



The Cost Method  
Reproduction vs Replacement  
Cost New


TFI Asset Valuation Conference

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# The Project

The project – Appraise Client’s Switching Assets

- The books (2212 and 2220)
  - \$2.8 billion
    - Spread over 30 years
- Statistics
  - Equipment Locations: 400 Central Offices
  - Customer Locations passed: 5.6 million
- Voice Subscribers
  - Then: 5.880 million at peak (105% take)
  - Now: 1.867 million (33% take), and losing 10% per year
- Technology
  - Then: TDM Circuit Switch (e.g., 5E, DMS100)
  - Now: IMS IP Soft Switch

  
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# Client’s Books


TDM Circuit Switch

- Client has 400 switching locations spread across the state
- Each location has a complex that has been built over centuries
- Equipment is part of an intermingled network
  - Copper loops and fiber loops
  - Main Distribution Frame
  - Digital loop Carriers
  - SONET Transport
  - ...more



However, they are transitioning to an IMS platform

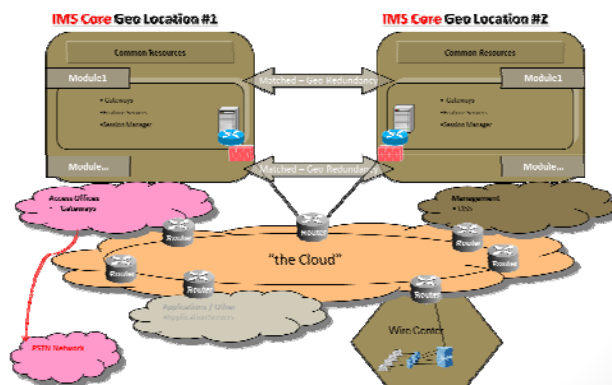


  
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## IMS Soft-Switching

Today's technology is IMS Switching

- IP Based
- Super Nodes – paired nodes can support multiple states
- Gateways, Ethernet Switches and Routers in network manage packet traffic



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## The Cost Approach

From "Valuing Machinery and Equipment", 3<sup>rd</sup> edition

- Using the cost approach, the appraiser starts with the current replacement or reproduction cost new of the property being appraised and then deducts for the loss in value caused by physical deterioration, functional obsolescence, and economic obsolescence
- The logic behind the cost approach is the principle of substitution: a prudent buyer will not pay more for a property than the cost of acquiring a substitute property of equivalent utility
  - The principle can be applied either to an individual asset or to an entire facility

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## Replacement vs Reproduction

From “Valuing Machinery and Equipment”, 3<sup>rd</sup> edition

- The replacement cost new is generally the proper starting point for developing an opinion of value using the cost approach
- It is essential that the appraiser understand the difference between *replacement cost new* and *reproduction cost new*
  - Replacement cost is the current cost of a similar new property having the nearest equivalent utility as the property being appraised
  - Reproduction cost is the current cost of reproducing a new replica of the property being appraised using the same, or closely similar, materials



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## Reproduction Considerations

From “Valuing Machinery and Equipment”, 3<sup>rd</sup> edition, a quote from Professor Bonbright

- “Most physical properties are not replaced by properties of the same size, design, and materials. They are replaced by materially different properties of a more modern type, better designed to meet the owner’s present needs.... [T]he replacement would be one of substitution [i.e., replacement cost] rather than identical reproduction.... In such cases, the hypothesis that the value of the existing property is derivable from the current cost of constructing or buying a substantially identical property [**reproduction cost**] is **always invalid**. The appraiser may still adhere to it [reproduction cost] if he believes that there is no material difference between the cost and efficiency of the different substitute [replacement cost] and the cost and efficiency of the replica [reproduction cost]. But he cannot ignore the discrepancy if it is serious—otherwise he will be **guilty of gross overvaluation**”



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## Reproduction Considerations

