Current Tax Law and Economics of Industrial Projects

John H. Ristroph, Martha F. Glassinger
University of Louisiana at Lafayette / Harry V. Barton, CPA, LLC

Introduction

Income taxes play a major role in the economics of industrial projects, but tax laws frequently change, so bringing current material into the classroom can be difficult. Nonetheless, only teaching basic principles and requiring students to learn tax regulations on their own leaves a void, for understanding regulations can be a difficult challenge. An alternative to this is to teach principles using today's laws, or minimally to explain any changes from classroom presentations and provide handouts. This strategy motivates students to learn something that they can use, and it exposes them to realities of interpreting and implementing regulations.

This paper reviews current legislation insofar as it impacts the taxation of engineering projects. Its objective is to keep professors up-to-date and to provide optional reading for students (via http://engrecon.home.att.net), rather than to present a more comprehensive treatment of taxes available elsewhere [1, 2, 3]. The paper's coverage includes major modifications to the tax code, such as those involving the depreciation of business use assets under the Modified Accelerated Cost Recovery System (MACRS) and expensing the cost of business use assets under Internal Revenue Code Section 179, as well as routine ones, such as deductions, exemptions, and tax brackets. The final topic clarifies when the commonly used assumption of treating gains or losses on disposal as ordinary income is acceptable. This is particularly relevant to smaller organizations that operate as pass-through entities, where capital gains provisions can differ sharply from corporate regulations.

MACRS

MACRS was enacted as part of the Tax Reform Act of 1986. It classifies property into two general categories, intangible and tangible. *Intangible* property includes items such as software, copyrights, or patents. It is depreciated using the straight-line (SL) method. *Tangible* property is anything that can be seen or touched, such as a project's buildings or equipment, but excluding (for depreciation purposes) land and inventory held for sale. There are two categories of tangible property, real and personal. *Real* refers only to buildings (since land itself is non-depreciable), and *personal* is everything else. Real property continues to use the SL depreciation methods set forth by MACRS, but changes have occurred for personal property.

The General Depreciation System of MACRS originally provided depreciation of personal property using the declining balance (DB) method of depreciation with an optimal switch to SL in the year t,

$$t = INT(n - n/DBR + 1.5), \quad (1)$$

where INT is the largest integer function, n is the recovery period, and DBR is the DB rate. For example, if n equals 10 and DBR is 200%, then t equals 7 and the first depreciation charge computed using SL is D_7. The DBR remains 200% for recovery periods of 10 years or less and 150% otherwise. Under the half-year convention, MACRS treats purchases and disposals of depreciable personal property as occurring at mid-year. The depreciation charge for year j is computed by multiplying a recovery rate m_j for that year by the initial book value or basis at time 0, so

$$D_j = m_j BV_0 . \quad (2)$$

First the Job Creation and Worker Assistance Act of 2002 and then the Jobs and Growth Tax Relief Reconciliation Act (JGTRRA) of 2003 changed this basic procedure. The 2002 Act provided that qualified property place in service after September 10, 2001 was eligible for a first-year bonus depreciation equal to 30% of the adjusted basis. Qualified property includes tangible property depreciated under MACRS with a recovery period of 20 years or less, water utility property, computer software that is depreciated using the straight line method over 3 years, and qualified leasehold property. With JGTRRA there is now a bonus first-year depreciation deduction of 50% for qualified new personal property[1] purchased between May 5, 2003, and January 1, 2005, and put into service before January 1, 2005.

If the bonus depreciation is elected, the initial basis is adjusted by subtracting the bonus before applying the recovery rates provided by MACRS. The net effect of these changes is that now depreciation charges can be computed as

$$D_j = r_j BV_0 , \quad (3)$$

where BV_0 remains the unadjusted basis and values of the revised recovery rates r_j under the half-year convention are given in Table 1, with the switch to SL set in italics. The appendix derives these revised rates.

