounding periods per year and 240 compounding periods during the life of the loan. The monthly interest is the same as the monthly interest in Example 16-9 or 0.75%.

Using Eq. (16-7) to find the monthly payments we get the following:

$$A = \$150{,}000[0.0075(1 + 0.0075)^{240}]/[(1 + 0.0075)^{240} - 1]$$
$$A = \$1{,}349.59$$

Using Eq. (16-8) to find the total interest paid during the life of the loan we get the following:

$$I = \$1{,}349.59(240) - \$150{,}000 = \$173{,}901.60$$

By taking out the twenty-year loan the company would pay an additional \$142.66 (\$1,349.59 − \$1,206.93) per month and would save \$110,593.20 (\$284,494.80 − \$173,901.60) in interest over the life of the loan.

From Examples 16-9 and 16-10 we see that a 12% (\$142.66/1,206.93) increase in the monthly payments results in a 33% decrease (1 − 20/30) in the length of the loan and 39% decrease (1 − \$173,901.60/\$284,494.80) in the total interest paid over the life of the loan. Table 16-1 shows the monthly payment and total interest paid over the life of the loan for a \$100,000 loan at 8% interest compounded annually for different lengths of loans.

TABLE 16-1 Payment and Interest Comparison for a $100,000 Loan at 8% Compounded Annually

YEARS	MONTHLY PAYMENT ($)	TOTAL INTEREST ($)
5	2,027.64	21,658.40
10	1,213.28	45,593.60
15	955.65	72,017.00
20	836.44	100,745.60
25	771.82	131,546.00
30	733.76	164,153.60
35	710.26	198,309.20

From Table 16-1 we see that for a twenty-year loan the interest paid over the life of the loan exceeds the amount borrowed and for a thirty-five-year loan the interest paid is almost twice the amount borrowed.

For a loan, the proceeds from the monthly payments are first used to pay off the interest accrued during the previous month and then the remaining proceeds are used to reduce the principal. This is the case even when the monthly payments are not equal. In the case where the monthly payment does not cover the previous month's interest, the unpaid interest is added to the principal. The monthly interest for month t is calculated by using the following formula:

$$I_t = U_{t-1}(i) \tag{16-9}$$

where

I_t = Interest Due for Month t
U_{t-1} = Outstanding Principal at the End of the Previous Month $(t-1)$
i = Periodic Interest Rate

The outstanding principal at the end of month t is calculated by the following equation:

$$U_t = U_{t-1} + I_t - A \tag{16-10}$$

where

U_t = Outstanding Principal at the End of Month t
U_{t-1} = Outstanding Principal at the End of the Previous Month $(t-1)$
I_t = Interest Due for Month t
A = Monthly Payment

By substituting Eq. (16-9) into Eq. (16-10) and combining terms we get the following:

$$U_t = U_{t-1}(1+i) - A \tag{16-11}$$

The reduction in the outstanding principal equals the outstanding principal balance at the beginning of the month less the outstanding principal balance at the end of the month and may be found by solving Eq. (16-10) for $U_{t-1} - U_t$ as follows:

$$B_t = U_{t-1} - U_t = A - I_t \tag{16-12}$$

where

B_t = Reduction in Outstanding Principal for Payment t
U_t = Outstanding Principal at the End of Month t
U_{t-1} = Outstanding Principal at the End of the Previous Month $(t - 1)$
A = Monthly Payment
I_t = Interest Due for Month t

Example 16-11: For the loan in Example 16-9, determine the monthly interest for the first and second months and the outstanding principal at the end of the first and second month.

Solution: From Example 16-9 the monthly payment is \$1,206.93 and the periodic interest rate for the month is 0.75%. Using Eq. (16-9) to find the interest paid on the loan for the first month we get the following:

$$I_1 = \$150{,}000(0.0075) = \$1{,}125.00$$

Before calculating the interest for the second month we need to calculate outstanding principal balance at the end of the first month. Using Eq. (16-10) we get the following:

$$U_1 = \$150{,}000.00 + \$1{,}125.00 - \$1{,}206.93 = \$149{,}918.07$$

Of the first month's payment, \$1,125.00 was used to pay the interest and \$81.93 (\$1,206.93 − \$1,125.00) was used to reduce the outstanding principal balance on the loan.

Using Eq. (16-9) to find the interest paid on the loan for the second month we get the following:

$$I_2 = \$149{,}918.07(0.0075) = \$1{,}124.39$$

Using Eq. (16-10) we get an outstanding principal balance at the end of the second month of the following:

$$U_2 = \$149{,}918.07 + \$1{,}124.39 - \$1{,}206.93 = \$149{,}835.53$$

Of the second month's payment, \$1,124.39 was used to pay the interest and \$82.54 (\$1,206.93 − \$1,124.39) was used to reduce the outstanding principal balance on the loan.

For a loan with a fixed interest rate and equal periods, the interest for each period decreases because the outstanding principal balance decreases and the amount of the payment that is used to reduce the outstanding principal balance on the loan increases. This is not always the case with variable rate loans and for

SIDEBAR 16-3

CALCULATING MONTHLY INTEREST, PRINCIPAL REDUCTION, AND BALANCE FOR A LOAN USING EXCEL

Example 16-11 may be set up in a spreadsheet as shown in the following figure:

	A	B
1	Annual Interest Rate	9.00%
2	Monthly Interest Rate	0.75%
3	Monthly Payment	1,206.93
4	Balance From Last Month	150,000.00
5	Interest For This Month	1,125.00
6	Principal Reduction	81.93
7	Balance From This Month	149,918.07

This spreadsheet shows the calculations for the first month. The second month may be calculated by entering the balance from the first month in cell B4. To set up the spreadsheet, the following formulas, text, and values need to be entered into it:

	A	B
1	Annual Interest Rate	0.09
2	Monthly Interest Rate	=B1/12
3	Monthly Payment	1206.93
4	Balance From Last Month	150000
5	Interest For This Month	=ROUND(B4*B2,2)
6	Principal Reduction	=B3-B5
7	Balance From This Month	=B4-B6

The spreadsheet uses the ROUND function to round the monthly interest to whole pennies. The ROUND function is written as

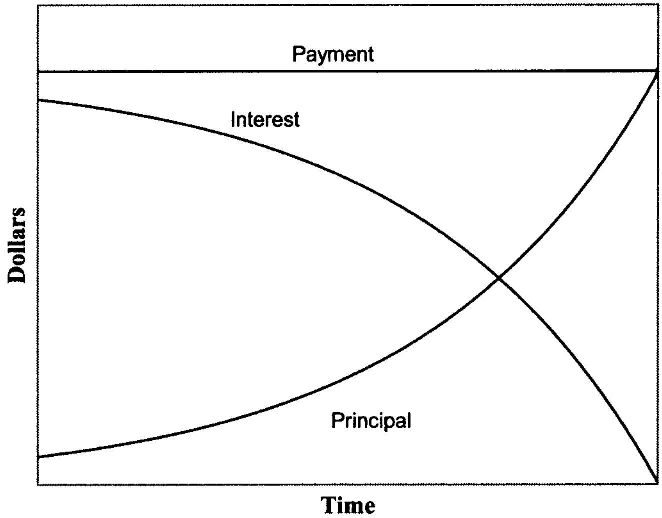
= ROUND(number,num_digits)

where

number = number to be rounded
num_digits = number of digits to round to, where positive numbers represent the number of digits to the right of the decimal point and negative numbers represent the number of digits to the left of the decimal point (2 rounds to whole pennies)

To calculate the monthly interest, principal reduction, and balance, the nominal interest rate is entered into the spreadsheet and the spreadsheet calculates the monthly interest rate.

FIGURE 16-1 Allocation of Loan Payments



loans with unequal periods because the periodic interest rate can vary from period to period. Figure 16-1 shows the allocation of the payment between principal reduction and interest paid.

The outstanding principal balance for a loan with a fixed payment and interest rate is calculated for any point in time using the following formula:

$$U_t = A[(1+i)^{(n-t)} - 1]/[i(1+i)^{(n-t)}] \tag{16-3}$$

where

U_t = Outstanding Principal Balance of the End of Month t
A = Monthly Payment
i = Monthly Interest Rate
n = Duration of Loan in Months
t = Number of Monthly Payments That Have Been Made

The outstanding principal balance equals the present value of the remaining payments measured at the end of month t.

Example 16-12: The borrowers in Example 16-9 have just made their 180th payment. What is the outstanding principal balance on the loan?

Solution: In this example, the borrowers have made 180 of the required 360 payments, leaving 180 remaining payments. Using Eq. (16-13) to find the outstanding principal balance we get the following:

$$U_{180} = \$1{,}206.93[(1+0.0075)^{(360-180)} - 1]/ [0.0075(1+0.0075)^{(360-180)}]$$

$$U_{180} = \$118{,}995.34$$

From Example 16-12 we can see that after making payments on the loan for half of the life of the loan, the borrowers have reduced the principal by less than 21% (1 − \$118,995.34/\$150,000.00). This is because during the early months of the loan most of the payment is being used to pay the interest. As we approach the end of the loan the majority of the payment is being used to pay down the outstanding principal balance.

