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Market Value Mass Appraisal Committee

Depreciation Analysis Guide

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Depreciation Analysis

1.0 Overview

The purpose of this guide is to explore the methods for recognizing and quantifying various types of depreciation and obsolescence. The proper application of these concepts is an essential part of the cost approach. The final objective of this process is an accurate representation of market value.

In the appraisal field, depreciation is defined as:

*a loss in utility and hence value from any cause.*¹

Similarly, accrued depreciation is defined as:

*a loss in value from the reproduction or replacement cost of an improvement due to any cause as of the date of the appraisal. It may also be defined as the difference between the reproduction or replacement costs of an improvement and its market value as of the date of appraisal.*²

There are several definitions of the term “depreciation” found in other fields however, they generally refer to accounting procedures and practices and are not applicable to the market valuation of property.

This valuation guide will explore property valuation by identifying the causes of depreciation and obsolescence and establishing techniques to estimate their effects on property value.

A brief review of the cost approach procedure is presented below.

The Cost Approach Procedure

Substitution is the fundamental principle used in the cost approach. The value of a property is equal to the cost of replacing it with a substitute of equal utility.

The following are the basic steps of the cost approach:

- 1) Collect improvement data.

¹ Barber, A.M. (ed), *Basics of Real Estate Appraising*, First Edition, (The Appraisal Institute of Canada, 1991), p. 284.

² *The Appraisal of Real Estate*, Ninth Edition, (The American Institution of Real Estate Appraisers, 1987), p. 377

2) Estimate replacement cost. Replacement cost is the cost as of a particular date. In mass appraisal a building classification system is required to estimate cost and the following characteristics may effect the estimate:

- design type
- construction type
- quality class
- floor area
- building shape.

Cost manuals itemize construction costs for different classes and models of buildings. Costs are estimated by comparing existing structures to model costs. There are commercially available cost manuals that have a national scope, are easy to use, and are updated frequently. When national cost manuals are not adequate, local cost manuals can be developed and maintained.

- 3) Establish land value, usually by preparing and analyzing comparable market sales data.
- 4) Determine depreciation.
- 5) Calculate the market value of the property including a summation of land value and depreciated improvement value.

Depreciation and Highest and Best Use

The cost approach dictates that before beginning a cost analysis, the utility of the property must be established and the highest and best use determined. A definition of highest and best use is:

*that use which will generate the highest net return to a property over a period of time.*³

The IAAO publication qualifies this definition with the following provisions.

- 1) The highest and best use must be legal.
- 2) The use must be physically feasible—a probable use, not a highly unlikely or speculative one.
- 3) The highest and best use must be an economically viable, complementary use.

³ *Property Assessment Valuation*, International Association of Assessing Officers, 1977, pp. 22-24

- 4) The highest and best use must be financially feasible. The most profitable use for the entire property—land, buildings and other improvements - because the market deals with the total property unit and not the sale of its individual parts.

The concept of highest and best use incorporates an analysis of possible uses including the financial value of those uses.

Often the highest and best use of the property is its existing use. For older properties in downtown locations, the highest and best use of the property may be in question. In these situations the assessor may have to complete several different types of valuation analysis before determining the “best” value of the property. Although this may cause the valuation process to be more difficult, it more accurately reflects the way the market will view the potential value of the property.

Analysis of depreciation, the cost approach, and market value often introduce the question of “value in use” rather than value in exchange. Under the *Municipal Government Act* in Alberta, and under Canadian jurisprudence, the value to be determined is the value in exchange. The leading authority in this matter is the *Sun Life Assurance Case*.⁴

...where no sale is contemplated and indeed any sale would be difficult...nevertheless the ultimate aim is to find the exchange value of the property, i.e., the price at which the property is salable.

...the owner must be regarded like any other purchaser and the price he would give [should be] calculated not on any subjective value to him but upon ordinary principles, i.e., what he would be prepared to pay if he were entering the market for a building to meet his requirements, or be willing to expend in erecting a building in place of one that is being assessed.

Where there is a limited market, the current owner should be considered as a potential purchaser, and the property should be valued in this light. The value to the owner must be considered using ordinary principles and the current owner should be regarded as any other potential purchaser.

This viewpoint gives the justification and practical means for the assessor to evaluate depreciation and obsolescence from the current owner’s perspective.

Replacement versus Reproduction Costs

The objective of every costing exercise is to determine the depreciated replacement cost of the improvements. Some confusion exists over the difference between reproduction costs and replacement costs of a property. A “reproduction” duplicates the existing structures; it is the identical design, layout, size and volume of the existing building. A “replacement” is what actually would be built if improvements were incorporated. Replacements are designed to replace the existing functions and

⁴ *Montreal v. Sun Life Assurance Co. of Canada*, [1952] 2 D.L.R. 81 (P.C.)

capacity of the property and to take advantage of advances in design, layout and construction technologies.

In determining reproduction cost, some of the original building materials may be substituted in construction. This does not necessarily constitute a full determination of functional depreciation nor does it automatically represent the replacement cost. Replacement cost considers many of the elements that lead to the functional depreciation (obsolescence) inherent in the property. The replacement cost method analyzes a substitute property with similar utility and can eliminate the process of quantifying two forms of construction functional obsolescence: superadequacy or inadequacy.

The assessor that begins with a reproduction cost analysis must ensure that all forms of depreciation are considered in the market value estimate. If a replacement cost analysis is used, some elements of functional depreciation may have already been considered.

2.0 Forms of Depreciation

Depreciation is a measure of the reduction in the value of a property from the cost new of a similar hypothetical property. Three recognized sources of depreciation are physical, functional and external.

Physical Depreciation

Physical depreciation is a result of physical deterioration in the structure and even though virtually all structures deteriorate with age, good maintenance can slow the deterioration. The two categories of physical depreciation are curable and incurable.

Curable physical depreciation is defined as

... items of deferred maintenance; the estimate of curable physical deterioration applies only to items in need of repair on the date of the appraisal.⁵

A curable item would increase the property value and/or its economic life, more than or at least equal to, the cost of correcting the condition.

Incurable physical depreciation is defined as

... that which, as of the date of the appraisal, is not economical to repair or replace, that is, the cost of repair exceeds the gain in value⁶

Incurable physical depreciation could include items such as structural framework, foundation or ceiling structures. Some property improvements have shorter life expectancies than the property as a whole.

A long-lived item is a building component that is expected to have a remaining economic life that is the same as the remaining economic life of the structure.

A short-lived item is a component that is expected to have a remaining economic life that is shorter than the remaining economic life of the structure.⁷

Long-lived items are the structural elements of a building, e.g., the frame, foundations etc., and any other elements that were not included in the above categories.

⁵ *ibid.*, p. 383

⁶ Eckert, Joseph K.(ed), *Property Appraisal and Assessment Administration*, (The International Association of Assessing Officers, 1990), p. 220

⁷ *The Appraisal of Real Estate*, Ninth Edition, (The American Institution of Real Estate Appraisers, 1987), p. 385

Short-lived items include finishes, mechanical and electrical systems and other elements that wear out faster than the rest of the property. This includes items that are not yet ready to be replaced.

Functional Obsolescence

Functional obsolescence is defined as

a decrease in value caused by an inability of an improvement to perform its function efficiently; [it] may be attributable to deficiencies, defects, inefficiencies, or super-adequacies of a property.