Section 179

Section 179 of the U.S. Internal Revenue Code permits small businesses to further accelerate MACRS depreciation. , For tax years beginning after 2002 and before 2006, JGTRRA allows taxpayers with purchases of personal property totaling $400,000 or less to expense (i.e., deduct from taxable income) up to $100,000 of those purchases. For example, consider a taxpayer with purchases of personal property totaling $350,000, including a $124,000 piece of equipment in the 5-year class. Expensing $100,000 of the equipment's cost decreases the taxable income (TI) of the first year by $100,000. It also adjusts the basis of the equipment from $124,000 to $24,000. The values of r_j in Table 1 are applied to the adjusted basis ($24,000) to compute depreciation charges. The value of r_1 is 60.0000%, so D_1 is $14,400 (0.6×24,000), and the total deduction for the first year is $114,400 (100,000 + 14,400). Each remaining charge D_j equals $24{,}000 r_j$.

As before, the maximal Section 179 expense is reduced on a dollar-for-dollar basis for taxpayers with more than $400,000 in purchases, so a taxpayer with purchases of $405,000 may

[1] If desired, the taxpayer may elect not to use this additional 50% and may elect to use the 30% bonus rate or may elect to use neither. This might be the case for someone who anticipates paying taxes at a much higher rate in the future.

Table 1. Revised MACRS Recovery Rates for Personal Property						
j	*n*=3	*n*=5	*n*=7	*n*=10	*n*=15	*n*=20
1	66.6650	60.0000	57.1450	55.0000	52.5000	51.8750
2	22.2250	16.0000	12.2450	9.0000	4.7500	3.6095
3	***7.4050***	9.6000	8.7450	7.2000	4.2750	3.3385
4	3.7050	***5.7600***	6.2450	5.7600	3.8500	3.0885
5		5.7600	***4.4650***	4.6100	3.4650	2.8565
6		2.8800	4.4600	3.6850	3.1150	2.6425
7			4.4650	***3.2750***	***2.9500***	2.4440
8			2.2300	3.2750	2.9500	2.2610
9				3.2800	2.9550	***2.2310***
10				3.2750	2.9500	2.2305
11				1.6400	2.9550	2.2310
12					2.9500	2.2305
13					2.9550	2.2310
14					2.9500	2.2305
15					2.9550	2.2310
16					1.4750	2.2305
17						2.2310
18						2.2305
19						2.2310
20						2.2305
21						1.1155

only expense up to $95,000, a decrease of $5,000 (405,000-400,000) due to exceeding the limit. If a taxpayer purchases more than $500,000 of Section 179 property in a given tax year, he is ineligible for any Section 179 deductions in that year. If the Section 179 deduction drives TI negative, then the excess expense may be carried over to later years. After 2006, the limit on total taxpayer purchases drops to its former value of $200,000, and the maximum deduction returns to its former value of $25,000.

Gains and Losses on Disposals

Depreciation charges and Section 179 expenses decrease an asset's book value to BV_d at the time of disposal. A gain or loss on disposal (GLD) occurs when BV_d differs from the amount realized (AR) from the sale,

$$GLD = AR - BV_d \,. \tag{4}$$

For purposes of engineering economics, a project's ordinary income (OI) equals its revenues minus its expenses (including depreciation, Section 179, operating costs, and interest), but excluding any GLDs; so a project's effect on taxable income (TI) is:

$$TI = OI \pm GLDs \tag{5}$$

Engineering economists frequently treat all GLDs as OI, but there are situations in which the GLD becomes a capital gain or loss (CGL). If a firm is a corporation, then the error introduced by treating a GLD as OI will be seen to be either non-existent or minimal, but this might not be the case for engineering firms operating as sole proprietorships, Sub-chapter S corporations, limited liability corporations, or partnerships. These organizations are called pass-through entities since their revenues and expenses and gains and losses are passed through to the owners or partners who pay taxes on them as individuals.