The interest paid between any two periods is calculated by subtracting the outstanding principal balance at the end of the last period from the outstanding principal balance at the beginning of the first period to determine the reduction in outstanding principal for the periods. The difference between the reduction in principal and the total of the monthly payments made during the periods equals the interest paid. The interest between any two periods is calculated using the following formula:

$$I = N(A) + U_t - U_{t-N} \tag{16-14}$$

where

$$\begin{aligned} I &= \text{Interest Due for a Period of } N \text{ Months} \\ N &= \text{Number of Monthly Payments Made Between Two Periods} \\ A &= \text{Monthly Payment} \\ U_t &= \text{Outstanding Principal at the End of the Last Period} \\ U_{t-N} &= \text{Outstanding Principal at the Beginning of the First Period } (t - N) \end{aligned}$$

The outstanding principal balances are calculated using Eq. (16-13). Equations (16-13) and (16-14) ignore the rounding of the payment and the interest to whole cents and as a result there will be small differences between the results of Eq. (16-14) and the actual amount of interest paid. This formula is useful when calculating the annual interest paid.

Example 16-13: How much interest do the borrowers in Example 16-9 pay during the fourth year of the loan?

Solution: During the fourth year they will make payments 37 through 48. The outstanding principal balance at the beginning of the fourth year equals the outstanding principal balance after the 36th payment has been made and is calculated using Eq. (16-13) as follows:

$$\begin{aligned} U_{36} &= \$1{,}206.93[(1 + 0.0075)^{(360-36)} - 1]/ \\ &\quad [0.0075(1 + 0.0075)^{(360-36)}] \\ U_{36} &= \$146{,}627.72 \end{aligned}$$

The outstanding principal balance at the end of the fourth year equals the outstanding principal balance after the 48th payment has been made and is calculated using Eq. (16-13) as follows:

$$U_{48} = \$1{,}206.93[(1 + 0.0075)^{(360-48)} - 1]/$$

$$[0.0075(1 + 0.0075)^{(360-48)}]$$

$$U_{48} = \$145{,}286.63$$

The interest for the year is calculated using Eq. (16-14) as follows:

$$I = 12(\$1{,}206.93) + \$145{,}286.63 - \$146{,}627.72 = \$13{,}142.07$$

Amortization Schedule

The monthly reduction in the outstanding principal balance and the interest accrued for each month may be expressed in tabular form as shown in Figure 16-2. Expressing the loan information in this format is known as an amortization schedule. An abbreviated amortization schedule for the loan in Example 16-9 is shown in Figure 16-2. The full amortization schedule is found in Appendix F.

When preparing an amortization schedule like the one found in Figure 16-2, one must keep in mind that payments will be made to the nearest whole penny. In Example 16-9 the monthly payment on the loan was calculated to be $1,206.933925, which was rounded to $1,206.93. Also, the monthly interest reported in the amortization schedule was rounded to the nearest penny. In the amortization schedule shown in Figure 16-2, the last payment has been increased by $6.81 to cover the rounding of the monthly payments and monthly interest. In Figure 16-2 the outstanding (ending) principal after the 180th payment has been made is $118,997.10. The value calculated in Example 16-12 was $118,995.34. The difference of $1.76 is due to round the payments and interest to the nearest penny in the amortization schedule.

When using a spreadsheet program to prepare an amortization schedule the payment and interest should be rounded to the nearest penny by using a rounding function. A common mistake is to format the cells so the payment and interest are shown to the nearest penny instead of rounding the values to the nearest penny. When formatting the cell to the nearest penny, although the values are only shown to the nearest penny, the values used in the calculations include fractions of a cent.

Amortization schedules for loans, which calculate the interest based on the number of days in the period, are prepared in the same manner as the amortization schedule shown in Figure 16-2, except the monthly interest rate must be calculated using Eq. (16-4). Figure 16-3 shows an amortization schedule for a thirty-six-month loan where the interest rate is based on the number of days in the month.

For the amortization schedule shown in Figure 16-3, both the monthly interest and payment have been rounded to whole pennies. As a result, the last payment has been reduced by $0.05 due to this rounding. The bill due date used in these calculations was the nineteenth of the month. If the nineteenth fell on a weekend or holiday, the bill date was the next business day.

APR: 9.00%
Term: 360 Months
Monthly Payment: $1,206.93

Page 1

Month	Beginning Principal	Monthly Payment	Monthly Interest	Principal Reduction	Ending Principal
0					150,000.00
1	150,000.00	1,206.93	1,125.00	81.93	149,918.07
2	149,918.07	1,206.93	1,124.39	82.54	149,835.53
3	149,835.53	1,206.93	1,123.77	83.16	149,752.37
4	149,752.37	1,206.93	1,123.14	83.79	149,668.58
5	149,668.58	1,206.93	1,122.51	84.42	149,584.16
6	149,584.16	1,206.93	1,121.88	85.05	149,499.11
7	149,499.11	1,206.93	1,121.24	85.69	149,413.42
8	149,413.42	1,206.93	1,120.60	86.33	149,327.09
9	149,327.09	1,206.93	1,119.95	86.98	149,240.11
10	149,240.11	1,206.93	1,119.30	87.63	149,152.48
…	…	…	…	…	…
175	120,835.26	1,206.93	906.26	300.67	120,534.59
176	120,534.59	1,206.93	904.01	302.92	120,231.67
177	120,231.67	1,206.93	901.74	305.19	119,926.48
178	119,926.48	1,206.93	899.45	307.48	119,619.00
179	119,619.00	1,206.93	897.14	309.79	119,309.21
180	119,309.21	1,206.93	894.82	312.11	118,997.10
181	118,997.10	1,206.93	892.48	314.45	118,682.65
182	118,682.65	1,206.93	890.12	316.81	118,365.84
183	118,365.84	1,206.93	887.74	319.19	118,046.65
184	118,046.65	1,206.93	885.35	321.58	117,725.07
185	117,725.07	1,206.93	882.94	323.99	117,401.08
…	…	…	…	…	…
350	12,704.00	1,206.93	95.28	1,111.65	11,592.35
351	11,592.35	1,206.93	86.94	1,119.99	10,472.36
352	10,472.36	1,206.93	78.54	1,128.39	9,343.97
353	9,343.97	1,206.93	70.08	1,136.85	8,207.12
354	8,207.12	1,206.93	61.55	1,145.38	7,061.74
355	7,061.74	1,206.93	52.96	1,153.97	5,907.77
356	5,907.77	1,206.93	44.31	1,162.62	4,745.15
357	4,745.15	1,206.93	35.59	1,171.34	3,573.81
358	3,573.81	1,206.93	26.80	1,180.13	2,393.68
359	2,393.68	1,206.93	17.95	1,188.98	1,204.70
360	1,204.70	1,213.74	9.04	1,204.70	0.00
Total		434,501.61	284,501.61	150,000.00	

FIGURE 16-2 Amortization Schedule for Example 16-9

Annual Percentage Rate:	9.00%
Term:	36
Principal:	20,000.00
Monthly Payment:	$635.99

Payment Date	Monthly Interest Rate	Beginning Principal	Monthly Payment	Monthly Interest	Principal Reduction	Ending Principal
1/19/2004						20,000.00
2/19/2004	0.0076438	20,000.00	635.99	152.88	483.11	19,516.89
3/19/2004	0.0071507	19,516.89	635.99	139.56	496.43	19,020.46
4/19/2004	0.0076438	19,020.46	635.99	145.39	490.60	18,529.86
5/19/2004	0.0073973	18,529.86	635.99	137.07	498.92	18,030.94
6/21/2004	0.0081370	18,030.94	635.99	146.72	489.27	17,541.67
7/19/2004	0.0069041	17,541.67	635.99	121.11	514.88	17,026.79
8/19/2004	0.0076438	17,026.79	635.99	130.15	505.84	16,520.95
9/20/2004	0.0078904	16,520.95	635.99	130.36	505.63	16,015.32
10/19/2004	0.0071507	16,015.32	635.99	114.52	521.47	15,493.85
11/19/2004	0.0076438	15,493.85	635.99	118.43	517.56	14,976.29
12/20/2004	0.0076438	14,976.29	635.99	114.48	521.51	14,454.78
1/19/2005	0.0073973	14,454.78	635.99	106.93	529.06	13,925.72
2/21/2005	0.0081370	13,925.72	635.99	113.31	522.68	13,403.04
3/21/2005	0.0069041	13,403.04	635.99	92.54	543.45	12,859.59
4/19/2005	0.0071507	12,859.59	635.99	91.95	544.04	12,315.55
5/19/2005	0.0073973	12,315.55	635.99	91.10	544.89	11,770.66
6/20/2005	0.0078904	11,770.66	635.99	92.88	543.11	11,227.55
7/19/2005	0.0071507	11,227.55	635.99	80.28	555.71	10,671.84
8/19/2005	0.0076438	10,671.84	635.99	81.57	554.42	10,117.42
9/19/2005	0.0076438	10,117.42	635.99	77.34	558.65	9,558.77
10/19/2005	0.0073973	9,558.77	635.99	70.71	565.28	8,993.49
11/21/2005	0.0081370	8,993.49	635.99	73.18	562.81	8,430.68
12/19/2005	0.0069041	8,430.68	635.99	58.21	577.78	7,852.90
1/19/2006	0.0076438	7,852.90	635.99	60.03	575.96	7,276.94
2/20/2006	0.0078904	7,276.94	635.99	57.42	578.57	6,698.37
3/20/2006	0.0069041	6,698.37	635.99	46.25	589.74	6,108.63
4/19/2006	0.0073973	6,108.63	635.99	45.19	590.80	5,517.83
5/19/2006	0.0073973	5,517.83	635.99	40.82	595.17	4,922.66
6/19/2006	0.0076438	4,922.66	635.99	37.63	598.36	4,324.30
7/19/2006	0.0073973	4,324.30	635.99	31.99	604.00	3,720.30
8/21/2006	0.0081370	3,720.30	635.99	30.27	605.72	3,114.58
9/19/2006	0.0071507	3,114.58	635.99	22.27	613.72	2,500.86
10/19/2006	0.0073973	2,500.86	635.99	18.50	617.49	1,883.37
11/20/2006	0.0078904	1,883.37	635.99	14.86	621.13	1,262.24
12/19/2006	0.0071507	1,262.24	635.99	9.03	626.96	635.28
1/19/2007	0.0076438	635.28	640.14	4.86	635.28	-
Total			22,899.79	2,899.79	20,000.00	

FIGURE 16-3 Amortization Schedule for Loan with Different Period Lengths

Closing Costs

There are often many fees added to a loan to cover the cost of setting up the loan and to provide a profit for the lending institution. These fees are known as closing costs and include such items as the origination fee, the cost of the appraisal of the property used as security, the cost of the credit report on the applicants, underwriting fees, processing fees, documentation preparation fees, courier fees, title insurance, and other title charges.