From "Valuing Machinery and Equipment", 3<sup>rd</sup> edition

- Professor Eugene Grant: "[I]f replacement with a different substitute asset would be more economical, **the cost of reproducing identically an existing old asset has no bearing on value.**"
- (page 42) "Whether the subject asset is an individual item of equipment or an entire plant, **improvements in design, product flow, processing methods, layout, and equipment size and mix make the modern substitute more desirable to own.** It will be more desirable to own because it is superior to the subject in one or more of the following respects: **it costs less to acquire (capital cost advantage), cost less to operate (operating cost advantage), or produces more revenue (profit advantage).**"
- Additional limitations of the reproduction method based on indexes:
  - **"The use of indexes and trending can easily lead to erroneous results.**
  - The following cautions are offered:
    - **Indexes generally do not reflect technological advances that may actually reduce cost new,** thus, trending does not indicate replacement cost new or provide a means to measure the difference between reproduction-replication cost new and replacement cost new.
    - Cost indexes are based on average values, but specific cases (including the subject property) may differ from the average.
    - The appraiser should be **extremely cautious about trending for periods in excess of ten years, unless the accuracy of the trended result can be independently confirmed by comparing it with the results of other methods of estimating cost new. ..."**



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## Cost Approach Implementation

- Examples for developing the reproduction and replacement cost approaches
  - AUS Telephone Plant Index - The goal of the telephone plant index is to produce a product which when utilized together with a companies' books and records would produce a reproduction cost value
    - The AUS Telephone Plant Index does not reflect replacement cost inasmuch as it was designed to produce the reproduction cost (the cost in today's dollars to reproduce the company's embedded plant in service)
  - CostQuest Replacement Cost - The goal of replacement cost new detail modeling is to develop an estimate of the current cost to replace an asset and/or system with a new asset and/or system of equivalent utility



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## Cost Approach Comparison

- Strengths and weakness of the Reproduction Cost Approach
  - Easy to develop using a Trend Index and company original cost
  - More difficult to develop if you attempt to cost out existing communication equipment
    - Replicating original equipment which may be manufacturer discontinued
    - Difficult to obtain inventory
    - Property type and capacity maybe unknown
  - Typically do not address changes in technology or capacity in developing a reproduction cost
    - Thus—in calculation depreciation, curve must address ALL forms of obsolescence
- Strengths and weakness of the Replacement Cost Approach
  - Preferred approach, but more data intensive
  - Detail, Cost to Capacity, Engineering Methods
    - Detail approach should be more accurate
      - Requires more information and knowledge to develop than either a trend index or costing out existing communication equipment and other RCN methods
  - Should address changes in technology and capacity
    - Thus—limits to need to address some forms of obsolescence in calculating the depreciation



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## Depreciation Application

- Depreciation Application
  - Reproduction Cost
    - Resulting cost does not address any form of depreciation
    - All forms of depreciation need to be addressed in the application of the depreciation curve: Physical, Functional and External
  - Replacement Cost
    - Resulting cost does address some functional forms of depreciation including Excess Capital
      - Cost represents the lower capital investment required to obtain the most economic new asset to perform the same service as the subject –
      - Removes ghost assets and excess capacity
      - Address technology change/impact
    - Does not address:
      - Physical depreciation
      - Functional obsolescence – excess operating cost
      - External obsolescence



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# Reproduction Study Overview

- Collect historical cost by vintage from the client's books
- Development of Reproduction Cost New
  - Select the trends to be used
  - Apply the trends by vintage
- Application of Depreciation Curve
  - Select depreciation curve that incorporates all forms of depreciation
  - Apply vintage depreciation % good to the trended value for each vintage of the Reproduction cost new
- Sum the value after application of the % good by vintage