Computing the tax effect of GLDs requires determining the type of asset disposed, the holding period of the asset, the character of the GLD, and the applicable tax rates for the entity that will be taxed on the disposal. The type of asset disposed for purposes of this discussion will be either assets used for investment (capital assets) or assets used in a taxpayer's trade or business. Under the current law, the holding period of an asset begins on the day after it is acquired and ends on the day it is disposed. In general, assets held longer than one year have long-term GLDs; assets held one year or less have short-term GLDs. The determination of the character of the GLD (ordinary or capital) is a critical step in computing the tax effect of GLDs that is discussed below. Finally, although the applicable tax rates for corporations have not changed, the individual tax rates have become more complex with the passage of JGGTRA.

Classifying Disposals

Determining whether ordinary or capital gains rates apply to a GLD begins with classifying the GLD. The taxation of disposals of most project equipment and buildings held long term in a taxpayer's trade or business is governed by Section 1231 of the Internal Revenue Code[2]. Two important categories of Section 1231 properties are Section 1245 and Section 1250 assets that are primarily MACRS personal and real properties, respectively. Seven cases can occur when a Section 1231 property is disposed. The first three apply to Section 1245 properties, and Figure 1 illustrates each of them for different values of AR denoted by arrows, and Table 2 summarizes computations made for tax purposes.

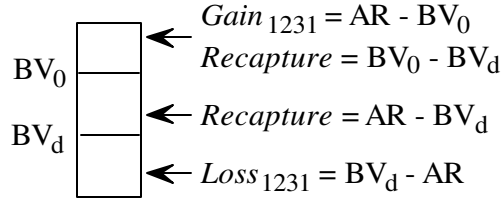

Figure 1. Section 1245 GLDs

1. $AR < BV_d$: The LD is classified as a *Section 1231 loss* and is denoted as $Loss_{1231}$.
2. $BV_d \leq AR \leq BV_0$: The GD is classified as *recapture* and treated as OI.
3. $BV_0 < AR$: The GD is divided into two components. The amount $BV_0 - BV_d$ is classified as recapture and treated as OI. The amount $AR - BV_0$ is classified as a *Section 1231 gain* and denoted as $Gain_{1231}$.

Table 2. Categories for Section 1245 GLDs

AR	Category
$AR < BV_d$	$Loss_{1231} = BV_d - AR$
$BV_d \leq AR \leq BV_0$	$Recapture = AR - BV_d$
$BV_0 < AR$	$Recapture = BV_0 - BV_d$ $Gain_{1231} = AR - BV_0$

[2] Examples of properties *not* regulated under Section 1231 include stocks and bonds that generate *capital gains and losses* that are considered shortly.

The last four cases apply to Section 1250 properties. Figure 2 shows the effect of different values of AR, and Table 3 summarizes computations as before.

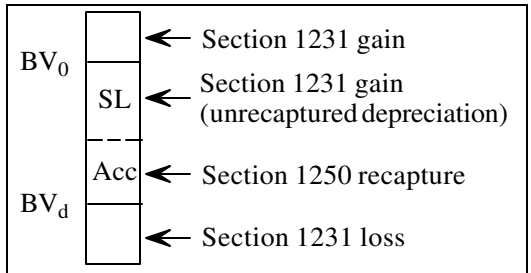

Figure 2. Section 1250 GLDs

4. $AR < BV_d$: The LD is classified as a Section 1231 loss, $Loss_{1231}$.
5. $BV_d \leq AR < BV_d + Acc$: For 1250 properties acquired in the 1980-86 time window, accelerated depreciation methods could be used instead of the SL of MACRS. The Acc region of Figure 2 represents the component of depreciation due to an accelerated method, if any. Any portion of a GD in this region is recaptured and treated as OI.
6. $BV_d + Acc \leq AR < BV_0$: Any portion of a GD in this region is classified as a Section 1231 gain. It also is classified as unrecaptured depreciation, but this second classification is relevant only for flow-through entities.
7. $BV_0 < AR$: Any portion of a GD in this region is a Section 1231 gain.