When looking for loans, lending institutions should prepare a good faith estimate identifying all of the closing costs and any additional costs to close the loan. These additional costs include the payment of any existing loans that are to be paid off, payment of accrued interest on the existing loans, and funds to be placed in an escrow account for the payment of hazardous insurance and tax assessments. The good faith estimate also shows the estimated monthly payment, including amounts to be placed in escrow. As the name implies, the good faith estimate is an estimate prepared in good faith and the numbers in the estimate are not guaranteed. A sample of a good faith estimate is shown in Figure 16-4.

The closing costs provide the lending institution revenue to cover its costs and make a profit on setting up the loan. The closing costs also act as a deterrent against the borrower changing loans every time the interest rates change a fraction of a percentage. The closing costs also increase the effective interest rate on the loan by decreasing the amount of the principal available to the borrower. For example, if a company borrows $100,000 and pays 2% of the amount borrowed in the form of closing costs, after paying the closing costs, the company has increased its available cash by $98,000 ($100,000 − $100,000   0.02). Because the company is paying interest on the full $100,000, the interest rate it is paying on the increase in available cash of $98,000 is greater than the yield on the loan. The cash flow for a loan with closing costs is shown in Figure 16-5.

The effective annual interest rate is calculated solving the following equation for i:

$$A = (P - \text{Closing Costs})\,[\,i(1 + i)^n\,]/[\,(1 + i)^n - 1\,] \qquad (16\text{-}15)$$

where

A = Monthly Payment
P = Principal
i = Periodic Interest Rate
n = Duration of Loan in Months

The effective annual interest rate may then be calculated from the periodic interest rate using Eq. (16-6).

Example 16-14: The bank charges $2,500 for closing costs on a $100,000 loan with an annual percentage rate of 9% compounded monthly and a term of thirty years. The bank will not allow the closing costs to be added to the $100,000 borrowed. What effect do the closing costs have on the effective annual interest rate?

Solution: Using Eq. (16-3) to find the monthly interest rate we get the following:

$$i = 0.090/12 = 0.0075$$

GOOD FAITH ESTIMATE

Lender:	Base Loan Amount:	$	75,000.00
	Total Loan Amount:	$	75,000.00
	Term	180 mo	
Applicant(s):	Interest Rate:		7.125%
	Type of Loan:	Fixed	
	Preparation Date:	3/29/02	

This Good Faith Estimate of closing costs is a sample form based upon HUD form HUD-1 Settlement Statement which the borrower receives at settlement. The charges are only estimates and may be more or less.

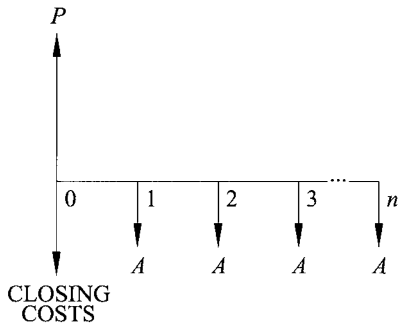
800	**Items Payable in Connection with Loan:**		
801	Loan Origination Fee 1.00 %	$	750.00
802	Loan Discount Fee %	$	
803	Appraisal Fee	$	250.00
804	Credit Report	$	20.00
805	Lender's Inspection Fee	$	
806	Mortgage Insurance Application Fee	$	
807	Assumption Fee	$	
808	Mortgage Broker Commission/Fee	$	
809	Tax Service Fee	$	104.00
810	Processing Fee	$	200.00
811	Underwriting Fee	$	85.00
812	Wire Transfer Fee	$	
813	Courier Fee	$	35.00
814	Document Preparation Fee	$	100.00
815	Other	$	
900	**Items Required by Lender to Be Paid in Advance:**		
901	Interest for 15 days @	$	
	$14.64 /day	$	219.60
902	Mortgage Insurance Premium	$	
903	Hazard Insurance Premium	$	
904	County Property Taxes	$	
905	Flood Insurance	$	
906	Other	$	
1000	**Reserves Deposited with Lender:**		
1001	Hazard Insurance		
	6 Months @ $ 29.17 /mo	$	175.02
1002	Mortgage Insurance		
	5 Months @ $ 132.19 /mo	$	660.95
1003	City Property Taxes		
	Months @ $ /mo	$	
1004	County Property Taxes		
	Months @ $ /mo	$	
1007	Flood Insurance		
	Months @ $ /mo	$	
1008	Other	$	

1100	**Title Charges:**		
1101	Settlement or Closing Fee	$	100.00
1102	Abstract or Title Search	$	
1103	Title Examination	$	
1104	Title Insurance Binder	$	
1105	Document Preparation Fee	$	
1106	Notary Fee	$	
1107	Attorney's Fee	$	
1108	Title Insurance	$	492.50
1109	Lender's Coverage	$	
1110	Owner's Coverage	$	
1111	Endorsements	$	55.00
1112	Reconveyance Fee	$	65.00
1113	Other	$	
1200	**Transfer Charges:**		
1201	Recording Fee	$	35.00
1202	City/County Tax/Stamps	$	
1203	State Tax/Stamps	$	
1204	Intangible Tax	$	
1205	Other		
1300	**Additional Settlement Charges:**		
1301	Survey	$	
1302	Pest Inspection		
1303	Other	$	

Total Estimated Funds Needed to Close:		
Pay Off Existing Loans/Liens	$	72,612.80
Estimated Closing Costs (Section 800, 900, 1100 to 1300)	$	2,511.10
Estimated Prepaid Items (Section 1000)	$	835.97
Other	$	
Estimated Funds Needed to Close	$	959.87
Total Estimated Monthly Payment:		
Principal and Interest	$	679.37
Real Estate Taxes	$	132.19
Hazard Insurance	$	29.17
Flood Insurance	$	
Mortgage Insurance	$	
Other	$	
Total Estimate Monthly Payment	$	840.73

FIGURE 16-4 Good Faith Estimate

FIGURE 16-5 Cash Flow for Loan



Using Eq. (16-7) to find the monthly payments we get the following:

$$A = \$100{,}000[0.0075(1 + 0.0075)^{360}]/[(1 + 0.0075)^{360} - 1]$$
$$A = \$804.62$$

Substituting the monthly payments, closing costs, and loan principal into Eq. (16-15) we get the following:

$$\$804.62 = (\$100{,}000 - \$2{,}500)[i(1 + i)^{360}]/[(1 + i)^{360} - 1]$$

Solving for the periodic interest rate by trial and error we get the following:

$$i = 0.0077379 \text{ or } 0.77379\%$$

SIDEBAR 16-4

CALCULATING THE EFFECTIVE ANNUAL INTEREST RATE WITH CLOSING COSTS USING EXCEL

Example 16-14 may be set up in a spreadsheet as shown in the following figure:

	A	B
1	Annual Interest Rate	9.00%
2	Monthly Interest Rate	0.75%
3	Years	30
4	Months	360
5	Principal	100,000.00
6	Closing Costs	2,500.00
7	Net Proceed From Loan	97,500.00
8	Monthly Payment	-804.62
9		
10	Effective Interest Rate	0.77%
11	Effective Annual Interest Rate	9.69%

To set up this spreadsheet, the following formulas, text, and values need to be entered into it:

	A	B
1	Annual Interest Rate	0.09
2	Monthly Interest Rate	=B1/12
3	Years	30
4	Months	=B3*12
5	Principal	100000
6	Closing Costs	2500
7	Net Proceed From Loan	=B5-B6
8	Monthly Payment	=PMT(B2,B4,B5)
9		
10	Effective Interest Rate	=RATE(B4,B8,B7)
11	Effective Annual Interest Rate	=EFFECT(B10*12,12)

The spreadsheet uses the PMT function from Sidebar 15-4 to calculate the monthly payment, the RATE function to calculate the effective interest rate per month, and the EFFECT function from Sidebar 16-1 to calculate the effective annual interest rate from the effective interest rate per month. The RATE function is written as

= RATE(nper,pmt,pv,fv,type)

where

nper = number of periods
pmt = payment
pv = loan principal of cash flow at present time
fv = balloon payment or a cash flow at the end of the specified number of periods (nper)
type = 1 for payment at the beginning of the period and 0 for payment at the end of the period (defaults to 0 if left blank)

To calculate the effective annual interest rate, the nominal interest rate and the duration of the loan in years are entered into the spreadsheet. The spreadsheet calculates the monthly interest rate and the duration of the loan in months.