It can also be defined as

loss in value due to inability of the structure to perform adequately the function for which it is being used, as of the appraisal date. Functional obsolescence results from changes in demand, design, and technology and can take the form of deficiency, need for modernization, or superadequacy.⁸

As with physical depreciation, functional obsolescence can be divided into two categories: curable and incurable.

Curable functional obsolescence refers to improvements where the cost of replacing the unacceptable or outmoded items is the same or less than the anticipated increase in value, or where the cost is offset by the increase in utility of the property. The following three measures of curable functional obsolescence are categorized by the cost to cure the depreciated condition.

- 1) Deficiencies—the property requires additions or improvements to fulfill its required function.
- 2) Modernization of deficiencies—the property requires re-modeling or renovation to adequately fulfill its required function.
- 3) Superadequacies—the building component is measurably greater than what is required to fulfill existing and intended functions, e.g., an outside stairwell to an upper floor that was never built.

Incurable functional obsolescence occurs when the cost to cure the deficiency exceeds any increase in value to the property. If a purchaser is willing to accept the problems associated with the property, they will do so at a lower rent or lower purchase price. Incurable functional obsolescence is best measured using the sales comparison approach and it can also be measured by capitalizing any income lost due to the obsolescence.

⁸ Eckert, Joseph K.(ed), *Property Appraisal and Assessment Administration*, (The International Association of Assessing Officers, 1990), pp. 220-221

External Obsolescence

External obsolescence is defined as

*the loss in value as a result of impairment in utility and desirability caused by factors outside the property's boundaries.*⁹

It can also be defined as

*the diminished utility of a structure due to negative influences from outside of the site.*¹⁰

Loss in value due to external obsolescence is conditional on the problem being long-term and generally beyond the control of the property owner. External obsolescence can arise from a variety of factors such as neighbourhood decline, changes in sources of supply, and changes in market conditions. Unlike physical deterioration, external obsolescence is considered to be incurable and is not age dependent. The factors are generally a result of actions taken by consumers, the competition, or regulatory agencies.

A form of external depreciation is locational obsolescence that is, the “loss in value due to less than optimal siting of an improvement.” Locational obsolescence would occur to a residential property if a scrap yard were placed next to the residential development.

Additional Definitions

Physical life—the period of time of actual physical endurance of improvements.

Economic life—the period of time during which a given building or other improvement to property is expected to contribute (positively) to the value of the total property. This period is typically shorter than the period during which the improvement could be left on the property, that is, its physical life.¹¹

Effective age—the typical age of a structure equivalent to the one in question with respect to its utility and condition. Knowing the effective age of an old, rehabilitated structure or a building with

⁹ Ibid., p. 221

¹⁰ *The Appraisal of Real Estate*, op.cit., p. 395

¹¹ Eckert, Joseph K.(ed), *Property Appraisal and Assessment Administration*, (The International Association of Assessing Officers, 1990), p. 642

substantial deferred maintenance is generally more informative than knowing its chronological age.¹²

Remaining economic life—economic life less effective age. The number of years remaining in the economic life of a building or other improvement as of the date of the appraisal. This period is influenced by the attitudes of market participants and by market reactions to competitive properties on the market.¹³

Chronological age—the number of years elapsed since an original structure was built. Also known as actual age and historical age.¹⁴

¹² Ibid., p. 642.

¹³ Ibid., p. 660

¹⁴ Ibid., p. 636

3.0 Identifying Depreciation

Recognizing Depreciation

There are three types of knowledge that will assist the assessor in establishing depreciation.

- 1) Knowledge about the physical nature of the property:
 - type of construction
 - condition of improvements
 - nature of the soil conditions
 - site configuration and building layout.
- 2) Knowledge about the operation of the property:
 - functionality of the property
 - financial health of the business
 - use, potential use, and utility of the property.
- 3) Knowledge about economic conditions:
 - general economic conditions
 - economic conditions with respect to the particular industry.

Information Gathering

A site inspection is necessary to determine the condition and functionality of the property. This analysis includes the following actions.

Discussions with Property Owner/Operator—The property owner or operator is often the best resource for information about the functionality and utility of a property. There are many ways to solicit information: the questions to ask, and appropriate interpretations of the answers are developed through experience and general knowledge of the property type.

General Research—Information about general economic conditions can be determined by financial statistics. Such data can be found in local newspapers or government publications, e.g., *Census*, or *Bank of Canada Review*. More specific information dealing with real estate can often be determined from other sources, e.g., newspapers, libraries, real estate publications, etc.

The property valuation process is easier and more accurate if the assessor incorporates a variety of current sources of information. This provides a foundation for evaluating whether typical depreciation is appropriate or if further analysis should be undertaken.

Determination of Effective Age

Effective age can be established for each component of a building or improvement.

Determining the effective age of each component involves:

- observed condition (inspection) of the item
- chronological age or year built
- physical life expectancy of the item
- general maintenance practices.

Determining the collective effective age of all the improvements is a combination of the following elements:

- weighted average age based on year built and cost of construction
- observed condition (inspection) of all improvements
- general maintenance practices
- life expectancy of improvements.

Obsolescence Investigation

Obsolescence Questions

Identifying and recognizing obsolescence conditions generally requires answers to the following questions.

- 1) Are there any functional problems with the property?
- 2) Are there excess operating costs inherent to the property that would indicate functionality problems?
- 3) Are there any inefficiencies in the use of space or the layout of the buildings?
- 4) Are there any external conditions affecting this property?

- 5) Could the existing facility be replaced with a more modern, efficient substitute that more adequately fulfills current and/or expected requirements? If so, what would constitute this modern unit?
- 6) How would a potential purchaser view this property?

If the answers to these questions deal with building functionality and usage, then functional obsolescence may be present.

If the answers to these questions deal with long-term over capacity, or poor financial performance due to depressed market conditions, then there may be external obsolescence present.

Factors that Produce Functional Obsolescence

Listed below are factors that could lead to functional obsolescence. The list is not intended to be all-inclusive, as many functional problems are property specific.

- 1) Excessive floor space

Includes floor areas that are not used or required for current or foreseeable operations. Such space may or may not have a viable use and value under an alternate highest and best use.

- 2) Piecemeal construction, inappropriate building layout, and disjointed production flow.

Poorly laid out buildings may be the cause of extra operating costs in manpower, transportation and machines e.g., floors at different levels, rooflines at different levels, loading docks at inconvenient locations etc.

- 3) Excessive operating costs

Factors such as excessive windows and openings, poor insulation, inadequate heating systems and inferior building services may generate excessive operating costs.

- 4) Excessive heights

- 5) Excessive or superior construction

A building may have originally been designed for certain roof loadings, floor loadings, or overhead cranes that no longer form part of the production process.

- 6) Inferior materials or construction

A lack of quality in construction may lead to inefficiencies. For example, storage on a second floor where the lift construction does not permit the operation of a forklift.

7) Change in property use

A manufacturing facility can require special services and designs to ensure that employees have a safe and comfortable working area, e.g., extra lighting, and environmental controls. If such a building is then converted to a warehouse, there may be redundant qualities in the services and structure that add nothing to the current property use.