Table 3. Categories for Section 1250 GLDs

AR	Category
$AR < BV_d$	$Loss_{1231} = BV_d - AR$
$BV_d < AR \leq BV_d + Acc$	$Recapture = AR - BV_d$
$BV_d + Acc < AR \leq BV_0$	$Recapture = Acc$ $Gain_{1231} = AR - (BV_d + Acc)$ $Unrecaptured\ depreciation = AR - (BV_d + Acc)$
$BV_0 < AR$	$Recapture = Acc$ $Gain_{1231} = AR - (BV_d + Acc)$ $Unrecaptured\ depreciation = BV_0 - (BV_d + Acc)$

Any part of a GD that is classified as recapture becomes OI and requires no further consideration. However, additional regulations apply to Section 1231 gains and losses. It is necessary to obtain the net Section 1231 gain or loss by summing the Section 1231 gains and losses from all disposals during the tax year:

$$Net_{1231} = \Sigma Gain_{1231} - \Sigma Loss_{1231} \tag{6}$$

A net loss is deducted from OI, and a net gain is classified as a *capital gain.*

If a firm is in a net Section 1231 loss position, the GLDs from individual projects only decrease or increase the amount of that net loss, so they are taxed as OI. A net Section 1231 loss assumption is reasonable if most disposals are Section 1245 assets comprised primarily of MACRS personal property such as machines and equipment. It is unlikely that the AR of such an asset will exceed its BV_0, so usually recapture or a Section 1231 loss occurs. Buildings classified as Section 1250 assets occasionally might generate a Section 1231 gain, but it is possible that such gains are more than offset by Section 1231 losses.

Section 1231 Net Gains and Capital Gains

If a firm should be in a net Section 1231 gain position, the GLDs from individual projects decrease or increase the amount of that net gain, which becomes a long-term capital gain (LCG). Then this LCG is summed with all other long-term capital gains and losses (such as those resulting from the sale of stocks owned more than one year), producing a net long-term capital gain (NLCG) or loss (NLCG). Similarly, all short-term capital gains and losses are summed, producing a net short-term capital gain (NSCG) or loss (NSCG). Finally, these net gains or losses are consolidated:

1. If both net values are gains, then the consolidated short and long-term capital gains (CSCG and CLCG) equal the corresponding net gains.

2. If both net values are losses, then the consolidated short and long-term capital losses (CSCL and CLCL) equal the corresponding net losses.

3. If one net value is a gain and the other a loss, then the resulting consolidated value of the net gain minus the net loss is

   a. short-term if the short-term net value is larger, or

   b. long-term if the long-term value is larger.

For example, a net long-term gain of $100 and a net short-term loss of $25 produce a CLCG of $75, since the long-term component is larger.

Taxation of Disposals

Once the consolidated capital gains and losses are known, then taxes are computed using the logic shown in Figure 3. Differences in the taxation of capital gains and losses for corporations and for owners of pass-through entities include:

1. If the taxpayer is a corporation, a CSCG is taxed as OI as shown in Table 4. A CLCG is taxed as OI except for corporations in the 38% bracket with a TI between $15,000,000 and $18,333,333 that use a 35% gain rate. Losses cannot be deducted but must be carried back three years , and then may be carried forward for five years to reduce any available capital gains. Capital loss carrybacks or carryovers are treated as short term losses, even if the original loss was long term.

Table 4. 2003 Tax Schedule for Corporations

Bracket	Tax
$0 ≤ OI ≤ $50,000	15% × OI
50,000 < OI ≤ 75,000	$7,500 + 25% × (OI – $50,000)
75,000 < OI ≤ 100,000	13,750 + 34% × (OI – 75,000)
100,000 < OI ≤ 335,000	22,250 + 39% × (OI – 100,000)
335,000 < OI ≤ 10,000,000	113,900 + 34% × (OI – 335,000)
10,000,000 < OI ≤ 15,000,000	3,400,000 + 35% × (OI – 10,000,000)
15,000,000 < OI ≤ 18,333,333	5,150,000 + 38% × (OI – 15,000,000)
18,333,333 < OI	6,416,667 + 35% × (OI – 18,333,333)

