

Case 2: Total Replacement Cost in Market (TRC_m)

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Objective

In Case 1, we calculated the maximum building envelope (B_{max}) that would fit on a site under existing zoning restrictions. These calculations were based on zoning codes and parking requirements which placed a constraint on the maximum size of a building that could be placed on a given site. In this case, we are going to calculate how much it would cost to actually build that project including both hard costs and soft costs.

Once the optimal or maximum building envelopes have been calculated, the market-based Total Replacement Cost (TRC_m) can be calculated. Basically, these costs are calculated by multiplying the number of units by the unit cost. However, the calculations are complicated by the fact that there are hard and soft costs that must be factored into the analysis. In addition, the analyst must solve for a circular equation, since some of the costs can be included in the mortgage financing and are determined by a combination of loan-to-value ratios and total costs. This creates a mathematical challenge since they are expressed as a percent of the final aggregate cost, rather than a discrete value. As such, they need to be backed into by isolating their contribution to the final costs in percent terms, and then grossing the preliminary costs other than these items to the final TRC_m.

Background

The TRC_m represents the market-based cost estimates for a proposed project. Several key concepts are applied in the analysis:

- **Hard Costs.** These are the actual outlays expressed in total \$'s or \$'s per unit that represent the costs for land, labor and materials.
 - **Land Costs.** These are the costs of acquisition and/or land improvements necessary to prepare the site for construction.
 - **Improvement Costs.** These are the costs of constructing buildings or other facilities on the site.

- **Building Costs.** These can be broken into detailed components or square footage of building. They will vary by size, type, location and quality.
 - **Parking Costs.** These costs can be expressed as \$’s/square foot of parking or per unit as in the case of underground parking.
 - **Landscaping Costs.** This is an allowance that it typically expressed as \$’s per square foot of open space and/or some lump sum.
 - **Other Improvement Costs.** This is a catch-all category for other budgeted improvement costs.

- **Soft Costs**
 - **Fixed Charges \$’s.** These are the standard costs that are charged in the market for a project of the size and nature of the proposed development. They include such items as consulting studies, appraisals, legal expenses, and property taxes.
 - **Known % Fees.** These are the fees that are based on the Improvement Costs including such items as architect design, inspection, builder’s overhead.
 - **Unknown % Fees.** These are financing fees –both construction and permanent—which are based on a % of the TRCm and are included in that total. That is, they are financed as part of the loan commitment and capital structure of the deal. These fees are part of the capital costs associated with delivering a completed project that reaches stabilized occupancy and moves from the production period to the operation period as certified by the closing of the permanent loan and settlement of all production costs and fees.
 - **Construction Loan Fees.** These are the fees that are charged for construction financing including commitment fees, inspection fees, interest payments, and other fees. In this model, the budget for such fees is approximated by considering the average outstanding balance and the term of the loan. Once the project design and construction contracts are finalized, the calculations can be refined to recognize the actual draw schedule.
 - **Permanent Loan Fees.** These are the charges for the permanent loan and any standby or interim loans that are built into the capital structure. They include such items as commitment fees, points, and origination fees. In some cases, these fees may include standby fees that are associated with interim or gap financing.

- **Total Replacement Costs in Market (TRCm).** This is the aggregate cost of development including all hard and soft costs.

Core Inputs (from Case 1: Building Envelopes)

Table 1: Site and Constraints

Building Envelope		
Gross Site SF	GSSF	43,560
Lot Coverage Ratio	LC	80%
# Stories in Building	#St	4
Parking Index	PI	4
Paving/Stall	PS	400

Note we are working with a building of 18,837sf.