8) Bay size (column spacing)

9) Poor lighting or poor installation of other services (generally considered curable)

10) Site Restrictions

A site that does not permit rational expansion or appropriate access can cause functional problems, inefficiencies and excess operating costs.

Factors that Produce External Obsolescence

Typically a decline in sales volume, profits, or value of the company assets can result in external obsolescence. These decreases should be the product of long-term conditions and not a reflection of temporary market aberrations, poor management, or labour unrest.

1) Technological changes

A decline in the price of a product due to new or increased competition, technological advances, or a permanent decrease in market demand can cause external obsolescence. Under these circumstances the property has lost some ability to generate income and therefore can incur a corresponding drop in value.

2) Change in the attractiveness of the location

A decline in value, commonly referred to as locational obsolescence, is caused by factors that change the attractiveness and subsequent value of a location. Incompatible development such as a scrap yard next to an apartment building, traffic being re-routed onto a new highway and from a retail strip, or the market for the goods moving away resulting in greater transportation costs all result in locational obsolescence.

3) Change in government restrictions or regulations

Property rezoning or changes to government regulations can affect land value. Situations such as a regulatory change in the amount of pollutants permitted in manufacturing may produce external obsolescence by restricting the amount of potential income or by increasing the cost of production without a corresponding increase to profit.

4) Physical site restrictions

A community may desire an expansion however, due to zoning or physical restrictions this may not be possible. Anything from the unfulfilled need for more parking spaces to an inability to add loading docks in a building expansion may cause this form of external obsolescence.

5) Changes in the sources of supply

A steel mill may have been located close to an ore deposit to save on transportation costs; however if the ore supply runs out the mill may suffer from a degree of external obsolescence.

4.0 Quantifying Depreciation

Overview

Property depreciation can begin the moment the construction crew leaves the site. Premature physical deterioration, poor design and external market forces can cause the immediate loss in property value. Conversely, 30-year-old buildings may be found in good repair and be normally functional with few negative influences. The value loss in older buildings may also be offset by the building's historical significance, architectural excellence, location, or a scarcity of supply.

- 1) Depreciation is not necessarily related to the actual age of the property.
- 2) It is ultimately the market that dictates the amount of depreciation in a property.
- 3) Because of the diverse nature of depreciation, there is not one correct or standard way to quantify loss in value from costs new. Appropriate market value evidence always provides some indication of depreciation, however it is not always possible to directly compare the available market evidence to the property being valued.

Depreciation and market value are ultimately determined in the marketplace, yet adequate market information is not always available for every property. Appraisers and assessors are required to estimate the type and degree of depreciation present in a property. An accurate quantification of depreciation involves information supplied by the property owner. Without such information quantification must be derived using the depreciation tables from cost manuals however these schedules are only a guide and may not always apply.

Applying Deductions due to Depreciation

The traditional breakdown approach involves the separate analysis of all forms of physical, functional and external depreciation. The breakdown approach involves the following steps.

- 1) Items of curable physical depreciation are identified and the cost to cure these items is established.
- 2) Current age and physical life expectancy of all short-lived items are estimated and the physical depreciation is quantified.
- 3) Age and life expectancy of long-lived items are established and incurable physical depreciation is estimated.
- 4) Deductions for curable and incurable functional obsolescence are determined.
- 5) Conditions of external obsolescence are estimated.

Example of Breakdown Approach

In this example, effective ages and life expectancies of all items are given and it is assumed that there is no functional or external obsolescence.

Summary Example of Breakdown Analysis

Subject:	21,500 ft ² refrigerated warehouse—5 loading docks
R.C.N.	\$40 per ft ² (all improvements)
Age:	18 years
Condition:	good/average
Expected Physical Life:	60 years
Repairs required:	Loading dock repair cost = \$1,200
	Refrigeration equipment = \$1,700

Short-Lived Items	RCN* (dollars)	Effective Age (years)	Life Expectancy (years)
Roof covering	15,000	18	20
Insulation	6,500	3	15
Plumbing	4,100	18	25
HVAC	4,700	1	20
Loading docks	6,000	2	15
Refrigeration Equip.	4,400	6	10

* RCN = reproduction costs new

Curable Physical Deterioration

Item	RCN	Cost to Cure	Depreciation
Loading Dock	\$6,000	\$1,200	\$1,200
Refrigeration	\$4,400	\$1,700	\$1,700
Total Curable Physical Deterioration:			\$2,900

Incurable Physical Depreciation

Item	Cost New (Remaining)	Effective Age	Physical Life	Ratio	Depreciation
Roof	\$15,000	18	20	90%	\$13,500
Insulation	\$6,500	3	15	20%	\$1,300
Plumbing	\$4,100	18	25	72%	\$2,952
HVAC	\$4,700	1	20	5%	\$235
Loading Docks	\$4,800	2	15	13.3%	\$640
Refrigeration	\$2,700	6	10	60%	\$1,620
Totals:	\$37,800				\$20,247

Physical Depreciation Long-lived Items

Total Reproduction Costs:	\$860,000
Less Reproduction costs of:	
Curable Items	\$2,900
Other short-lived items	\$37,800
Reproduction costs long-lived items	\$819,300
Expected Economic Life:	60 years
Effective age:	18 years
Ratio:	18 / 10 30%
Total: Long-lived physical depreciation	\$245,790

Depreciation Summary - Breakdown Example

Total Curable:	\$2,900
Total Short-lived Incurable:	\$20,247
Total Long-lived Incurable:	\$245,790
Functional obsolescence:	\$ 0
External obsolescence:	\$ 0
TOTAL DEPRECIATION	\$268,937

The required analysis and subjectivity to determine life expectancy and age of components, physical depreciation, functional obsolescence and external obsolescence make this approach challenging and time consuming.

Example Property

Examples and work presented in this manual assume that the highest and best use has not changed due to depreciated conditions inherent in the property.

The depreciation analysis example presented in this section is based on a small assembly plant example—AB Manufacturing.

AB Manufacturing is a small manufacturing/assembly plant that makes parts used in oil exploration equipment. The plant is 30 years old and has grown over the years, adding warehousing space. The processing equipment was updated recently and can produce 100,000 parts per year. The security of the business relies upon the amount of on going oilfield exploration.

The plant, office and first warehouse addition are typical cement block construction. The plant is a steel frame construction and the office and warehouse are built with load-bearing walls. The second warehouse addition in 1986 has insulated metal siding on steel frame construction.

Figure 1: Schematic Outline, Quantification and Reproduction Cost of AB Manufacturing

Office 1964	Plant 1963	Plant	Area (ft²)	Height	Volume (ft³)
		Plant	12,440	24.0	298,560
		Office	2,855	12.0	34,260
		Warehouse	7,000	20.0	140,000
		Whs Addition	4,120	36.0	148,320
		Totals	26,415	23.5	621,140
	Warehouse 1970	Plant Costs	Area (ft²)	Rate	RCN
		Plant	12,440	\$51.00	\$634,440
		Office	2,855	\$60.00	\$171,300
		Warehouse	7,000	\$42.00	\$294,000
		Whs Addition	4,120	\$57.00	\$234,840
	Whs Addn 1986	Totals	26,415	\$50.52	\$1,334,580

Calculating Effective Age

Determining the effective year built, or effective age of a property is mostly an arithmetic exercise. To determine the effective year built of a group of buildings forming an integrated property (i.e., an industrial facility built in four construction phases), a weighted average method is recommended. The calculation of such a weighted average is shown in Table 2 below. It is assumed that all buildings receive average maintenance.