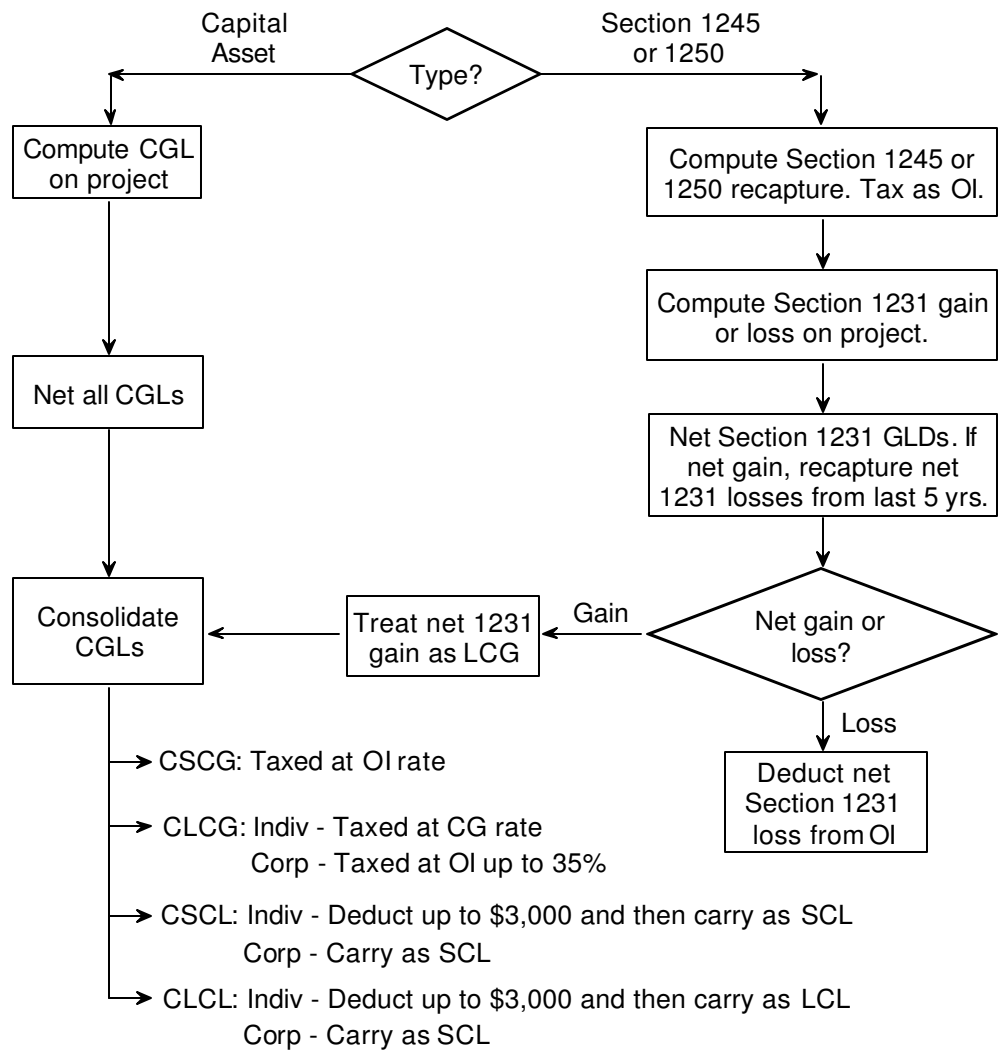

Figure 3. Taxation Logic

2. If the taxpayer is an owner of a pass-through entity, a CSCG is taxed as OI, but a CLCG is taxed at varying rates, depending the type of asset disposed and its date of disposal. Capital gains are sorted into what popularly are called "buckets." Tax rate buckets are collectibles (stamp collections, art objects, etc.) taxed at 28%, unrecaptured Section 1250 depreciation taxed at 25%, and adjusted net capital gains (net gains other than those taxed at 28% or 25%).

Under JGGTRA, adjusted capital gains for dispositions after May 5, 2003, and before January 1, 2009, are lowered from 10% to 5% for taxpayers in the 10% or 15% brackets (0% in 2008) and from 20% to 15% for other brackets. Losses can be deducted up to the lesser of $3,000 or taxable income, and then they are carried indefinitely into future years, retaining their short or long-term character. Capital losses are netted against gains in the highest taxed buckets first.