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# Reproduction Study

Vintage	Historical Cost	Trend	Reproduction	% Good	ReprCNLD
2014	\$ 3,862,069	1.000	\$ 3,862,069	100.0%	\$ 3,862,069
2013	\$ 5,793,103	1.025	\$ 5,937,931	85.0%	\$ 5,047,241
2012	\$ 7,724,138	1.050	\$ 8,110,345	75.0%	\$ 6,082,759
2011	\$ 9,655,172	1.070	\$ 10,331,034	70.0%	\$ 7,231,724
2010	\$ 11,586,207	1.090	\$ 12,628,966	65.0%	\$ 8,208,828
2009	\$ 15,448,276	1.100	\$ 16,993,103	60.0%	\$ 10,195,862
2008	\$ 19,310,345	1.350	\$ 26,068,966	55.0%	\$ 14,337,931
2007	\$ 23,172,414	1.500	\$ 34,758,621	50.0%	\$ 17,379,310
2006	\$ 27,034,483	1.750	\$ 47,310,345	45.0%	\$ 21,289,655
2005	\$ 30,896,552	1.500	\$ 46,344,828	37.5%	\$ 17,379,310
2004	\$ 38,620,690	1.250	\$ 48,275,862	30.0%	\$ 14,482,759
2003	\$ 50,206,897	1.200	\$ 60,248,276	25.0%	\$ 15,062,069
2002	\$ 57,931,034	1.100	\$ 63,724,138	22.5%	\$ 14,337,931
2001	\$ 77,241,379	1.000	\$ 77,241,379	20.0%	\$ 15,448,276
2000	\$ 108,137,931	0.975	\$ 105,434,483	17.5%	\$ 18,451,034
1999	\$ 135,172,414	0.950	\$ 128,413,793	15.0%	\$ 19,262,069
1998	\$ 154,482,759	0.925	\$ 142,896,552	12.5%	\$ 17,862,069
1997	\$ 173,793,103	0.900	\$ 156,413,793	11.0%	\$ 17,205,517
1996	\$ 189,241,379	0.875	\$ 165,586,207	10.0%	\$ 16,558,621
1995	\$ 220,137,931	0.850	\$ 187,117,241	9.0%	\$ 16,840,552
1994	\$ 227,862,069	0.840	\$ 191,404,138	8.0%	\$ 15,312,331
1993	\$ 204,689,655	0.830	\$ 169,892,414	7.0%	\$ 11,892,469
1992	\$ 173,793,103	0.800	\$ 139,034,483	6.0%	\$ 8,342,069
1991	\$ 135,172,414	0.725	\$ 98,000,000	5.0%	\$ 4,900,000
1990	\$ 115,862,069	0.700	\$ 81,103,448	5.0%	\$ 4,055,172
1989	\$ 108,137,931	0.600	\$ 64,882,759	5.0%	\$ 3,244,138
1988	\$ 100,413,793	0.500	\$ 50,206,897	5.0%	\$ 2,510,345
1987	\$ 92,689,655	0.500	\$ 46,344,828	5.0%	\$ 2,317,241
1986	\$ 77,241,379	0.475	\$ 36,689,655	5.0%	\$ 1,834,483
1985	\$ 57,931,034	0.450	\$ 26,068,966	5.0%	\$ 1,303,448
1984	\$ 50,206,897	0.400	\$ 20,082,759	5.0%	\$ 1,004,138
1983	\$ 38,620,690	0.300	\$ 11,586,207	5.0%	\$ 579,310
1982	\$ 34,758,621	0.250	\$ 8,689,655	5.0%	\$ 434,483
1981	\$ 23,172,414	0.200	\$ 4,634,483	5.0%	\$ 231,724
<b>TOTAL</b>	<b>\$ 2,800,000,000</b>		<b>\$ 2,296,318,621</b>		<b>\$ 334,486,938</b>

Effective Age 14.16

All data is illustrative



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## Replacement Study Overview

### Capture:

- Anticipated demand during the valuation period
- Delivery of services consistent with existing network capabilities and user experiences
- Operational and technological efficiencies (e.g., currently available equipment and methods)
- Architectures consistent with the market
- Available company resources



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## Replacement Study Overview

- Collect statistics about the network (i.e., the Utility)
  - Usage information, customer counts
- Select appropriate technology
- Identify engineering rules
- Obtain costs data to capture ALL capitalized costs
  - Market costs for material, installation, taxes etc..
  - Loadings/Rates for engineering, planning
  - Appropriate levels of Interest During Construction
  - Other costs such as permitting, legal, right of way, etc..
- Identify capacity drivers
- Create model to develop Replacement Costs
- Test metrics from study for reasonableness
- Identify any additional forms of Obsolescence



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# Replacement Study

RCN Model:

- 400 gateway nodes
- 2 IMS nodes
- Built to meet current demand, some forecasted growth, spares
  - 1.867 million customers

Equipment
Call Server (hardware)
Call Server (Software)
Gateway Router
LATA Core Router
Application Edge Router
Line Border Controller Complex
Session Border Controller (Hardware)
Session Border Controller (Software)
Application Layer Firewall
Router
Peering Border Controller Complex
Session Border Controller (Hardware)
Session Border Controller (Software)
Gateway Controller -- Trunks
Passport Voice Gateway
Session Server Trunks
IMS Complexes
Application Servers
Media Servers
Network Servers and other Software
DNS
VMNNet Firewall
EPNNet Firewall (Hardware)
EPNNet Firewall (Software)
Other