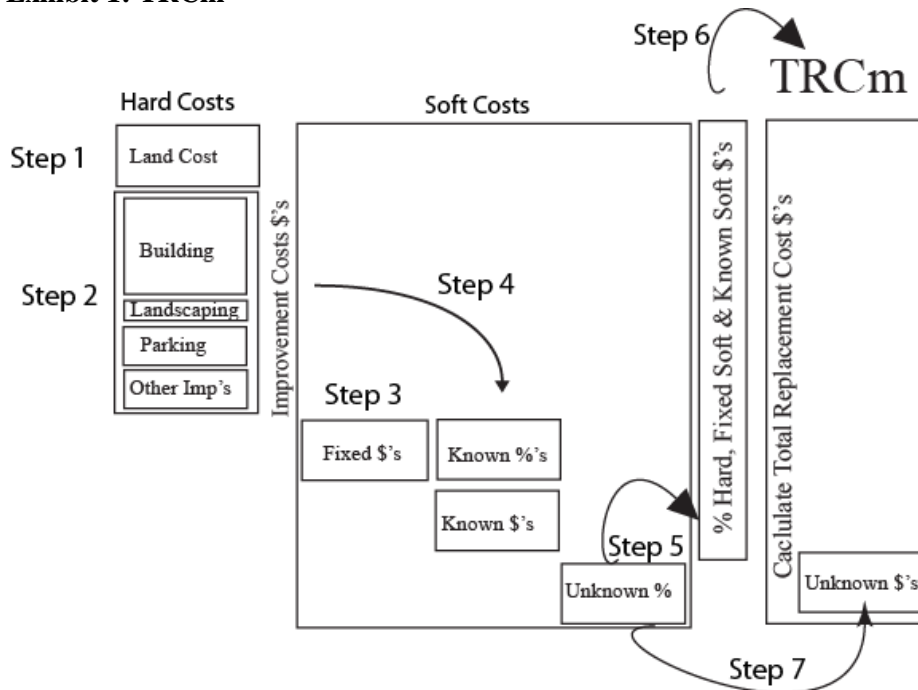
Table 2: Building Envelope from Case 1

Bldg Footprint	=	Building SF / #St	
	=	18,837 / 4	
	=		4,709
Parking Footprint	=	# Modules * PS	
	=	75.3 * 400	
	=		30,139
Open Space	=	GSSF * LC	
	=	43,560 * 80%	
	=		8,712
Total Site	=		43,560

Overview of TRCm

Exhibit 1 presents a graphical representation of the basic TRCm calculations. As noted in the exhibit, the process can be broken down into seven steps.

Exhibit 1: TRCm



Step 1: Land Costs. The first step is to calculate land costs. These are the costs of acquisition and/or land improvements (e.g., clearing, grading) to prepare it for construction.

Step 2: Improvement Costs. Calculate the cost of improvements including labor and materials. These costs are typically based on multiplying the number of units of the various components multiplied by the unit cost, or specified as a lump sum cost.

Step 3: Fixed Soft Costs. Specify the fixed soft costs that can be expressed in dollars. These figures will be market-based and include typical costs plus any adjustments due to unique or special circumstances (e.g., legal fees higher due to rezoning).

Step 4. Known % Soft Costs. Calculate the amount of the soft costs that are based on a fixed percent of the Improvement costs. Such costs include architect's fees, builder's overhead and other items that are based on the construction costs. They typically exclude the land costs since no effort is extended by these parties in creating land value.

Step 5. Unknown % Soft Costs. These costs are fee-based costs that are based on the final TRCm and thus must be isolated algebraically. These costs typically refer to the costs of financing, both construction and permanent, included in the total value that will be created by the development.

Step 6. Calculate Residual % of TRCm. These costs are calculated through the application of simple algebra. In effect, the Unknown % Soft Costs can be aggregated into a composite

percent. Since these costs are included in TRCm, they equal a fixed percent of that final number. Given that relationship, they can be netted from 100% to indicate the percent that the costs up to that point are of the total. Given this relationship, the final number (TRCm) can be calculated by dividing the known costs (i.e., hard costs and known soft costs) by the Residual % they comprise.