A few observations on the application of taxation of project disposals may be noted.

1. For both corporations and owners of pass-through entities:

a. A net Section 1231 loss position causes the GLD on any individual project to increase or decrease taxes at OI rates.

b. The impact of a net Section 1231 gain on capital gains and losses must be determined through the consolidation process.

c. A CSCG is taxed at OI rates.

2. For a corporation:

a. A CLCG is taxed at rates identical to OI up to a maximum of 35%.

b. A consolidated loss (CSCL or CLCL) postpones the taxes due to the net Section 1231 gain until the corporation eventually has a consolidated gain (CSCG or CLCG).

c. If a GLD's cash flow for taxes is relatively small and late in the project when compared with other cash flows, then using OI rates on the GLD results in either no error for the likely scenario of a net 1231 loss position or at worst a small error in the net present value (NPV) of a project. For example, consider a project where the AR is 5% of the total cash flows, but the present worth (PW) of the AR is only 3% of the NPV due to its late occurrence. If the GLD equals the entire AR and the corporation is in net 1231 gain and CLCG positions, then applying an OI rate of 39% to the GLD instead a CG rate of 35% results in an error of only 3% x (39% – 35%) or 0.12% of NPV. Similarly, suppose that the 3% component of present worth is based on a discount rate of 15%. If the tax effect of 3%(35%) or 1.05% were delayed for one year due to a capital loss position, then the correct effect would be 3%(35%) / 1.15 or 0.91%, so not accounting for the shift in timing would cause an error of 1.05% – 0.91% or 0.16%.

3. For an owner of a pass-through entity:

a. A CLCG may be taxed at the lowest rates at 5% for individuals in the 10% and 15% brackets and at 15% thereafter for dispositions after May 5, 2003.

b. A consolidated loss of more than $3,000 postpones the taxes due to the net Section 1231 gain until the corporation eventually has a consolidated gain.

c. The potential magnitude of errors due to using OI rates on GLDs is comparatively much worse than in the corporate case, although cash flows for taxes on GLDs that are small and late relative to other cash flows still mitigate the impact of the errors on NPV.

OI Rates and Brackets for Owners of Pass-Through Entities

With the passage of JGGTRA, OI rates and brackets have changed since 2002 for individuals. Tax rates and brackets for 2003 are provided in Table 5 and Table 6. Other changes for individuals in 2003 include standard deductions of $4,750 for singles and $9,500 for married couples filing jointly, and an exemption of $3,050 is allowed for each dependent. Corporate rates and brackets did not change in 2003.

Summary and Conclusions

This paper presents recent changes in tax regulations that affect engineering projects, including modifications to MACRS and Section 179. Then it clarifies when the commonly used assumption of treating gains or losses on disposal as OI is acceptable. This is particularly relevant to smaller organizations that operate as pass-through entities, where capital gains provisions

Table 5. 2003 Tax Schedule for Single Individuals	
Bracket	Tax
$0 ≤ OI ≤ $7,000	10% × OI
7,000 < OI ≤ 28,400	700.00 + 15% × (OI – 7,000)
28,400 < OI ≤ 68,800	3,910.00 + 25% × (OI – 28,400)
68,800 < OI ≤ 143,500	14,010.00 + 28% × (OI – 68,800)
143,500 < OI ≤ 311,950	34,926.00 + 33% × (OI – 143,500)
311,950 < OI	90,514.50 + 35% × (OI – 311,950)

Table 6. 2003 Tax Schedule for Married Filing Jointly	
Bracket	Tax
$0 ≤ OI ≤ $14,000	10% × OI
14,000 < OI ≤ 56,800	$1,400.00 + 15% × (OI – 14,000)
56,800 < OI ≤ 114,650	7,820.00 + 25% × (OI – 56,800)
114,650 < OI ≤ 174,700	22,282.50 + 28% × (OI – 114,650)
174,700 < OI ≤ 311,950	39,096.50 + 33% × (OI – 174,700)
311,950 < OI	84,389.00 + 35% × (OI – 311,950)

can differ sharply from corporate regulations. Finally, routine changes for owners of pass-through entities are presented: tax brackets, standard deductions, and exemptions.