To establish the age of a property, there are two common methods weighting methods:

1. By size, or
2. By value.

Table 2: Analysis of the Effective Physical Age - AB Manufacturing

Building	Area (ft ²)	RCN	Year Built	Weighted Age by RCN Value	Weighted Age by Area
Assembly plant	12,440	\$634,440	1963	933.2	924.5
Office	2,855	\$171,300	1964	252.1	212.3
Warehouse	7,000	\$294,000	1970	434.0	522.1
Hi bay whse addn	4,120	\$234,840	1986	349.5	309.8
Totals	26,415	\$1,334,580		1968.8	1968.7

Weighted Age Calculations

The Weighted Age by RCN Value calculations in Table 2 were completed as follows:

$$\text{RCN} \div \text{Total RCN} \times \text{Year Built}$$

$$\text{Assembly plant: } \$634,440 \div \$1,334,580 \times 1963 = 933.2$$

The Weighted Age by Area calculations in Table 2 were completed as follows:

$$\text{Area} \div \text{Total Area} \times \text{Year Built}$$

$$\text{Assembly plant: } \$12,440 \div \$26,415 \times 1963 = 924.5$$

In the example of AB Manufacturing, the average physical age of the entire group of improvements weighted by size is 1968.6, rounded to 1969. The weighted average age based on value was 1968.7,

rounded to 1969. Although the numbers in this example are close, weighting the average effective age *by value* is probably more appropriate than by size.

Applying Physical Depreciation

Apart from the *Marshall & Swift Valuation Service Manual*, most commercial cost manuals do not publish depreciation tables. Generally, the tables found in assessment cost manuals are not based on the physical life of the improvements *but their expected economic life*.

The most significant factors in the longevity of improvements are economic considerations. The longevity of structures will depend on use, construction materials, maintenance and climatic conditions. The physical life expectancy of items that are periodically replaced such as roofing, plumbing elements, and heating components, are generally known. However there are no hard and fast rules, manuals, or information available on the physical life expectancy of long-lived components such as framing, foundations, etc.

The assessment process relies upon the economic age-life depreciation tables that incorporate normal physical depreciation based on age. Analysis of physical deterioration should be established based on the observed condition of the property however a detailed analysis of every component of physical deterioration must typically rely on engineering expertise.

Where physical deterioration is analyzed, it is generally deducted on a straight-line basis. For example, if a building was expected to stand for 50 years, applying physical depreciation on a straight-line basis means a deduction of 2% per annum ($100\% \div 50 \text{ years} = 2\% \text{ per year}$).

Economic Age-Life Analysis

Economic life is different from physical life. By definition it is “the period of time over which improvements to real estate contribute to property value”¹⁵ i.e., it still has function and utility in the market place. Instead of considering the physical life of the improvements, the economic age-life approach bases its analysis on the expected economic life of the improvements.

Because the analysis of economic life concentrates on utility and market considerations, it is a better reflection of depreciation due to market influences than the analysis of physical age.

The remaining economic life of an improvement is determined in the market place. In valuing a property where elements of the improvements have lost their economic purpose two different considerations arise.

- 1) Is the deficiency curable, and curable at a reasonable cost?

¹⁵ *The Appraisal of Real Estate*, op.cit., p. 378

2) Has the highest and best use of the property changed?

Depreciation Schedules and Tables from Manuals

Depreciation schedules are intended to reflect standard physical, functional, and age-related depreciation of a property. This method of estimating depreciation relies upon four separate points of analysis:

- effective age of the improvements
- determination of the expected life of the improvements
- recognition that the property may be subject to other forms of depreciation
- maintenance/condition of the improvements.

The accuracy of depreciation tables and schedules will depend on the answers to the following questions.

- 1) What sales and types of properties were used to establish the depreciation table?
- 2) Is this information comparable to the type of property being valued?
- 3) Do the historical relationships between sales volumes and property age established in these tables, still reflect the current market?

Application of Depreciation Tables and Remaining Economic Life

If the effective age of an older property cannot be determined, but its remaining life expectancy is known (for example a mine that is scheduled to close in three years), then it is possible to work backward from the terminal value (e.g., 20%) to determine the current level of depreciation based on the remaining economic life. Similarly, the depreciation inherent in a building in either below average or above average condition can be determined by adjusting the effective age of the improvement, upward or downward from the physical age, as required.

Example of Depreciation Analysis - Age-Life Depreciation Tables

The industrial property AB Manufacturing, as outlined in Table 2, will be used for this example. There are two methods to calculate typical age-related depreciation.

- 1) Piece by piece, on the premise that each individual component has a distinct economic life.
- 2) As one overall facility, on the premise that the entire property will close at the same time.

To calculate depreciation the choice of approach should be guided by the perspective of the market place, i.e., how the market would view the purchase of this property. Generally the overall approach is preferred. If a purchaser chooses to split the property into components, a piece by piece analysis is required.

In Table 2 the average overall effective age of AB Manufacturing plant was calculated to be 1969 (based on weighted value). If the property were in average condition, the effective age on July 1, 1998 would be 30 years old. Information from the *Marshall & Swift Valuation Service Manual* indicates that the life expectancy of this type of property is 45 years. A portion of the depreciation table from *Marshall & Swift* is reprinted in Table 3.

Table 3: Marshall & Swift 45 Year Life Depreciation Table

Age	% Depreciation
27	37%
28	40%
29	42%
30	45%
32	50%

The depreciation rate for a building that is expected to last 45 years with effective age of 30 years is 45%. Therefore the typical overall depreciation suggested by *Marshall & Swift Valuation Service Manual* is:

Cost new determination indicated at Figure 1

Cost New - Depreciation = Value of Improvements

$$\$1,334,580 - (1,334,580 \times 0.45) = \$734,019$$

This illustrates the estimated market value of the improvements of AB Manufacturing, based on typical depreciation, would be \$734,000 (rounded).

Note: Improvements suffering from other forms of “abnormal” depreciation and abandoned buildings are factors that must be dealt with on a case-by-case basis.

The recognition and analysis of some forms of depreciation require a level of knowledge and understanding of the property that may not be readily available to the valuator. In many instances the assessor must rely on material presented by the taxpayer before coming to a fair assessment value for the property.

In order to expect a fair estimation of depreciation and assessment value the taxpayer must ensure all information is available to the assessor.

Cost to Cure

Cost to cure items are those that would usually be repaired at the time of sale, or those that prevent the rational functioning of a property (e.g., re-roofing or fixing an inadequate heating system).

Cost manuals contain general information on the cost to replace certain items. It is likely that the assessor will rely on information supplied by the property owner to determine the actual cost of repairing items. The assessor should view this information with a critical eye and can make reference to cost manuals if costs appear inappropriate.

Apart from the estimate of costs, there are three valuation issues that arise when considering costs to cure.

- 1) How does curing the item affect the value of the property? For example, if a property owner spends \$10,000 to install new washroom facilities, it does not necessarily mean a corresponding \$10,000 increase in property value.
- 2) If the repair is necessary to carry on the functions within the building, then either the owner or a prospective purchaser will be required to affect repairs. In this case, the total repair amount is a form of depreciation. Once the repairs have occurred, the assessor should relate back to the basic market value question (addressed in point 1).
- 3) Repairing items or renovating a property will likely affect the effective age of the property.