Using Eq. (16-6) to determine the effective annual interest rate we get the following:

$$i_a = (1 + 0.0077379)^{12} - 1 = 0.0969 \text{ or } 9.69\%$$

The increase in interest rate is due to both the effect of compound interest and the loan closing costs. Without the closing costs the effective annual interest rate could be calculated as follows, using Eq. (16-6):

$$i_a = (1 + 0.0075)^{12} - 1 = 0.0938 \text{ or } 9.38\%$$

The loan closing costs raised the effective annual interest rate from 9.38% to 9.69%.

If the bank in Example 16-14 allowed the closing costs to be added to the loan, the principal of the loan would be increased by \$2,500 to \$102,500.

The effective annual interest rate in Example 16-14 is based on the assumption that the loan is paid off over its thirty-year term. The closing costs have an even greater effect if the loan is paid off early. The cash flow for a loan with closing costs, which is paid off early, is shown in Figure 16-6. The outstanding principal balance at the end of t months will be paid at the time payment t is made.

The effective annual interest rate is calculated for a loan that is paid off after month t by solving the following equation for periodic interest rate:

$$P = \text{Closing Costs} + A[(1+i)^t - 1]/[i(1+i)^t] + U_t/(1+i)^t \quad (16\text{-}16)$$

where

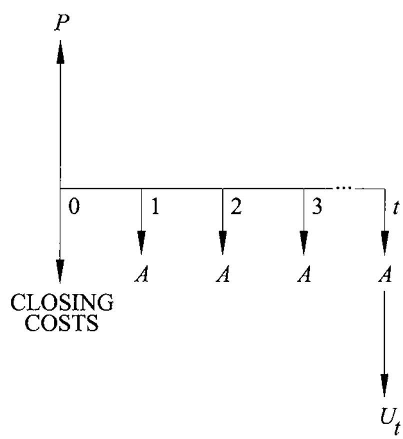
P = Principal
A = Monthly Payment
i = Periodic Interest Rate
t = Actual Duration of Loan in Months
U_t = Outstanding Principal Balance of the End of Month t

The derivation of Eq. (16-16) is found in Appendix D. The effective annual interest rate is then calculated from the periodic interest rate using Eq. (16-6). If there are penalties for paying off the loan early this formula may be used to find the periodic interest rate by adding the penalties to outstanding principal balance and then substituting the sum into Eq. (16-16) in place of U_t.

Example 16-15: If the loan in Example 16-14 is paid off at the end of the fifth year (at the time of the 60th payment), what effect does this have on the effective annual interest rate?

Solution: At the time of the 60th payment we will also need to pay off the outstanding balance on the loan. To solve Eq. (16-16) we need

FIGURE 16-6 Cash Flow for Loan with Shortened Life



P, A, U_t, i, and the closing costs. From Example 16-14 we find the following:

$$P = \$100{,}000.00$$
$$A = \$804.62$$
$$i = 0.0075 \text{ or } 0.75\%$$

and the closing costs are \$2,500.00. Using Eq. (16-13) to find the outstanding principal balance we get the following:

$$U_t = \$804.62[(1 + 0.0075)^{(360-60)} - 1]/[0.0075(1 + 0.0075)^{(360-60)}]$$
$$U_t = \$95{,}879.82$$

The outstanding principal balance is calculated at the monthly interest rate for the loan. Using Eq. (16-16) we get the following:

$$\$100{,}000 = \$2{,}500 + \$804.62[(1 + i)^{60} - 1]/[i(1 + i)^{60}] + \$95{,}879.82/(1 + i)^{60}$$

Solving for the periodic interest rate by trial-and-error we get the following:

$$i = 0.0080359 \text{ or } 0.80359\%$$

Using Eq. (16-6) to solve for the effective annual interest rate we get the following:

$$i_a = (1 + 0.0080359)^{12} - 1 = 0.1008 \text{ or } 10.08\%$$

If the loan were paid off after five years, the loan closing costs would have increased the effective interest rate from 9.38% to 10.08%.

Loan closing costs make it difficult to determine if it is worthwhile to change loans when loans with lower interest rates are available. One way of approaching the problem is to identify the interest rate at which the monthly payments for the new loan would be equal to the monthly payments for the existing loan. The monthly interest rate should be expressed as an annual percentage rate (APR) to be consistent with how banks specify interest rates on loans. If the interest rate of the new loan is less than the interest rate at which the monthly payments for the new loan are equal to the payments of the existing loan, then the new loan is financially attractive. If the interest rate of the new loan is equal to or greater than the interest rate at which the monthly payments for the new loan are equal to the payments of the existing loan, then the new loan will cost your company as much or more than the existing loan. For this comparison to work the new loan must have the same number and size of monthly payments as the current loan. The beginning principal for the new loan must include the unpaid balance on the existing loan plus the closing costs for the new loan. This is necessary because if we were to close out our existing loan and replace it with a new loan, the principal of the new loan would need to pay off the existing loan and cover the closing costs on the new loan to maintain the company's available cash at its current level. If the principal on the new loan only paid off the existing loan, paying the closing costs on the new loan would reduce the company's available cash. These calculations are shown in the following example.

Example 16-16: Your company has an existing loan with monthly payments—principal and interest—of $1,100.00. There are 60 payments left on the loan and the loan has an unpaid balance of $55,000.00. Your company is looking at the possibility of replacing this loan with a loan with closing costs of $1,590.00. At what interest rate would this become attractive?

SIDEBAR 16-5

CALCULATING THE INTEREST RATE WHERE REPLACING A LOAN BECOMES ATTRACTIVE USING EXCEL

Example 16-16 may be set up in a spreadsheet as shown in the following figure:

	A	B
1	Months	60
2	Existing Loan Amount	55,000.00
3	Closing Costs	1,590.00
4	New Loan Principal	56,590.00
5	Monthly Payment	-1,100.00
6		
7	Monthly Interest Rate	0.52%
8	Nominal Interest Rate	6.23%

To set up this spreadsheet, the following formulas, text, and values need to be entered into it:

	A	B
1	Months	60
2	Existing Loan Amount	55000
3	Closing Costs	1590
4	New Loan Principal	=B2+B3
5	Monthly Payment	-1100
6		
7	Monthly Interest Rate	=RATE(B1,B5,B4)
8	Nominal Interest Rate	=B7*12

The spreadsheet uses the RATE function from Sidebar 16-4 to calculate the monthly interest rate. The monthly payment must be a negative number for this spreadsheet to work correctly.

Solution: To replace this loan with another loan while maintaining your company's available cash at the same level, a loan for \$56,590.00 (\$55,000.00 + \$1,590.00) would need to be secured. Using Eq. (16-7) and setting the new loan's payment equal to the payment of the existing loan we get the following:

$$\$1{,}100.00 = \$56{,}590.00[i(1 + i)^{60}]/[(1 + i)^{60} - 1]$$

Solving for the periodic interest rate by trial-and-error we get the following:

$$i = 0.0051884 \text{ or } 0.51884\%$$

The annual percentage rate is found by solving Eq. (16-3) for r as follows:

$$r = 0.0051884(12) = 0.0623 \text{ or } 6.23\%$$

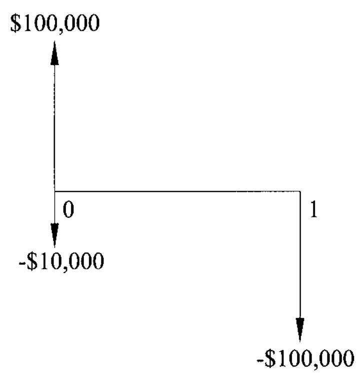
In the above calculations, the monthly payments include only the principal and interest. The payments exclude money placed in escrow to pay for insurance and property tax. These are not costs associated with the loan but with owning property.

Short-Term Loans

Short-term loans are loans with a term of one year or less. Simple interest is often used in lieu of compound interest when calculating the interest on a short-term loan. It is common for the interest on short-term loans to be paid at the time the loan is acquired. This is known as discounting the interest. For example, if you were to take out a \$100,000 loan with a term of one year and an interest rate of 10%, the lending institution would take \$10,000 out of the loan when it was opened as the interest payment and you would receive the remaining \$90,000. Because the interest has already been paid, only the principal needs to be paid off at the end of the loan. In the previous example, you would have to pay the lending institution \$100,000 at the end of the year. The cash flow for this loan is shown in Figure 16-7.

Discounting interest increases the effective annual interest rate paid on the loan by decreasing the amount of the principal available to the borrower and

FIGURE 16-7 Cash Flow for Example 16-17



requiring the interest to be paid at the beginning of the loan. We can determine the effective annual interest rate for a loan where the interest is discounted using the following equation:

$$i = [P/(P - I)] - 1 \tag{16-17}$$

where

i = Periodic Interest Rate
P = Principal
I = Total Interest Paid

The derivation of Eq. (16-17) is found in Appendix D. The total interest paid on the loan is determined by Eq. (16-1) or (16-2). From this periodic interest rate we may calculate the effective annual interest rate.