Guidelines for engineering economists include treating projects' GLDs as OI if the taxpayer is in a net Section 1231 loss position, a situation that seems likely. If a corporation has a net Section 1231 gain, then treating its GLDs as OI causes no or little error in a project's NPV. The potential for error is comparatively larger for a pass-through entity, particularly if it has a CLCG. However, even for a pass-through with a CLCG, the impact on a project's NPV of treating a GLD as OI is reduced if the potential tax flow for a GLD is small and late relative to other cash flows. Due to the complexity of this area, it is advisable that tax flows computed by engineers for projects having a large impact on a firm should be reviewed by a taxation professional.

Appendix: Derivations of Current Recovery Rates

The bonus component of D_1 is

$$D_{1,\text{Bonus}} = 0.5BV_0 . \tag{7}$$

This charge is removed from the initial basis, so the adjusted basis used for the remainder of the calculations is

$$BV_{0,\text{ Adjusted}} = (1 - 0.5)BV_0 . \tag{8}$$

Thus the remaining MACRS component of D_1 is

$$D_{1,\text{MACRS}} = m_1 BV_{0,\text{ Adjusted}} , \tag{9}$$

and the entire first year's depreciation is

$$D_1 = 0.5\,BV_0 + m_1\,BV_{0,\text{ Adjusted}}\,. \tag{10}$$

Substitute the expression for $BV_{0,\text{ Adjusted}}$ to obtain

$$D_1 = 0.5BV_0 + m_1(1 - 0.5)BV_0\ , \tag{11}$$

so

$$D_1 = (0.5 + 0.5m_1)BV_0 \tag{12}$$

Thus the revised recovery rate for year 1 is $(0.5 + 0.5m_1)$, or

$$r_1 = 0.5 + 0.5m_1\,. \tag{13}$$

Then the revised charges for all following years are computed by:

$$D_j = m_j\,BV_{0,\text{ Adjusted}}\,,\ j = 2, 3, \ldots, n. \tag{14}$$

Since $BV_{0,\text{ Adjusted}}$ equals $0.5BV_0$, then

$$D_j = 0.5m_j\,BV_0\,,\ j = 2, 3, \ldots, n. \tag{15}$$

Thus the revised recovery rates after year 1 equal $0.5m_j$, so

$$r_j = 0.5m_j\,,\ j = 2, 3, \ldots, n. \tag{16}$$

Table 1 contains the revised recovery rates, and now depreciation charges for personal property are given by

$$D_j = r_j BV_0\,. \tag{17}$$

Bibliography

1. Ristroph, John H., *Economics of Industrial Projects, 2003-04 Edition*, Infoneering, Inc., www.infoneering.biz, 2003.

2. *RIA Federal Tax Handbook, 2004 Edition,* Thomson-RIA, www.riahome.com/federaltaxhandbook, 2003

3. *Kleinrock's Tax Expert*, ATX II, LLC, Release October 2003, Version 2003.5.4

4. *Surgent's Tax Implications of the Jobs and Growth Relief Reconciliation Act of 2003*, Surgent and Associates, LLC, www.surgent.com, 2003

Authors

JOHN H. RISTROPH is jointly appointed as professor of Engineering and Technology Management and as a professor of Economics and Finance at the University of Louisiana at Lafayette. His doctorate is in industrial engineering, and his non-academic experience includes service to the Louisiana Department of Natural Resources first as Head of Economics and Statistics and then as Director of Policy and Planning.

MARTHA F. GLASSINGER is a CPA in the firm of Harry V. Barton, CPA, LLC in Lafayette, Louisiana, where she has extensive experience in the practice of taxation of small businesses and individuals. She enjoys working with engineers, and finds that her having taught mathematics at Xavier University facilitates her expressing the mathematical and algorithmic aspects of accounting.