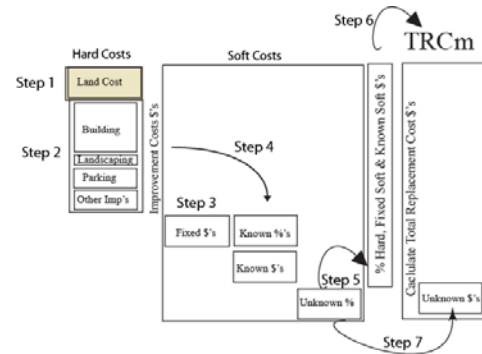
Step 7. Calculate Unknown % Soft Costs \$'s. Since the TRCm has been calculated in the prior step, the final step is to convert the % from each component in the Unknown % Soft to dollars. This is done by multiplying the component % for each by the calculated TRCm.

TRCm Analysis

Step 1: Land Costs

Exhibit 2. Land Costs

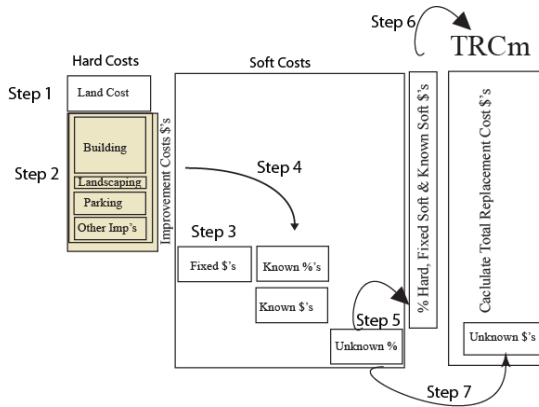
The first step it to calculate land costs. These are the costs of acquisition and/or land improvements (e.g., clearing, grading) to prepare it for construction or development of the actual, income-producing improvements. In some cases, land costs may include fees, legal and other costs of obtaining entitlements and other approvals. The inclusion of such items is based on the fact that they may create value by reducing the risk associated with development approvals and can be transferred with the property as part of its inherent value proposition in the event the development is not undertaken by the land owner.



In some projects, the developer's equity contribution can include a combination of land value which is carried at its improved value (i.e., ready for development) and cash or earned fees. Thus, to the extent the land value at the time of project finance is "created" by the developer and exceeds the initial cost to the developer, it is possible that the developer may avoid any additional equity investment. At the same time, the developer may bring in partners who assume the land at the appreciated, developed value, providing the opportunity for surplus proceeds that can be extracted by the developer or included in his equity share as a promoted interest.

Step 2: Improvement Costs

Exhibit 3: Improvement Costs



Once the land costs have been established, the cost of construction of the scheduled improvements --labor and materials--can be calculated. While the costs can be determined through a number of methods, in essence they all start with the number of units and the costs of putting those units in place. The units can be costs are based on either the number of units of the various components multiplied by the unit cost, or specified as a lump sum cost.

The initial step involves the compilation of the basic Building/Construction Components including parking, open space, building envelope and other design elements. Exhibit 1 presents a snapshot of the core elements at a general unit level. It should be noted that the TRCm calculations at this stage of the analysis are intended to support alternative use analysis and as such, are not detailed. Once alternative uses have been filtered through the analysis, more detailed cost analysis can be conducted to ensure adequate financial resources are available and the project satisfies the “effective demand” market segment for which it is targeted.

Exhibit 4: Basic Construction Components

Building	18,837
Parking	30,139
Landscaping	8,712

Starting with the basic components, the development costs can be calculated. The first stage in this analysis involves the specification of the quality level of the project since the costs will materially differ depending on this assumption. There are a number of on-line and published resources that can be used for cost estimation. In this case, we will use the R.S. Means free on-line system. <http://www.rsmeans.com/calculator/index.asp> Once you access the “cost calculator” page, you will see a screen that requests some basic inputs (see: Exhibit 5 (a)). Please note that you may have to Register to use this feature.

Exhibit 5(a): RS Means QuickCost Estimator Inputs

RSMeans
Reed Construction Data

PAC-CLAD
Petersen Aluminum

THE LOW SLOPE SOLUTION

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RSMeans® QuickCost Estimator

Select from more than 50 building types in 930 locations throughout the U.S. and Canada. The RSMeans Quick Cost Estimator enables you to quickly calculate an estimated value of total project cost localized to your selected area. The calculations include add-on costs itemizing low, medium & high estimates for Architectural Fees & Contractor's Overhead & Profit.