Example 16-17: Determine the effective annual interest rate on a $100,000 short-term loan, with a term of 11 months and a nominal interest rate of 10%. The bank discounts the interest.

Solution: Using Eq. (16-1) to find the total interest paid on the loan we get the following:

$$I = \$100{,}000(0.10)1 = \$10{,}000$$

The interest on the loan is $10,000 and will be deducted from the loan proceeds at the time the loan is acquired, leaving the borrower with $90,000 as the net proceeds from the loan. Using Eq. (16-17) to find the periodic interest rate we get the following:

$$i = [\$100{,}000/(\$100{,}000 - \$10{,}000)] - 1$$
$$i = 0.1111 \text{ or } 11.11\%$$

In the absence of any other fees, we can use Eq. (16-6) to get the effective annual interest rate.

$$i_a = (1 + 0.1111)^{(12/11)} - 1 = 0.1218 \text{ or } 12.18\%$$

We see that when the term of the short-term loan is one year the interest rate calculated from Eq. (16-17) is the same as the effective annual interest rate and we need not perform the last step. This is only the case when the length of the loan is one year, in other words c equals 1.

If there are closing costs associated with the short-term loan they may be added to the total interest paid and used in Eq. (16-16).

Example 16-18: The loan in Example 16-17 has an origination fee of $2,000. Determine the effective annual interest rate on the loan.

Solution: From Example 16-17 the total interest paid on the loan is $10,000. The total of the interest paid and the closing costs—the loan origination fee—on the loan is \$12,000 (\$10,000 + \$2,000) and is substituted into Eq. (16-16) to find the periodic interest rate as follows:

$$i = [\$100{,}000/(\$100{,}000 - \$12{,}000)] - 1$$
$$i = 0.1364 \text{ or } 13.64\%$$

The effective annual interest rate is found using Eq. (16-16) as follows:

$$i_a = (1 + 0.1364)^{12/11} - 1 = 0.1496 \text{ or } 14.96\%$$

Short-term loans that pay compound interest are evaluated in the same manner as long-term loans.

SIDEBAR 16-6

CALCULATING THE EFFECTIVE ANNUAL INTEREST ON A SIMPLE-INTEREST LOAN WITH DISCOUNTED INTEREST USING EXCEL

Example 16-17 may be set up in a spreadsheet as shown in the following figure:

	A	B
1	Duration (days)	365
2	Principal	100,000.00
3	Interest Rate	10.00%
4	Closing Costs	0.00
5	Interest	10,000.00
6	Net Proceed From Loan	90,000
7	Periodic Interest Rate	11.11%
8	Effective Annual Interest Rate	11.11%

To set up this spreadsheet, the following formulas, text, and values need to be entered into it:

	A	B
1	Duration (days)	365
2	Principal	100000
3	Interest Rate	0.1
4	Closing Costs	0
5	Interest	=B2*B3
6	Net Proceed From Loan	=B2-B4-B5
7	Periodic Interest Rate	=B2/B6-1
8	Effective Annual Interest Rate	=(1+B7)^(365/B1)-1

The EFFECT function cannot be used when there is not a whole number of periods. The equation for cell B8 is derived by substituting Eq. (16-3) into Eq. (16-5). This spreadsheet may also be used to solve Example 16-18.

LINES OF CREDITS

A line of credit consists of a lender committing to loan a borrower up to a specified amount of money on an as needed basis. The borrower may borrow up to the limit of the line of credit one week and pay it off the next week. Lines of credit are used to finance short-term fluctuations in cash flows. The borrower pays interest on the amount of funds borrowed at any given time. The interest rate on a line of credit is usually a variable rate that changes frequently. Interest is usually accrued monthly for lines of credits. Lines of credit may use a monthly interest rate as calculated by Eq. (16-3) using twelve equal periods per year or a monthly interest rate as calculated by Eq. (16-4), taking into account the number of days in each period. To calculate the monthly interest, the average daily balance is multiplied by the monthly interest rate by using the following formula:

$$I_t = ADB_t(i) \tag{16-18}$$

where

$$\begin{aligned} I_t &= \text{Interest Due for Period } t \\ i &= \text{Periodic Interest Rate} \\ ADB_t &= \text{Average Daily Balance for Period } t \end{aligned}$$

The average daily balance is calculated by summing the daily balances for a period and dividing the sum by the number of days in the period. The monthly interest may be calculated using the average daily balance.

Example 16-19: How much interest would be charged on a line of credit that charges a monthly interest rate of 1.1% if the average daily balance for the month was $55,100?

Solution: Using Eq. (16-18) to calculate the interest for the month we get the following:

$$I = \$55{,}100.00\,(0.011) = \$606.10$$

Granting a line of credit requires a lender to commit funds to the line of credit without knowing how much money will be borrowed over the life of the line of credit. Committing these funds to a line of credit prevents the lender from committing the funds to other loans and requires the funds to be invested in less profitable, short-term investments. Two provisions—compensating balance and commitment fee—are often used in lines of credit to compensate the lender for committing these funds.

Compensating Balance

The first provision is to require that percentage of the maximum amount that may be borrowed from the line of credit be placed in a low- or non-interest-bearing account. This is known as a compensating balance. A typical compensating balance is 10%. For example, if you were to set up a $10,000 line of credit with a requirement that a 10% compensating balance be placed in a non-interest-bearing savings account, $1,000 would need to be placed in the savings account leaving $9,000 from the line of credit available for use by your company. From the time the line of credit was set up your company would be paying interest on the $1,000 compensating balance even though you could not use the money. The compensating balance reduces the funds available from the line of credit and increases the effective annual interest rate. The effect the compensating balance has on the actual interest rate is dependent on the amount of money borrowed against the line of credit. In the above example, if the average daily balance were $1,000, we would be using $1,000 and paying interest on $2,000, effectively doubling the interest rate. If the average daily balance increased to $2,000, you would be using $2,000 and paying interest on $3,000. This increases the effective interest rate by 50%. Hence, the more you use the line of credit the smaller the impact of the compensating balance. The requirement for a compensating balance also acts as a deterrent against a company obtaining an excessively large or unneeded line of credit.

When determining the effective annual interest rate for a line of credit, the rate needs to be based on the proceeds from the line of credit used to fund operations and exclude the uses of cash that are associated with the line of credit. The costs associated with the line of credit include interest on the line of credit and the compensating balance. Just as was done with long-term loans, we are interested in finding out what the effective annual interest rate is that a company is paying for the additional capital that is available for daily operations. Each month when interest is paid on the line of credit, this interest payment reduces the cash available for operations and increases the amount of money that is needed to borrow from the line of credit. For example, if a company's operations needed a constant $4,000 from a $10,000 line of credit for three consecutive months and the line of credit required a 10% compensating balance and had a monthly interest rate of 1% collected monthly, the first month the average daily balance would be $5,000, the $4,000 plus a compensating balance of $1,000. The second month the average daily balance would be the $4,000 and the $1,000 compensating balance plus the first month's interest. The first month's interest would be an additional $50 ($5,000.00   0.01) for an average daily balance for the second month of $5,050. The first month's interest may be paid out of operating costs, thus increasing the need to borrow against the line of credit to cover our operating costs, or the interest may be paid out of the line of credit. The third month, the average daily balance would be the previous month's balance of $5,050.00 plus the second month's interest. The second month's interest would be an additional $50.50 ($5,050.00   0.01) for an average daily balance for the third month of $5,100.50. The third month's interest would be $51.00 ($5,100.50   0.01). The total interest paid during the three months would be $150.50. Although the average daily balance for the three months for the line of credit was $5,050.17, the average daily balance of the increase in available cash was only the $4,000. To borrow this $4,000 the company paid $150.50 of interest.

The interest on the line of credit may be calculated as it was in the previous example. The interest paid during the year on the line of credit may be approximated by substituting the yield for the line of credit into Eq. (16-18) in place of i. Unless the average daily balance for each of the months is equal, this is only an approximation. The use of the yield takes into account the increase in the line of credit average daily balance due to the monthly payment of interest.

Example 16-20: Determine the effective annual interest rate on a \$50,000 line of credit with an annual percentage rate of 12% compounded monthly. The bank requires a 10% compensating balance be placed in a non-interest-bearing account. The average daily balance is anticipated to be \$25,000, excluding the compensating balance and interest due on the line of credit.

Solution: Using Eq. (16-5), we get a yield for the line of credit of the following:

$$i_a = (1 + 0.12/12)^{12} - 1 = 0.12683 \text{ or } 12.683\%$$

The lender requires that 10% of the \$50,000 line of credit or \$5,000 be placed in a non-interest-bearing account. The average daily balance, including the compensating balance, is \$30,000 (\$25,000 + \$5,000). The interest for the year can be estimated using Eq. (16-18) as follows:

$$I = \$30{,}000.00(0.12683) = \$3{,}804.90$$

The interest rate paid on the funds used from the line of credit (\$25,000) is calculated by solving Eq. (16-18) for i_a and using the average daily balance of the funds available for operations as follows:

$$i_a = \$3{,}804.90/\$25{,}000.00 = 0.15220 \text{ or } 15.220\%$$

In essence, the effective annual interest rate has been increased by over 2.5% (15.220 − 12.683) by the compensating balance.