Example of Cost to Cure Analysis - AB Manufacturing

If AB Manufacturing requires a \$50,000 new roof to keep the property functioning, then the roof cost represents the cost to cure. The amount of depreciation is the amount spent for functionality reasons.

If the roof problem was not cured, the following table summarizes the depreciation.

Cost to Cure Depreciation Analysis - AB Manufacturing

Cost new	\$1,334,580
Cost to cure (roof)	\$50,000
Sub-total	\$1,284,580
Normal depreciation	42%
Market value of improvements	\$745,056

Note: The normal depreciation rate was adjusted from 45% to 42% due to the overall improvement in the effective age arising from the roof repair. In this example, the assessor judged that by spending \$50,000 on a new roof, the owner improved the effective age of the property by 1 year to 29 years of age. The Marshall & Swift depreciation rate for a building that is expected to last 45 years with effective age of 29 years is 42%. (Table 3)

The difference in value between the estimated age-life depreciation calculation of \$734,000, and the cost to cure depreciation analysis of \$745,000 occurs for two reasons.

- 1) Depreciation tables are imprecise.

- 2) An estimated change in effective age as a result of repairs is also a somewhat subjective exercise.

This is also an example of the imprecise nature of valuation estimates.

Cost to Cure Value Analysis Where Repairs are Completed

If AB Manufacturing spent \$50,000 and repaired the roof, a prospective purchaser would recognize this improved condition and might offer an additional \$35,000 to buy the property over a typical property without the roof repair. From a market perspective the new market value of the improvements at AB Manufacturing would be:

$$\$734,000 + \$35,000 = \$769,000.$$

From the perspective of a cost approach analysis the cost new of the property does not change, but the effective age changes and the typical overall depreciation suggested by *Marshall & Swift Valuation Service Manual* is now calculated as follows:

$$\text{Costs New} - \text{Depreciation} = \text{Value of Improvements}$$

$$\$1,334,580 - (1,334,580 \times .42) = \$774,056$$

As a result of curing the roofing problem at AB Manufacturing, applying the new effective age provides a new value of \$774,000 (rounded). Again there is a slight difference in the calculation results compared to the market-generated analysis due to the imprecision of measuring market value.

Elemental Approach

The elemental approach considers the functionality and utility of each improvement on an item-by-item basis. This method requires a building-by-building evaluation of the property (or floor by floor) assessing the functionality and utility of each element (e.g., it may be that 20% of the floor space is unused in one building or there is 5' excess height in the ceiling of another).

This process requires a judgment on each component of the property improvements and their effect on its remaining economic life and functionality with respect to the rest of the property. The question "does this space or building serve a purpose?" must be asked continually throughout this process. If the answer to this question is "yes" then the next question to be addressed is "what is the purpose and what would be necessary to replace this function?"

The advantage of this method is that it forces a thorough inspection of the property. This knowledge enables the assessor to make better judgments about functionality and effective age. The disadvantage of this method is that it does not necessarily address factors that affect the value of the property as a whole (e.g., piecemeal site construction, inefficient site layout).

Example of Elemental Approach - AB Manufacturing

The buildings in the AB Manufacturing example consist of several different sections. At 24 feet, the height of the older assembly plant area is overbuilt for today's production requirements. Production machinery only requires ceiling heights of 16 feet therefore the assembly plant of AB Manufacturing is overbuilt. Replacing the AB Manufacturing plant at a 24-ft. height would cost \$51/sq ft. however to build a plant with the new standard of a 16-ft. roof height would be \$42.50/sq ft.

The remaining AB Manufacturing buildings appear to be fully utilized.

Table 4: Elemental Approach - AB Manufacturing

Building	Area (ft²)	Year Built	Height (ft.)	Original RCN	New Ht. (ft.)	New RCN
Assembly plant	12,440	1963	24	\$634,440	16	\$528,700
Office	2,855	1964	12	\$171,300	12	\$171,300
Warehouse	7,000	1970	20	\$294,000	20	\$266,000
Hi bay whs. addn.	4,120	1986	36	\$234,840	36	\$296,640
Totals	26,415			\$1,334,580		\$1,228,840

Using the elemental approach, the cost difference represents the amount of functional obsolescence in this plant as a 7.9% reduction in value.

Old plant:	\$1,334,580
<u>New plant:</u>	<u>-\$1,228,840</u>
Difference: 7.9%	\$105,740

Since the elemental approach uncovered no other functional depreciation considerations, the following is a summary of the property depreciation.

Summary of Depreciation: After Elemental Analysis - AB Manufacturing

Cost new	\$1,334,580
Cost to cure (roof)	\$50,000
Sub-total	\$1,284,580
Functional obsolescence (Ht.)	7.9%
Normal depreciation	42.0%
Market value of improvements	\$686,000

Replacement Model Approach

This approach begins by replicating the functions in the existing property while taking advantage of technological advances to produce a modern and competitive facility. A realistic evaluation of the requirements and capabilities of the existing property is needed. Constraints such as current location, site size and zoning by-laws should be taken into account. The cost new of the replacement model sets the upper limit of value for the improvements and represents the maximum amount that a potential purchaser would pay.

If completed properly, the depreciation in the existing property will be the difference between the costs new produced using the replacement model approach and the costs new of the existing plant. This process may also identify and measure the following features of a replacement plant:

- functionality
- excess operating costs, and
- excess construction costs.

Designing a Model

The major requirement of the model is that the design must capture the functionality of the existing plant. This includes:

- 1) the plant's current functions

- 2) any other functions that the existing property is capable of *and* are planned in the foreseeable future.

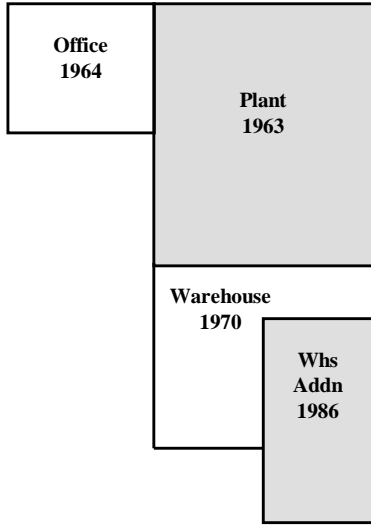
Due to changes in technology, in many cases a model will also represent an improvement over the capability and functionality of the existing property. The assessor should remember that the objective of the exercise is to determine the value of the existing property. Therefore the model should reflect the same functionality as the existing plant so that value is established by comparing apples to apples.

Models may require analysis and expertise not available to the assessor. In such cases, the owner must supply the necessary information for the assessor to complete the valuation.

Example of the Replacement Cost Approach - AB Manufacturing

In-depth research into the functionality and utility of the AB Manufacturing plant reveals that a state-of-the-art facility would be designed to have smaller office and warehouse areas. The height of the assembly plant area would be reduced to 16 feet and the new high bay warehouse space would be at 36 feet. The volume of warehouse space stays the same at 288,000 cubic feet, but better layout increases the utility of the space. Figure 2 illustrates the differences between the existing plant and the model.