PROJECT DETAILS

Project Title:

Building Type:

Gross Square Footage:

Zip Code of Project Location:

[Get city list](#) (Leave zip code field blank for national average)

[Click here for Canadian Cost Data](#)

Important note: These costs are not exact and are intended only as a preliminary guide to possible project cost. Actual project cost may vary greatly depending on many factors. RSMeans uses diligence in preparing the information contained here. RSMeans does not make any warranty or guarantee as to the accuracy, correctness, value, sufficiency or completeness of the data or resulting project cost estimates. RSMeans shall have no liability for any loss, expense or damage arising out of or in connection with the information contained herein.

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As noted in the exhibit, we have plugged the basic size and type of building into the QuickCost model. If you click on the drop-down menu next to building type, you will see a number of options that should match your proposed use in terms of number of stories and type of use. The use of the zip code is to introduce some local cost factors into the equation, since some markets are inherently more expensive due to wage levels, material shortages, construction regulations and other factors.

Once the Calculate button is entered, the QuickCost calculator will generate the general cost breakdowns presented in Exhibit 5 (b)

Exhibit 5 (b): QuickCost Output

RSMeans QuickCost Estimator			
Project Title:	RE Process Demo		
Model:	Apartment, 1-3 Story		
Construction:	Face Brick with Concrete Block Back-up / Wood Joists		
Location:	SEATTLE, WA		
Stories:	3		
Story Height (l.f.):	10		
Floor Area (s.f.):	18,837		
Data Release:	2007		
Wage Rate:	Union		
Basement:	Not included		
	 <p><i>Costs are derived from a building model with basic components. Scope differences and market conditions can cause costs to vary significantly.</i></p>		
Cost Ranges	Low	Med	High
Total:	\$1,818,450	\$2,020,500	\$2,525,625
Contractor's Overhead & Profit:	\$454,613	\$505,125	\$631,406
Architectural Fees:	\$140,837	\$156,485	\$195,606
Total Building Cost:	\$2,413,899	\$2,682,110	\$3,352,638

At this stage, you can select your “quality” level, and then proceed to the rest of the cost analysis. To test the numbers, divide the \$2,020,500 by the 18,837sf to see if the number is reasonable and to get the raw building costs. Note that we will handle the Overhead & Profit and other Fees as we calculate the fully loaded, all-in costs in our model later. At this stage, we are looking at the raw construction costs that for a starting point. In this case it is \$107, so we can go with the \$100 as a rough starting point in setting up the model.

It should be noted that the following TRCm model can be used to estimate the impacts of various component choices or trade-offs (e.g., green building components). Similarly, by modifying the basic structure and adding more components, analysis of the cost implications of alternative features and quality levels can also be accommodated at this stage. To provide this flexibility, it is useful to set the problem up in Excel or another spreadsheet model.

Exhibit 6 (c): Hard Cost Schedule

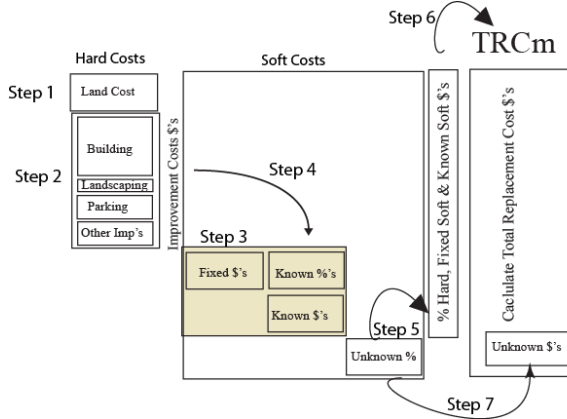
Land Costs	Land \$/SF	\$ 10.00	43,560	\$ 435,600	\$ 435,600
Building	Bldg \$/SF	\$ 100.00	18,837	\$ 1,883,676	
Parking	Pkg \$/SF	\$ 8.00	30,139	\$ 241,110	
Landscaping	Lndscp \$/SF	\$ 1.80	8,712	\$ 15,682	
Other Improvements	Other Imp \$	\$ 300,000		\$ 300,000	
Total Construction					\$ 2,440,468
Total Land & Const. Costs					\$ 2,876,068