Example 16-21: How would the effective annual interest rate change for Example 16-20 if the average daily balance were increased to \$35,000?

Solution: From Example 16-20, the yield for the line of credit is 12.683% and the compensating balance is \$5,000. The average daily balance, including the compensating balance, is \$40,000 (\$35,000 + \$5,000). The interest for the year can be estimated using Eq. (16-18) as follows:

$$I = \$40{,}000.00(0.12683) = \$5{,}073.20$$

The interest rate paid on the funds used from the line of credit (\$35,000) is calculated by solving Eq. (16-18) for i_a and using the average daily balance of the funds available for operations as follows:

$$i_a = \$5{,}073.20/\$35{,}000.00 = 0.14495 \text{ or } 14.495\%$$

From Examples 16-20 and 16-21 we can see the effect that the compensating balance has on the effective annual interest rate is less dramatic when we use a greater portion of the line of credit. This is due to the fact that the interest being paid on the compensating balance is spread over a larger average daily balance.

Once the line of credit has been set up and interest is being paid on the compensating balance, the cost to borrow additional funds from the line of credit is equal to the yield on the line of credit. In Example 16-21 an additional $10,000 was borrowed that cost an additional $1,268.30 ($5,073.20 − $3,804.90) in interest. The interest rate on these additional funds was 12.683% ($1,268.30/$10,000.00), which is equal to the yield on the line of credit.

Sometimes the compensating balance is placed in an interest-bearing account.

Example 16-22: Determine the actual annual interest rate on a $50,000 line of credit with an annual percentage rate of 12% compounded monthly. The bank requires that a 10% compensating balance be placed in an interest-bearing account that pays an annual percentage rate of 2% compounded monthly. The average daily balance is anticipated to be $35,000, excluding the compensating balance and interest due on the line of credit.

Solution: Using Eq. (16-5), we get a yield for the line of credit of the following:

$$i_a = (1 + 0.12/12)^{12} - 1 = 0.12683 \text{ or } 12.683\%$$

Using Eq. (16-5), we get a yield for the interest bearing account of the following:

$$i_a = (1 + 0.02/12)^{12} - 1 = 0.02018 \text{ or } 2.018\%$$

The lender requires that 10% of the $50,000 line of credit or $5,000 be placed in an interest-bearing account. The average daily balance for the line of credit, including the compensating balance, is $40,000 ($35,000 + $5,000). The interest paid on the line of credit for the year can be estimated using Eq. (16-18) as follows:

$$I = \$40{,}000.00(0.12683) = \$5{,}073.20$$

The interest received from the compensating balance is calculated using Eq. (16-18) as follows:

$$I = \$5{,}000.00(0.02018) = \$100.90$$

The net interest paid on both accounts is as follows:

$$I = \$5{,}073.20 - \$100.90 = \$4{,}972.30$$

The interest rate paid on the funds available for use from the line of credit ($35,000) is calculated by solving Eq. (16-18) for i_a and using the average daily balance of the funds available for operations as follows:

$$i_a = \$4{,}972.30/\$35{,}000.00 = 0.14207 \text{ or } 14.207\%$$

From Examples 16-21 and 16-22 we can see that the higher the interest rate paid on the compensating balance, the lower the effective annual interest rate was on the line of credit.

Commitment Fee

The second provision is to require that the borrower pay a percentage on the unused balance. This percentage is often 1/2 to 1%. This is known as a commitment fee.

For example, if a company were to set up a $10,000 line of credit with a 1% commitment fee and an annual percentage rate of 8% and the average daily balance were $4,000, the company would pay 8% on the $4,000 and 1% on the unused $6,000. Like the compensating balance, the commitment fee acts as a deterrent against obtaining an excessively large line of credit. The commitment fee also increases the effective annual interest rate. The effect of the commitment fee on the effective annual interest rate is dependent on the amount of money borrowed against the line of credit. The commitment fee uses the same compounding periods as the annual percentage rate on the line of credit.

Example 16-23: Determine the effective annual interest rate on a $50,000 line of credit with an annual percentage rate of 12% compounded monthly. The bank requires a 1% commitment fee be paid on the unused balance of the line of credit. The average daily balance is anticipated to be $25,000.

Solution: Using Eq. (16-5), we get a yield for the line of credit of the following:

$$i = (1 + 0.12/12)^{12} - 1 = 0.12683 \text{ or } 12.683\%$$

Using Eq. (16-5), for the unused portion of the line of credit we get a yield of the following:

$$i = (1 + 0.01/12)^{12} - 1 = 0.01005 \text{ or } 1.005\%$$

The interest paid on the borrowed funds over one year are estimated using Eq. (16-18) as follows:

$$I = \$25{,}000(0.12683) = \$3{,}170.75$$

The average daily balance of unused funds equals $50,000 less the average daily balance of the used funds or $25,000. The interest paid on the unused portion of the line of credit over one year is estimated using Eq. (16-18) as follows:

$$I = \$25{,}000(0.01005) = \$251.25$$

The total interest paid equals the following:

$$I = \$3{,}170.75 + \$251.25 = \$3{,}422.00$$

The effective annual interest rate paid on the funds available for use from the line of credit ($25,000) is calculated by solving Eq. (16-18) for i_a and using the average daily balance of the funds available for operations as follows:

$$i_a = \$3{,}422.00/\$25{,}000 = 0.13688 \text{ or } 13.688\%$$

In essence, the effective annual interest rate has been increased by 1.005% (13.688 − 12.683) by the commitment fee.

Example 16-24: How would the effective annual interest rate change for Example 16-23 if the average daily balance were increased to $35,000?

Solution: From Example 16-23 the yield for the line of credit is 12.683% and the yield for the unused portion of the line of credit is 1.005%. The interest paid on the borrowed funds over one year is estimated using Eq. (16-18) as follows:

$$I = \$35{,}000(0.12683) = \$4{,}439.05$$

The average daily balance of unused funds equals $50,000 less the average daily balance of the used funds or $15,000. The interest paid on the unused portion of the line of credit over one year is estimated using Eq. (16-18) as follows:

$$I = \$15{,}000(0.01005) = \$150.75$$

The total interest paid equals the following:

$$I = \$4{,}439.05 + \$150.75 = \$4{,}589.80$$

The interest rate paid on the funds available for use from the line of credit ($35,000) is calculated by solving Eq. (16-18) for i_a and using the average daily balance of the funds available for operations as follows:

$$i_a = \$4{,}589.80/\$35{,}000 = 0.13114 \text{ or } 13.114\%$$

In essence, the effective annual interest rate has been increased by about 0.43% (13.114% − 12.683%) by the commitment fee.

From Examples 16-23 and 16-24 we can see that the effect of the commitment fee on the effective annual interest rate is less dramatic when we use a greater portion of the line of credit. This is due to the fact that the interest being paid as a commitment fee is smaller and is spread over a larger amount of funds used in the company's operations.

Once the line of credit has been set up and interest is being paid on the compensating balance, the cost to borrow additional funds from the line of credit is equal to the yield on the line of credit less the yield of the commitment fee. In Example 16-24 we borrowed an additional $10,000 that cost an additional $1,167.80 ($4,589.80 − $3,422.00) for an effective annual interest rate of 11.678% ($1,167.80/$10,000). This interest rate is the same as the yield on the line of credit (12.683%) less the yield of the commitment fee (1.005%).

Fixed fees on lines of credit can be handled in the same manner as closing costs on loans. When selecting between lines of credit, all fees, closing costs, compensating balances, and commitment fees as well as the interest rate may be incorporated into the effective annual interest rate. The lines of credits may be compared based on this effective annual interest rate. For example, if we could choose between the line of credit in Example 16-21, Example 16-22, and Example 16-24, we would choose the line of credit in Example 16-24 because it has the lowest effective annual interest rate.

Another common provision in a line of credit is that the line of credit must be paid off for one or two months during the year. This prevents the borrower from using the line of credit to finance capital equipment and requires careful financial planning on the part of the borrower to meet this obligation.

LEASING

Leasing is an alternate to financing equipment and real property through loans. Under a lease, the lessor or landlord retains ownership of the equipment or property during the life of the lease along with any tax benefits from the depreciation of the equipment or property. At the end of the lease, the ownership of the equipment or property may transfer to the company leasing the equipment or property.

Leases are divided into two types, capital leases and operating leases. A lease must be classified as a capital lease if it is noncancelable and meets at least one of the following conditions: (1) the lease extends for 75% or more of the equipment or property's useful life, (2) ownership transfers at the end of the lease, (3) ownership is likely to transfer at the end of the lease through a purchase option with a heavily discounted price, or (4) the present value of the lease payments at market interest rates exceeds 90% of the fair market value of the equipment or property. All cancelable leases and noncancelable leases that fail to meet all four of the above conditions may be considered operating leases. The key difference between capital leases and operating leases is that capital leases must be recognized on the financial statements as liability the same as a loan. An operation lease is not recorded on the financial statements and is often referred to as off-balance-sheet financing because it is a form of financing that does not show up on the balance sheet. Off-balance-sheet financing can be used to improve a company's financial ratios.

Because the tax consequences are different for leases than they are for loans, taxes must be taken into account when comparing leases to loans. Comparison between loans and leases is discussed in Chapter 18.