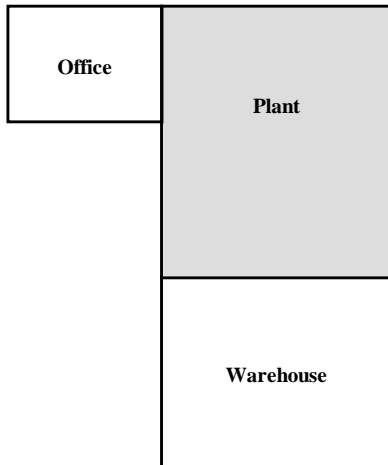
Figure 2: AB Manufacturing Model Analysis



Plant	Area (ft²)	Height	Volume (ft³)
Plant	12,440	24.0	298,560
Office	2,855	12.0	34,260
Warehouse	7,000	20.0	140,000
Whs Addition	4,120	36.0	148,320
Totals	26,415	23.5	621,140

Plant Costs	Area (ft²)	Rate	RCN
Plant	12,440	\$51.00	\$634,440
Office	2,855	\$60.00	171,300
Warehouse	7,000	\$42.00	294,000
Whs Addition	4,120	\$57.00	234,840
Totals	26,415	\$50.52	\$1,334,580

AB Manufacturing Replacement Model



Plant	Area (ft²)	Height	Volume (ft³)
Plant	12,440	16.0	298,560
Office	2,650	11.0	34,260
Warehouse	8,000	36.0	140,000
Totals	23,090	22.4	621,140

Plant Costs	Area (ft²)	Rate	RCN
Plant	12,440	\$52.50	\$528,700
Office	2,650	\$60.00	\$159,000
Warehouse	4,120	\$57.00	\$140,000
Totals	23,090	\$49.53	\$1,143,700

The replacement model approach estimates part of the functional obsolescence inherent in the construction of the AB Manufacturing property as the difference between the cost of the existing plant and the cost of the model.

The table below summarizes the depreciation at AB Manufacturing to this point in the analysis.

Summary of Depreciation: After Replacement Model—AB Manufacturing

Cost New	\$1,334,580
Functional Obsolescence 14.3%	\$190,880
Replacement Cost	\$1,143,700
Cost to cure (adjusted) *	\$45,000
Sub-total	\$1,098,700
Normal Depreciation	42.0%
Market Value of Improvements	\$637,246

* Cost to cure the roof was adjusted from \$50,000 to \$45,000 to reflect the smaller roof area of the replacement model.

Replacement Model and Double Counting Functional Obsolescence

The model cost reflects the cost new of the most functionally equivalent replacement for the subject, i.e., replacement costs. It does not account for other forms of depreciation such as normal physical, functional, and external obsolescence that require consideration.

Since the normal (economic age-life) depreciation rate applied in the valuation of AB Manufacturing arises from depreciation tables that are based on sales data, the rate takes into account typical functional obsolescence associated with the property. As such, there may be double counting if both forms of depreciation (replacement model and economic age-life percentage deduction) are fully applied. To prevent double counting, the age-life deduction may require a reduction if the replacement model is also used. Without detailed knowledge of how the age-life depreciation schedule was calculated it is very difficult to determine the adjustments that would be needed to balance this type of depreciation.

5.0 Excess Operating Costs

A prudent purchaser will take into account all cash outlays when considering the price of a property. The choice for the purchaser is a decision between buying an old property with inefficiencies or building a new property. There will be a lower price at which an older property becomes as attractive as the higher cost of a new property.

Excess operating costs result from inefficiencies in a plant. They negatively impact the value and, can be measured by capitalizing the amount of excess costs. For example, a plant may have an old heating system that adds \$5,000 per annum to the heating bill. This extra heating cost makes the property less attractive than a plant with an efficient system.

What Constitutes Excess Operating Costs?

Any excess operating costs or inefficiencies attributable to the real estate (improvements or site) should be considered forms of depreciation. Costs related to the business (labour, management, machinery, etc.) should not be considered part of the functional obsolescence in the property valuation process. Typically the following factors generate excess operating costs.

- Inefficient heating, air conditioning and/or ventilation systems.
- Poor property design or layout causing excess materials handling costs including extra costs for personnel and equipment.
- Poor property design and/or excess space causing extra maintenance cost.

Judgment

Sometimes obsolescence is easy to recognize but difficult to quantify especially when the only method for quantifying the obsolescence is a judgment call. This judgment must include current competitive standards and typical operating conditions for that industry.

In the AB Manufacturing example, instead of quantifying all the various forms of depreciation inherent in the property, depreciation should be reviewed and catalogued. From this inclusive review, a judgment can be made regarding the cumulative depreciation effect on value of approximately 25%.

Summary of Depreciation: Judgment - AB Manufacturing

Cost New	\$1,334,580
Obsolescence (abnormal depreciation)	25.0%
Sub-total	\$1,000,935
Normal Depreciation	45.5%
Market Value of Improvements	\$550,514

In this example, the abnormal depreciation inherent in the AB Manufacturing property was estimated to be 25%. Although it is often difficult to determine an appropriate deduction without completing a more detailed analysis, abnormal depreciation should be recognized and quantified in some manner.

6.0 External Obsolescence Issues

External obsolescence is a loss in property value caused by external forces. The loss is conditional on the problem being long-term and beyond the control of the property owner. Unlike physical depreciation, external obsolescence is not related to the age of the property.

It is often easier to identify obsolescence than to determine and quantify its affect on property value. Generally, external obsolescence is a result of actions taken by consumers, the competition, or regulatory agencies. A decline in sales volume, profits or a decline in the value of company assets can lead to external obsolescence.

It is necessary for the assessor to determine whether the negative condition affecting a property is a cause for a loss in property value or simply reflects a loss in business value. Additionally, a long-term loss in business value can ultimately have negative effects on the value of the property. The best method to evaluate a loss in business value versus a loss in property value is to take the perspective of the potential purchaser.

The steps to estimate external obsolescence are as follows.

- 1) Identify the obsolescence problem.
- 2) Determine whether it affects the business or the real estate value (or both).
- 3) Quantify the obsolescence.
- 4) Adjust the property value accordingly.

Quantifying External Obsolescence

For an income property, external obsolescence often causes a loss in property value due to a negative effect on the income stream i.e., decreased rent. In the valuation of other properties external obsolescence must be quantified in some manner and deducted from the cost value to assess the property. Difficulties in quantifying obsolescence also arise if there is not an established market place to form comparative judgments.

Note: Poor economic conditions or other external obsolescence factors may negatively affect the value of the land. This condition can be analyzed through a study of land sales.

Methods of Quantifying External Obsolescence

Listed below are a number of methods to determine the effect of economic obsolescence.

1) Capitalization of Income Loss

With appropriate income information, external obsolescence can be quantified by capitalizing the loss in income.

External obsolescence may result in a loss of income attributable to the real estate. For example, a lower rent for office space located on the side of a building next to a scrap yard can be established by comparing rental rates for a similar office not exposed to this problem. The loss in value is established as the annual difference in rent capitalized. If the loss of income is attributable to the real estate but is not a loss in rent, for example ticket sales at a ski hill, then this type of loss in income can also be capitalized.

Four important tasks are involved in this analysis.