As noted in Exhibit 6 (c), once the component costs are determined, the total cost per component and the aggregate land and construction costs can be calculated. In this case, the total costs are \$2,876,068 with the land brought in at acquisition cost and \$300,000 in Other Improvements.

Step 3. Soft Costs for Fixed \$'s and Known %'s

Once the total land and actual construction costs are derived, it is possible to calculate the known soft and hard costs. The Soft Costs are comprised of three components: 1) Soft Costs for Fixed \$ Fees, 2) Soft Costs with Known % of Construction Costs, and 3) Unknown Fees as % of TRCm.

Exhibit 7. Soft Costs for Fixed \$ Fees and Known % Fees



The calculation of Soft Costs includes two steps: Step 3 and Step 4. In Step 3, the Soft Costs for Fixed \$ Fees can be filled into the cost schedule. Exhibit 8 presents a typical cost schedule for a typical list of Soft Cost items.

Exhibit 8: Known \$ Soft Costs

Components	Item Costs	Subtotal
Known Soft Costs		
Taxes	\$ 23,009	
Insurance	\$ 40,000	
Title & Recording	\$ 20,000	
Legal & Organizational	\$ 35,000	
Monthly Inspections (\$500 each)	\$ 9,000	
Appraisal	\$ 7,500	
Cost/Engineering Review	\$ 2,500	
Environmental Repot/Review	\$ 2,500	
		\$ 139,509

The actual amount of the Known Soft Costs will vary by project, but will tend to fall in certain ranges as a function of the project type, scale and location. Similarly, the list of items may vary depending on circumstances and level of detail at which the analysis is conducted. Note you can calculate the property taxes by multiplying the current assessed value by the appropriate millage rate (1/1000 of AV) provided by the assessor. In some cost estimating models, such costs are included in the overall costs/square foot of construction.

Step 4: Soft Costs with Known % of Construction Costs

The calculation of the portion of Soft Costs that are a Known % of Construction Costs is fairly straightforward. In essence, these costs are first estimated as a % of Construction Costs, which are the Hard Costs net of the Land Costs. The isolation of Land Costs is based on the fact that the fees are compensation for professional services associated with the design and construction of the project. Since such services are not extended toward the Land –or if so, are embedded in the Land Costs—the fees focus on the actual construction budget.

Exhibit 9: Soft Costs as % of Construction

Components	Fees	Item Costs	Subtotal
Known Fees as % Const. Cost			
General Requirements	5.2%	\$ 126,904	
Builder's Overhead	2.5%	\$ 61,012	
Builder's Profit	6.0%	\$ 146,428	
Architect's Design	5.8%	\$ 140,327	
Architect's Inspection	1.8%	\$ 42,708	
Bond Fee	1.0%	\$ 24,405	\$ 541,784

As noted in Exhibit 9, once the Soft Cost Fee schedule is specified, the Itemized Costs can be calculated by multiplying those %'s by the Construction Costs. For example, the “General Requirements” which is an allowance for the contractor for anticipated but unspecified costs of 5.2% translate to \$126,904 (i.e., 5.2% * \$2,440,468).

Exhibit 10 presents the Combined Hard and Soft Costs net of the Unknown Financing Fees.