TRADE FINANCING

Another source of short-term financing and probably the most common source of financing for a construction company is trade financing. Trade financing occurs whenever there is a delay between the supplying of material, labor, and equipment to a construction project and the payment for these items. When this happens, the supplier or subcontractors are providing financing to the project in the amount of the materials, labor, and equipment supplied for the time between the delivery of these items and the payment of the bill. We saw extensive use of trade financing in Chapters 12 and 14.

When a general contractor pays bills from suppliers and subcontractors prior to being paid by the project's owner for the associated work, the general contractor begins providing financing to the project's owner. For these reasons, it is often in the general contractor's best interest to minimize the amount of financing that is provided to the project's owner. This is often done by arranging for suppliers and subcontractors to wait to be paid until the owner pays the general contractor for the work. This may be included in contracts and supplier agreements in the form of a "Paid when Paid" clause. A paid when paid clause ties the payment of supplier and subcontractor bills to a specified number of days after the general contractor has received payment for the bills in the form of unrestricted funds from the owner. It is not uncommon for a general contractor to finance the majority of a construction project through trade financing rather than their own operating capital.

Some suppliers and subcontractors may offer a discount to construction companies who pay their bill early. Suppliers may provide discounts to improve their cash flows, to reduce their need for operating capital, or to reduce their bill collecting costs. The effective annual interest rate on early payments is calculated by the following formula:

$$i_a = [\text{Discount }\%/(100\% - \text{Discount }\%)](365/\#\text{ of Days Early}) \quad (16\text{-}19)$$

where

$$\text{Discount }\% = \text{Discount Offered by the Supplier or Subcontractor}$$
$$\#\text{ of Days Early} = \text{Number of Days Early the Bill is Paid}$$
$$i_a = \text{Effective Annual Interest Rate}$$

This effective annual interest rate of the discount can be compared to the cost to obtain the funds to pay the bills to determine if it is financially advantageous to pay the bills early.

Example 16-25: A supplier has offered your company a 1% discount for all bills that are paid 10 days after they are billed. The bills would normally be due 30 days after they are billed. What is the return on paying the bills early? If your company can borrow funds from a line of credit at a yield of 14%, is it financially attractive to pay the bills early? The line of credit requires a compensating balance.

Solution: The effective annual interest rate is calculated as follows:

$$i_a = [1.00\%/(100\% - 1.00\%)][365/(30 - 10)] = 18.43\%$$

From Examples 16-20 and 16-21 we saw that the cost to borrow additional funds from a line of credit was equal to the yield on the line of credit when the line of credit is required to have a compensating balance. Because the effective annual interest rate of 18.43% is greater than the yield on the line of credit at 14%, it is financially advantageous to pay the bills early. The saving on the bills will more than offset the interest costs.

To take advantage of trade discounts, the company's accounting system must process bills weekly and be able to identify those bills that offer discounts for early payment.

Although it is financially advantageous to put off paying a bill as long as possible, it is important to pay bills on time to maintain a good credit rating. Suppliers and subcontractors often discontinue extending trade credit or increasing prices to contractors who have a history of slow bill paying. The extra interest earned by putting off paying bills can be quickly offset by a loss of trade credit or by having to pay less favorable prices because your company is a poor credit risk.

Credit Cards

Credit cards may be used to provide a source of financing. Most credit cards do not charge interest on purchases, provided the monthly balance is paid in full by the due date. Credit cards can provide a cheap source of very short-term financing provided the bills are paid in full each month. Because the bills are usually due 20 to 25 days from the date the bill is prepared, items purchased may be financed for up to 55 days interest free, depending on when they are purchased. For example, if you purchased a new copier for your offices on the day after your credit card company prepared its monthly bill, it would be a month before you received a bill for the copier. If the bill was due 20 days after the date the bill was prepared and you paid the bill a few days before the due date, you would have financed the copier for about a month and a half interest free. This time would be reduced to a half a month or so if you purchased the copier just in time for the copier to be billed on the monthly bill. This lag between the date a purchase is made and the date interest is charged is known as a grace period and applies only to those card holders who pay their bill in full each month. Credit cards are a good substitute to trade financing with companies that are not set up to extend financing to your company, provided the bill is paid in full each month.

If the bill is not paid in full, interest is charged based on the average daily balance in the same manner interest is charged on lines of credit. When the balance is not paid in full, the grace period is ignored and interest is charged from the date of the purchase. The interest rate on credits cards is usually much higher than the interest rate on lines of credit and other debit instruments. Credit cards are an expensive source of financing if the bill is not paid in full each month.

Equity Financing

So far in this chapter we have discussed debt financing, which appears as a liability on the balance sheet. Financing may also be obtained by selling equity in the company or project. By selling equity, the existing shareholders share the risk and the rewards (the profits) with the new shareholders.

The return on investment can be maximized by minimizing equity financing through the use of debt financing. For example, if we had a project that required a $2,000,000 investment and sold it for $2,400,000, which was financed with $1,000,000 of equity financing and $1,000,000 of debt financing with an interest cost of $100,000, the shareholders would make $300,000 ($2,400,000 − $1,000,000 − $1,000,000 − $100,000) in profit. This equals a 30% ($300,000/ $1,000,000) return on investment. If we financed the same project with $2,000,000 of equity financing, we should make $400,000 ($2,400,000 − $2,000,000) in profit. This equals a 20% ($400,000/$2,000,000) return on investment. In the second case, the decreased return on investment is due to the profit being shared among more shareholders.

This increased return on investment comes at a price. The shareholders in the first case assume more risk. If the project sold for $1,800,000—a $200,000 loss—and the project was financed with $1,000,000 of equity financing and $1,000,000 of debt financing with an interest cost of $100,000, the shareholders would lose $300,000 ($1,800,000 − $1,000,000 − $1,000,000 − $100,000). This equals a 30% ($300,000/$1,000,000) loss on investment. If we financed the same project with $2,000,000 of equity financing, we would lose $200,000 ($1,800,000 − $2,000,000). This equals a 10% ($200,000/$2,000,000) loss on investment. In the second case, the decreased loss on investment is due to the losses being shared among more shareholders. The ideal mix of equity and debt financing is 1 part equity to 2 parts debt financing.

Selecting a Banker

The most important thing to consider in selecting a banker is to find a banker that you can work with. A little extra interest paid by one bank will not mean much if you cannot get a line of credit or loan that is needed for you to expand your operations. When selecting a bank, be sure that the bank will be responsive to your needs. Here are some things to keep in mind when selecting a banker.

First, bankers like to deal with the complete package. They want your checking account, savings account, certificates of deposit, lines of credits, and loans all with their institution. One reason for this is that it is easier for them to monitor your financial status if all your accounts are with their bank. This is particularly important if they have loaned funds to your company.

Second, some banks specialize in the construction industry. Banks that specialize in the construction industry will be more aware of the unique financial structure and needs of the construction industry.

Third, small banks may be more suitable for a small construction company because they are often more flexible and can offer more personalized service. However, small banks' funds are often more limited, as is their line of services. For this reason, large construction companies often have to look to larger banks to meet their financial needs.

Fourth, choose a bank in a convenient location. Running the deposits to a bank in an out-of-the-way location can waste a lot of time and money.

Applying for a Loan

When applying for a loan, it is important for a company to ask the lending institution for the funds it wants rather than leaving it guessing as to what funds are needed. The request should include the amount, duration, and purpose for the loan.

Before a lending institution grants a company a loan or extends a line of credit, the bank want to know that the company is a good credit risk and has the capacity to pay off the debt along with its interest. To determine if a company is a good credit risk, the lending institution requests that the company submit an application along with supporting documentation for review. The supporting documentation often includes the following:

Tax Returns: Federal tax returns for the past three years.

Financial Statements: Company financial statements for the past three years. Often the lending institution will require that the financial statements be reviewed or audited by a certified public accountant (CPA). Auditing financial statements provides a more stringent review of the documentation that supports the financial statements than does a review. Having a company's financial statements audited is also more expensive than having them reviewed. If the loan is being guaranteed by a third party or has a personal endorsement, financial statements for the third party will also be required for the past three years.

Work on Hand Report: A report detailing all work on hand, including all work-in-progress, all projects completed in the past twelve months, as well as all potential jobs for the next twelve months. Potential jobs are those jobs for which the contractor was the low bidder but has not been notified that the work has been awarded and jobs that are being negotiated that have a significant chance of being awarded. The status of each of the potential jobs should be clearly and accurately stated in the work on hand report.

Overhead Budget: Overhead budget for the next year. The overhead budget should detail the anticipated costs of operating the construction company for the next year. All costs not associated with specific projects should be included in the overhead budget.

Annual Cash Flow Projection: Cash flow projections for the company for the next year. The purpose of the cash flow projection is to determine if the company has the ability to repay the debt along with its associated interest during the next year. The cash flow projections should be consistent with the work on hand report and the overhead budget.

Project Pro Forma: Project pro forma, including the cash flow projections for the next several years. This is only required if the proceeds from the loan are being used to finance a project or capital facility. The purpose of the pro forma is to determine if the project or capital facility has ability to repay the debt along with its associated interest. The pro forma should cover the entire life of the debt to be serviced.

Business Plan: A business plan detailing how the company will be operated. The business plan should demonstrate management's ability to run the company in a professional manner.

References: Business and trade references that can vouch for the company's payment history.

When applying for a loan, remember the bank is in the business of lending money and it needs to lend money to people and companies who will pay the money back along with interest. Careful preparation of the application package and the associated document will improve your chances of successfully obtaining a loan.