- Determine the annual income loss for the real estate, due to the externally imposed condition(s).
- Establish that the income loss is long-term and not a result of business or other cycles.
- Determine the appropriate capitalization or discount rate. A discount rate should be considered in situations where the remaining economic life of the property is limited. The best way to establish an appropriate capitalization rate is to analyze the sales of similar income properties, however for many properties there may not be comparable sales and income information. In such cases other approaches, such as band of investment, are used to determine the capitalization rate. If income loss is used to support an external obsolescence estimate, then a valuation based on income analysis should also be used.
- Convert the annual income loss to a deduction for the cost value of the property.

2) Model Approach

Analysis of the economic circumstances of a property may suggest that in light of current and future demands, the property is overbuilt. In these circumstances a model approach may be an appropriate way to determine value.

For example, a sawmill may be located where there are only enough trees to maintain its operations at 40% of its present capacity. A replacement model based upon 40% capacity is one way of addressing this condition of external obsolescence. This does not necessarily mean that a replacement would be 60% smaller because certain processes in a sawmill require a specific building area no matter how much wood is produced. Nor can it automatically be assumed that the loss in value is 60%.

The depreciation inherent in the property due to external obsolescence is the difference between reproduction cost new of the existing facility and replacement model cost as new.

3) Judgment

There will be instances where judgment is the only approach to the quantification of obsolescence. Current competitive standards and the current operating conditions for the industry must be considered in this judgment.

Example of a Model Approach to Quantify External Obsolescence — AB Manufacturing

Scenario 1—Cyclical Business Climate

Year	Wells Drilled	AB Mfg. Production
1984	8,010	85,600
1985	7,320	77,000
1986	6,455	63,500
1987	5,284	56,000
1988	3,729	32,600
1989	3,514	34,100
1990	3,306	32,800
1991	3,770	35,500
1992	3,528	35,000
1993	4,890	42,600
1994	5,466	55,000
1995	7,322	69,800
1996	8,860	90,000
1997	9,432	95,400
1998	9,840	97,200

The years 1986 to 1995 indicate the plant was running well below its 100,000 unit potential. The other years in this chart show the plant running closer to capacity.

- 1) Consider production history over an extended period of time to ensure that external obsolescence is not a reflection of normal business cycles.
- 2) Not many production facilities expect to run at 100% of capacity. As a benchmark, claims of external obsolescence for properties running at anything above 85% capacity should be considered with a critical eye.

Scenario 2—External Conditions

This scenario illustrates the number of wells drilled and the production levels for AB Manufacturing.

Year	Wells Drilled	AB Mfg. Production
1984	8,010	85,600
1985	7,320	77,000
1986	6,455	63,500
1987	5,284	56,000
1988	3,729	32,600
1989	3,514	34,100
1990	3,306	32,800
1991	3,770	35,500
1992	3,528	35,000
1993	4,890	42,600
1994	5,466	58,500
1995	7,322	53,100
1996	8,860	58,600
1997	9,432	62,000
1998	9,840	60,400

In this situation AB Manufacturing was unable to take advantage of the revival in oil drilling activity. Under this scenario, other factors must be considered to justify external obsolescence.

1) Is this loss in production a management problem at AB Manufacturing?

- If this is the case then it is not an externally imposed condition and is not external obsolescence.

2) Is the loss in production a result of new competition?

- If this is the case then the performance of the competition should be considered before obsolescence can be applied to AB Manufacturing. If both plants are doing poorly then there is over-capacity in the industry and obsolescence applies. If the competition is doing well because of a smaller plant then there may still be over-capacity in the

industry. This situation puts into question the management abilities of AB Manufacturing and therefore the external nature of the problem becomes questionable.

As a result of this analysis there are two additional points to consider.

- 1) It is important to know the current state of the industry before external obsolescence can be established?
- 2) It may be necessary to determine what is happening with the competition and the customers to establish if an externally imposed condition affects property value.

Scenario 3—Decline in Demand

In the third scenario there has been a decline in the demand for the products produced by AB Manufacturing. In this scenario the number of wells drilled and the production of AB Manufacturing are as follows:

Year	Wells Drilled	AB Mfg. Production
1984	8,010	85,600
1985	7,320	77,000
1986	6,455	63,500
1987	5,284	56,000
1988	3,729	32,600
1989	3,514	34,100
1990	3,306	32,800
1991	3,770	35,500
1992	3,528	35,000
1993	4,890	42,600
1994	4,977	48,500
1995	5,283	53,100
1996	5,930	58,600
1997	5,813	62,000
1998	6,176	60,400

From these figures, combined with general knowledge about the oil industry, we can conclude that there has been a significant decline in oil exploration activity and a corresponding long-term decline in the demand for AB Manufacturing products. It is determined that AB Manufacturing is 30% overbuilt. This external obsolescence can be quantified by using a replacement model.

AB Manufacturing Replacement Model - External Obsolescence

The design, quantification and costing of the replacement model are found below. The model was designed assuming a production level of 70,000 units, or 30% below capacity. All areas of the plant were reduced but only the warehouse area was reduced by the full 30%.

Figure 3: AB Manufacturing Model Analysis

AB Manufacturing - Existing Production Plant

Office 1964	Plant 1963	Warehouse 1970	Whs Addn 1986																								
<table border="1"> <thead> <tr> <th>Plant</th> <th>Area (ft²)</th> <th>Height</th> <th>Volume (ft³)</th> </tr> </thead> <tbody> <tr> <td>Plant</td> <td>12,440</td> <td>24.0</td> <td>298,560</td> </tr> <tr> <td>Office</td> <td>2,855</td> <td>12.0</td> <td>34,260</td> </tr> <tr> <td>Warehouse</td> <td>7,000</td> <td>20.0</td> <td>140,000</td> </tr> <tr> <td>Whs Addition</td> <td>4,120</td> <td>36.0</td> <td>148,320</td> </tr> <tr> <td>Totals</td> <td>26,415</td> <td>23.5</td> <td>621,140</td> </tr> </tbody> </table>				Plant	Area (ft²)	Height	Volume (ft³)	Plant	12,440	24.0	298,560	Office	2,855	12.0	34,260	Warehouse	7,000	20.0	140,000	Whs Addition	4,120	36.0	148,320	Totals	26,415	23.5	621,140
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Totals	26,415	\$50.52	\$1,334,580																								

AB Manufacturing Replacement Model - External Obsolescence

Office	Plant	Plant	Area (ft ²)	Height	Volume (ft ³)
			Plant	10,240	16.0
		Office	2,150	11.0	23,650
		Warehouse	5,600	36.0	201,600
		Totals	17,990	21.6	389,090
	Warehouse	Plant Costs	Area (ft ²)	Rate	RCN
		Plant	10,240	\$43.25	\$442,880
		Office	2,150	\$61.00	\$131,150
		Warehouse	5,600	\$57.00	\$319,200
		Totals	17,990	\$49.65	\$893,230

In this scenario the degree of obsolescence suggested by the replacement model is the difference between the cost new of the model and the reproduction cost of the improvements.

The difference between reproduction and replacement cost is:

$$\$1,334,580 - \$893,230 = \$441,350 \text{ or } 33.1\%$$

This sample replacement model incorporates the issues of curable and incurable deficiencies, raised in the analysis of functional obsolescence and supersedes the model designed for functional obsolescence considerations. The roof conditions, excess operating costs and normal depreciation must still be considered.