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# Replacement Study

Replacement Cost New = \$ 85,000,000					
Vintage	Historical	Historical	RCN Spread	% Good	ReplCN
2014	5	0.001379	\$ 117,241	100.0%	\$ 117,241
2013	7.5	0.002069	\$ 175,862	95.0%	\$ 167,069
2012	10	0.002759	\$ 234,483	92.5%	\$ 216,897
2011	12.5	0.003448	\$ 293,103	90.0%	\$ 263,793
2010	15	0.004138	\$ 351,724	85.0%	\$ 298,966
2009	20	0.005517	\$ 468,966	80.0%	\$ 375,172
2008	25	0.006897	\$ 586,207	75.0%	\$ 439,655
2007	30	0.008276	\$ 703,448	67.5%	\$ 474,828
2006	35	0.009655	\$ 820,690	60.0%	\$ 492,414
2005	40	0.011034	\$ 937,931	52.5%	\$ 492,414
2004	50	0.013793	\$ 1,172,414	45.0%	\$ 527,586
2003	65	0.017931	\$ 1,524,138	40.0%	\$ 609,655
2002	75	0.02069	\$ 1,758,621	35.0%	\$ 615,517
2001	100	0.027586	\$ 2,344,828	30.0%	\$ 703,448
2000	140	0.038621	\$ 3,282,759	27.5%	\$ 902,759
1999	175	0.048276	\$ 4,103,448	25.0%	\$ 1,025,862
1998	200	0.055172	\$ 4,689,655	22.5%	\$ 1,055,172
1997	225	0.062069	\$ 5,275,862	20.0%	\$ 1,055,172
1996	245	0.067586	\$ 5,744,828	17.5%	\$ 1,005,345
1995	285	0.078621	\$ 6,682,759	15.0%	\$ 1,002,414
1994	295	0.081379	\$ 6,917,241	12.5%	\$ 864,655
1993	265	0.073103	\$ 6,213,793	12.0%	\$ 745,655
1992	225	0.062069	\$ 5,275,862	11.0%	\$ 580,345
1991	175	0.048276	\$ 4,103,448	10.0%	\$ 410,345
1990	150	0.041379	\$ 3,517,241	9.0%	\$ 316,552
1989	140	0.038621	\$ 3,282,759	8.0%	\$ 262,621
1988	130	0.035862	\$ 3,048,276	7.0%	\$ 213,379
1987	120	0.033103	\$ 2,813,793	6.0%	\$ 168,828
1986	100	0.027586	\$ 2,344,828	5.0%	\$ 117,241
1985	75	0.02069	\$ 1,758,621	5.0%	\$ 87,931
1984	65	0.017931	\$ 1,524,138	5.0%	\$ 76,207
1983	50	0.013793	\$ 1,172,414	5.0%	\$ 58,621
1982	45	0.012414	\$ 1,055,172	5.0%	\$ 52,759
1981	30	0.008276	\$ 703,448	5.0%	\$ 35,172
<b>TOTAL</b>	<b>3625</b>		<b>\$ 85,000,000</b>		<b>\$ 15,831,690</b>

Effective Age 16.13

All data is illustrative


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# Results

- Reproduction Results:
  - RCN: \$2.3 billion
  - RCNLD: \$334.5 million
  - Value: SAY \$335 million
- Replacement Results:
  - RCN: \$85 million
  - RCNLD: \$15.8 million
  - Additional obsolescence adjustments
    - Power Opex: 0.5 million
    - Mtce Opex: 1.5 million
    - Cost of removal: 2 million
  - Value: SAY \$12 million

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# Results Comparison

- Comparison of Studies
  - Overcapacity addressed? How?
  - Technology change addressed? How?
  - Change in price of TDM gear addressed?
  - Change in price of voice equipment addressed?
  - Other...
- Associated Issues
  - Excess space in buildings

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## Hearing Issues

- Issues brought up in recent cases in regard to Replacement Cost New (from parties submitting Reproduction Cost New)
  - Entrepreneurial profit / Opportunity Cost
  - Complexity
  - Broad Assumptions
  - Feasibility
  - Undue Delay
  - If you build, you are competing against what you are valuing
    - Loss profits / opportunity costs



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