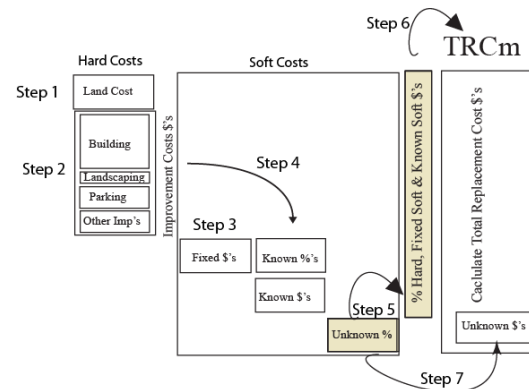
Exhibit 10: Combined Hard and Soft Costs

Total Known Soft Costs & Fees	
Land Costs	\$ 435,600
Construction Costs	\$ 2,440,468
Known Soft Costs	\$ 139,509
Known Fees	\$ 541,784
Combined Hard and Soft Costs	\$ 3,557,360

Step 5: Unknown Fees at % of TRCm

Once the Known Hard and Soft Costs have been calculated, it is possible to calculate the TRCm through a simple algebraic manipulation. This calculation depends on the ability to calculate the % of the TRCm that the Unknown Fees represent, and then determining the complement (i.e., 100% - Unknown Fee %). Since this complement is the % of TRCm that the Known Hard and Soft Costs constitute, by dividing the Known \$ amount

Exhibit 11: Unknown Fees % of TRCm



by that %, the TRCm can be calculated. Exhibit 12 presents the basic algebraic expressions by which the TRCm can be calculated in spite of the circular nature of the Unknown % Fees which are included in the TRCm. In simple terms, if the Unknown Costs are 10% of the TRCm, the TRCm can be estimated by dividing the Known \$'s by 90% (i.e., 1-10%).

Exhibit 12: Algebraic Rationale for TRCm

Total Replacement Cost	=	Known \$'s	+	Unknown
TRC	=	Known \$'s	+	[(TRC*LV*Unknown %)]
TRC - (TRC*LV*Unknown %)	=	Known \$'s		
TRC * (1-(LV*Unknown %))	=	Known \$'s		
TRC		TRC	=	$\frac{\text{Known \$'s}}{(1-(LV * \text{Unknown \%}))}$

Exhibit 13 presents the calculations for the Construction and Permanent Loan fees. Note the calculation for the Construction Loan interest load assumes an average outstanding balance of 65% based on a “typical” draw schedule. Similarly, the Construction Period is used to adjust the annual interest rate to an equivalent rate that spans the entire construction period. That is, since the Construction Period is 18 months, the effective estimated rate is 18/12 or 1.5 * the 5.5% annual rate. As noted in the exhibit, the Total Unknown Financing Fees for this case is 10.16%. This could vary depending on nature of the project and speed of construction.

Exhibit 13: Unknown % Financing Fees

Unknown Financing Costs				Total
Construction Financing Fees				
(Const Rate)	*	$\frac{\text{Const. Period}}{12 \text{ mo/yr}}$	* Avg. Bal.	
5.50%	*	$\frac{18}{12}$	65%	5.36%
Commitment Fee		1.20%		1.20%
Permanent Loan Fees				
Commitment Fee		1.00%		
Financing Fee		2.00%		
Inspection Fee		0.60%		3.60%
Total Unknown Financing Fee %				10.16%

Step 6: Calculation of TRCm

Once the Unknown % Financing Fee has been estimated as a % of TRCm, the TRCm can be calculated as noted in Exhibit 14. As noted in Exhibit 12, the Unknown % Financing Fees totaled 10.16%. Since the borrower will be able to finance that fee with the mortgage, the drain that they constitute must be modified by the Loan-to-Value (LV) ratio. The equation that is used to estimate TRCm from known data is presented in Exhibit 15. In this case, the Known Items totaled \$3,557,360 which is 91.87% of the TRCm.