Summary of Depreciation: After External Obsolescence Replacement Model –
AB Manufacturing

Cost New	\$1,334,580
Obsolescence 33.1%	\$441,350
Replacement Cost	\$893,230
Excess Operating Cost	\$152,000
Cost to cure (adjusted)*	\$39,000
Sub-total	\$702,230
Normal Depreciation **	37.0%
Market Value of Improvements	\$442,405

* Cost to cure roof must again be adjusted to reflect the smaller roof of the replacement model versus the actual building.

** The normal depreciation has also been reduced to an effective age of 27 years because most of the functional and economic obsolescence inherent in the property has been quantified elsewhere.

In this example, the market value of the improvements for AB Manufacturing, after all forms of depreciation are taken into account, is \$442,400.

7.0 Double Depreciation

In a situation such as the one illustrated in the AB Manufacturing example, care must be taken not to double count any forms of depreciation.

Physical Quantities and Condition

In the AB Manufacturing example, the effects of a roof in need of repair were recognized and the deduction for this condition was adapted to correspond with the analysis of replacement costs. If, in the replacement cost model, the value were reduced to reflect a smaller roof, then it would be double counting to deduct the entire roof repair amount.

The same process does not hold true for excess operating costs. Regardless of the size or design of the replacement, any operator of this property will encounter excess operating costs in comparison to a more efficient property. The general rule is:

where the depreciation reflects a physical condition, adjustments that take into account the physical quantity or condition of the property will interrelate. Some adjustments may be required to avoid double counting.

Order of Deduction

Another common cause for double counting depreciation is the order of deduction. The general rules for this process are as follows.

- 1) Where all deductions are expressed as a percentage of the total reproduction costs new, the order of deduction does not matter.
- 2) Where all deductions are made in dollar amounts, the order of deduction does not matter.
- 3) Where some deductions are expressed as dollar amounts and others are percentage amounts, *the order of deduction matters*. In such cases, first establish the replacement costs new, then deduct any dollar amounts before applying the percentage reductions.

Mixed Deduction Example—1

Cost New	\$1,500,000
Obsolescence	\$500,000
Sub-total	\$1,000,000
Normal Depreciation 40%	\$400,000
Market Value of Improvements	\$600,000

Mixed Deduction Example—2

Cost New	\$1,500,000
Normal Depreciation 40%	\$600,000
Sub-total	\$900,000
Obsolescence	\$500,000
Market Value of Improvements	\$400,000

In the first example the market value of the improvements was correctly determined to be \$600,000. In the second example the order of deduction was reversed and the market value of the improvements was determined to be \$400,000. The \$500,000 deduction for obsolescence should have been applied first, or the amount could be converted into a percentage of the cost new ($\$500,000 \div \$1,500,000 = 33.3\%$) The revised calculation is shown below.

Cost New	\$1,500,000
Normal Depreciation 40%	\$600,000
Sub-total	\$900,000
Obsolescence 33.3%	\$300,000
Market Value of Improvements	\$600,000

8.0 Determination of Depreciation From Market Sales Evidence

One method of establishing the total amount of depreciation inherent in a property is by studying the sale of similar properties. A depreciation schedule that applies to that type of property is established through the analysis of sales comparisons and the individual attributes associated with the property. The total amount of depreciation and hence the market value is determined by comparing these findings to the effective age of the subject.

Depreciation and the Market Sales Comparison Approach

The advantage of a market sales comparison approach, where total amount of depreciation is the difference between the costs new and the purchase price of the improvements, is that all forms of depreciation are taken into account. Physical depreciation and functional and external obsolescence are considered by an informed buyer and an informed seller during the purchase of a property.

Sales Analysis Process

The value of the improvements should be distinguished from the value of the land to establish the depreciation schedule. The sales analysis involves several steps.

- 1) Identify potential sales comparables.
- 2) Establish sale date, sale price, building and site areas, and land values.
- 3) Determine net improvement values by subtracting estimated land values from the total sale price.
- 4) Determine the effective age of each property through analysis of property data including (wherever possible), site inspections, appraisal reports, and construction dates.

Using the residual value of improvements, it is possible to construct tables showing how different types of buildings deteriorate over time. The mass appraisal process uses this information, the effective age and the type of construction to determine the typical depreciation of buildings.

Example: Study of Industrial Plant Sales

An example of the typical level of total depreciation facing a group of industrial assembly plants is summarized in the table and graph on the following pages. The information was determined through sales analysis of 56 such plants in Toronto between 1992 and 1997.

Conclusions—Depreciation Derived from Market Sales

Analysis of the sales data presented at Table 5 and the graph on Figure 7 produce the following conclusions.

- 1) The relationship between age and typical value is a progressive one: as properties age the difference in value changes (curved line).
- 2) The graph identifies the improvement value of a 30-year-old property as typically \$20.50.
- 3) If costs new are approximately \$60.00 as suggested by the sales evidence, then a 30-year-old property retains approximately 34% of its value or is 66% depreciated. (Further study of costs new would be required to finalize the conclusions suggested by this data).

Table 5: Age - Depreciation Analysis - Industrial Buildings 22,000 to 30,000 SF

Insert Chart Here

Figure 4: Depreciation Schedule: Industrial Plants from 22,000 to 30,000 Ft²

Insert Chart Here

Conclusions of Value AB Manufacturing—Market Sales Depreciation Schedule

The market derived depreciation findings in this example indicate a 66% depreciation rate for a 30-year-old industrial property (based on Toronto area data). Using this rate, the total market depreciation for AB Manufacturing is estimated as follows.

Cost New	\$1,334,580
Depreciation form market	66%
Depreciation	\$880, 820
Market Value of Improvements	\$453,760

This compares to the value of \$442,400 generated through the component by component depreciation analysis.

9.0 Consolidating and Applying Depreciation

An assessment system incorporates a mass appraisal process. Generally, mass appraisal systems derive the value of a property in a normal, average, or typical situation. The discrepancies and characteristics of individual properties are analyzed and adjustments are made to individual property values as variations come to light.

Normally, assessors do not have the time or resources to initiate analysis of all forms of depreciation on all properties in an assessment region. Instead, age-related depreciation is usually estimated using depreciation schedules. If, in discussion or upon written request, the property owner/operator provides information to the contrary, then a more thorough investigation of depreciation and obsolescence may be required.

There are a number of methods to determine the accrued depreciation in a property. As demonstrated, the valuation of the property using the cost approach often requires elements of judgment and in-depth knowledge of the property. Estimating these forms of depreciation is not necessarily straightforward, nor have all possible methods for identifying and quantifying depreciation been covered in this guide. It is essential to recognize the obsolescence conditions and in some rational manner make allowance for these conditions in the valuation of the property.

The purpose of a market value appraisal is to estimate the market value of the entire property, not simply to ensure that the individual depreciated costs of a sink, a door or a marble floor match the estimates listed in a cost manual.

In the process of determining the depreciation factors there are three questions to remember.

- 1) Is there a depreciation problem in the property?
- 2) Does it affect the real estate value?
- 3) How can this depreciation be quantified?

To address these questions the assessor must ask, “How would a prospective purchaser, including the current owner, view this property?” The market value estimate can only be completed after the issues of depreciation have been fully addressed and incorporated.