Financial Documents

All financial documents should be carefully read and understood before they are signed. The financial documents are legally binding contracts between the borrower and the lending institution. Concerns about any of the provision in the documents should be reviewed by a professional familiar with financial documents, such as an attorney or certified public accountant.

Conclusion

Debt financing is a major source of funding for construction companies. Debt financing includes loans, lines of credit, leases, trade financing, and credit cards. Interest on financing is divided into two types, compound interest and simple interest. Compound interest pays interest on the previous period's interest, whereas simple interest ignores the effects of compound interest. Simple interest is used only on short-term loans. Compound interest is used for long-term loans, lines of credit, credit cards, and trade financing. Compound interest rates are quoted in terms of annual percentage rate (APR) or annual percentage yield (APY). The annual percentage rate ignores the effects of compound interest, whereas the annual percentage yield includes the effects of compound interest. Loan provisions and closing costs may be incorporated into the loan's effective annual interest rate, which may be used to compare the attractiveness of different types of debt financing. During the early years of a loan most of the loan payment is used to pay the interest, whereas during the last years of the loan most of the loan payment is used to reduce the principal. An amortization schedule details how loan payments are divided between interest and principal and how the principal is reduced over time. When obtaining debt financing, the duration of the financial instrument should be matched to the length of the financial need. This is known as maturity matching.

PROBLEMS

1. Determine the interest due on an $85,000 short-term loan, with a term of 300 days and a simple interest rate of 8%.
2. Determine the interest due on a $15,000 short-term loan, with a term of 90 days and a simple interest rate of 11.5%.
3. Determine the quarterly, monthly, and daily interest rates for an annual percentage rate of 10%.
4. Determine the quarterly, monthly, and daily interest rates for an annual percentage rate of 7%.
5. Determine the interest rate for a billing period with 31 days for a loan that charges an annual percentage rate of 9%.
6. Determine the interest rate for a billing period with 30 days for a loan that charges an annual percentage rate of 11.5%.
7. Determine the annual percentage yield for an annual percentage rate of 10% for quarterly and monthly compounding periods.
8. Determine the annual percentage yield for an annual percentage rate of 7% for quarterly and monthly compounding periods.
9. Determine the annual percentage yield for a loan that charges a monthly interest rate of 1.5% and compounds the interest monthly.
10. Determine the annual percentage yield for a loan that charges a monthly interest rate of 3.2% and compounds the interest quarterly.
11. Determine the monthly payment for a thirty-year real estate loan with an annual percentage rate of 8.5% and an initial principal of $200,000. How much interest is paid over the life of the loan?
12. Determine the monthly payment for a sixty-month truck loan with an annual percentage rate of 11% and an initial principal of $17,000. How much interest is paid over the life of the loan?

13. The real estate in Problem 11 is to be purchased with a fifteen-year loan with an annual percentage rate of 8.5%. What is the difference in the monthly payments for the fifteen-year and thirty-year loans? How much does using the fifteen-year loan save in interest?
14. The truck in Problem 12 is to be purchased with a forty-eight-month loan with an annual percentage rate of 11%. What is the difference in the monthly payments for the forty-eight-month and sixty-month loans? How much does using a forty-eight-month loan save in interest?
15. For the loan in Problem 11, determine the monthly interest for the first and second months and the outstanding principal at the end of the first and second months.
16. For the loan in Problem 12, determine the monthly interest for the first and second months and the outstanding principal at the end of the first and second months.
17. Determine the outstanding principal balance on the loan in Problem 11 after 120 payments have been made.
18. Determine the outstanding principal balance on the loan in Problem 12 after 20 payments have been made.
19. How much interest do the borrowers in Problem 11 pay during the tenth year of the loan?
20. How much interest do the borrowers in Problem 12 pay during the second year of the loan?
21. The bank charges $4,000 for closing costs on a $200,000 loan with an annual percentage rate of 8.5% compounded monthly with a term of thirty years. The bank will not allow the closing costs to be added to the $200,000 borrowed. What effect do the closing costs have on the effective annual interest rate?
22. The bank charges $500 for closing costs on a $17,000 loan with an annual percentage rate of 11% compounded monthly with a term of five years. The bank will not allow the closing costs to be added to the $17,000 borrowed. What effect do the closing costs have on the effective annual interest rate?
23. If the loan in Problem 21 is paid off at the end of the tenth year (at the time of the 120th payment) what effect does this have on the effective annual interest rate?
24. If the loan in Problem 22 is paid off at the end of the thirtieth month (at the time of the 30th payment) what effect does this have on the effective annual interest rate?
25. Your company has an existing loan with monthly payments, principal and interest, of $1,888.59. There are 120 payments left on the loan and the loan has an unpaid balance of $155,660.00. Your company is looking at the possibility of replacing this loan with a loan that has estimated closing costs of $3,300.00. At what interest rate would this become attractive?

26. Your company has an existing loan with monthly payments, principal, and interest of $1,883.65. There are 48 payments left on the loan and the loan has an unpaid balance of $74,269.00. Your company is looking at the possibility of replacing this loan with a loan that has estimated closing costs of $1,900.00. At what interest rate would this become attractive?
27. Determine the effective annual interest rate on a $75,000 short-term loan, with a term of one year and a nominal interest rate of 12%. The bank discounts the interest.
28. Determine the effective annual interest rate on a $100,000 short-term loan, with a term of 245 days and a nominal interest rate of 8%. The bank discounts the interest.
29. How would the effective annual interest rate for Problem 27 change if the bank charged a 1% loan origination fee?
30. How would the effective annual interest rate for Problem 28 change if the bank charged $1,000 in closing costs?
31. How much interest would be charged on a line of credit that charges a monthly interest rate of 0.75% if the average daily balance for the month were $26,200?
32. How much interest would be charged on a line of credit that charges a monthly interest rate of 0.96% if the average daily balance for the month were $75,000?
33. Determine the actual annual interest rate on a $100,000 line of credit with an annual percentage rate of 10% compounded monthly. The bank requires that a 5% compensating balance be placed in an interest-bearing account that pays an annual percentage rate of 1.5% compounded monthly. The average daily balance is anticipated to be $75,000, excluding the compensating balance and interest due on the line of credit.
34. Determine the actual annual interest rate on a $40,000 line of credit with an annual percentage rate of 12% compounded monthly. The bank requires that a 10% compensating balance be placed in an interest-bearing account that pays an annual percentage rate of 1.25% compounded monthly. The average daily balance is anticipated to be $25,000, excluding the compensating balance and interest due on the line of credit.
35. Determine the effective annual interest rate on an $85,000 line of credit with an annual percentage rate of 9.25% compounded monthly. The bank requires that a 2% commitment fee be paid on the unused balance of the line of credit. The average daily balance is anticipated to be $70,000.
36. Determine the effective annual interest rate on a $25,000 line of credit with an annual percentage rate of 8.75% compounded monthly. The bank requires that a 1.5% commitment fee be paid on the unused balance of the line of credit. The average daily balance is anticipated to be $10,000.
37. A supplier has offered your company a 0.5% discount for all bills that are paid 10 days after they are billed. The bills would normally be due 30 days

after they are billed. What is the return on paying the bills early? If your company can borrow funds from a line of credit at a yield of 8%, is it financially attractive to pay the bills early? The line of credit requires a compensating balance.

38. A supplier has offered your company a 1% discount for all bills that are paid 15 days after they are billed. The bills would normally be due 45 days after they are billed. What is the return on paying the bills early? If your company can borrow funds from a line of credit at a yield of 13%, is it financially attractive to pay the bills early? The line of credit requires a compensating balance.
39. Modify the spreadsheet in Sidebar 16-2 to calculate the total interest paid over the life of the loan. Test your spreadsheet by entering the data from Example 16-9 and Problems 11 and 12. Compare your spreadsheet's solution to the answer to these problems. Hint: You need to add the balloon payment to Eq.(16-8).
40. Using the principles from Sidebar 16-3, prepare an amortization schedule for a 30-year loan with monthly payments. The amortization schedule should be set up as shown in Figure 16-2 and allow the user to change the schedule by changing the APR and the loan amount (the ending principal for month 0). The spreadsheet should calculate the monthly payment. Be sure to round the monthly payment and monthly interest to whole pennies. Test your spreadsheet by entering the data from Appendix E and compare your spreadsheet's solution to the appendix. Hint: The last payment needs to be adjusted to bring the balance to zero at the end of 30 years.
41. Modify the spreadsheet from Problem 41 to handle a term of 1 to 360 months. Test your spreadsheet by entering data from Appendix E and Problems 11 through 14. Compare your answer to the solutions to these problems. There may be some minor differences due to the way rounding is handled in the spreadsheet versus the problems. Be sure to adjust your last payment to bring the balance to zero at the end of the term. Hint: Use the IF function to blank out cells beyond the loan's duration.
42. Using the principles from Sidebar 16-3, prepare an amortization schedule for a 60-month car loan with an annual percentage rate of 11% and an initial principal of $17,000. The monthly interest rate is based on Eq.(16-4). The loan is originated on January 10, 2009, and the payments are due on the tenth of each month. If the payment date falls on a Saturday or Sunday, then the payment is due the following Monday. Use the same format as was used in Figure 16-3. Hint: Use the Goal Seek function to find the payment; then re-enter the payment to the nearest penny.