Exhibit 14: Calculation of TRCm

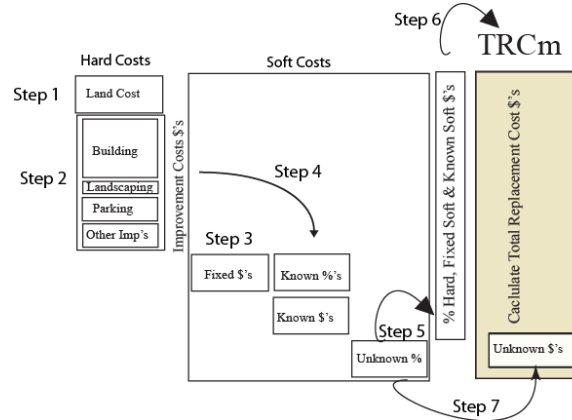


Exhibit 15: Mathematical Calculation of TRCm

TRC =	$\frac{\text{Known \$'s}}{(1 - (LV * \text{Unknown \%}))}$
TRC	$\frac{\$3,557,360}{(1 - (80\% * 10.16\%))}$
TRC =	$\frac{\$3,557,360}{91.87\%}$
TRC =	$\$3,872,167$

Step 7: Calculation of Unknown % Fees

The final step in TRCm is to reconstruct the fee schedule for the Financing Fees that are included in the TRCm and can be covered in part by the permanent mortgage. As noted in Exhibit 17, these figures can be determined by multiplying the vector of %'s for the respective items by the TRCm.

Exhibit 16: Calculation of Unknown % Fees

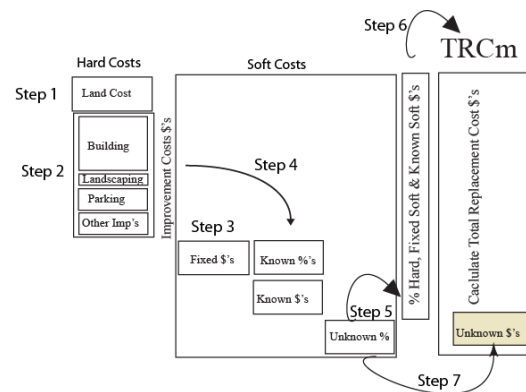


Exhibit 17: Financing Fee Schedule

Construction Financing Fees	% of TRC	\$'s
Construction Interest	5.36%	\$ 166,116
Commitment Fee	1.20%	\$ 37,173
Permanent Loan Fees		
Commitment Fee	1.00%	\$ 30,977
Financing Fee	2.00%	\$ 61,955
Inspection Fee	0.60%	\$ 18,586
Total Unknown Financing Fee %	10.16%	\$ 314,807

Now that each of the components of TRCm have been converted to their \$'s, the cost schedule can be specified. As noted in Exhibit 18, the TRCm consists of 74% hard costs and 25.7% soft costs.

Exhibit 18: TRCm Summary

Component	Item	Cost	Subtotal	Share	Comp Share
Hard Costs					
	Land Costs	\$ 435,600		11.2%	
	Construction Costs	\$ 2,440,468		63.0%	
	Subtotal		\$ 2,876,068		74.3%
Soft Costs					
	Known Soft Costs	\$ 139,509		3.6%	
	Const-Related Fees	\$ 541,784		14.0%	
	Financing Fees	\$ 314,807		8.1%	
	Subtotal		\$ 996,100		25.7%
	Total Replacement Cost (TRCm)		\$ 3,872,167	100.0%	100.0%

The final step is to establish the capital structure for the project. In this case, the LV ratio is used to determine the split between the permanent mortgage and the equity investment. As suggested earlier, the equity may come in the form of cash or land contributions. In some cases, it may also come in the form of promoted interests whereby the developer defers fees and/or profit and leaves them in the project as an equity contribution.

Exhibit 19: Capital Structure

Sources of Capital					
Permanent Loan	=	TRC *	LV	=	\$ 3,097,734
Equity	=	TRC *	(1 - LV)	=	\$ 774,433
Total Capital					\$ 3,872,167

As noted, by going through the Soft Cost calculations, you pick up additional loan proceeds and reduce your equity contribution. The permanent loan commitment may differ since the lender may recognize some of the “value creation” which occurs through your entrepreneurial efforts and apply the permanent loan LV to the completed market value. On the other hand, the lender will require that you have adequate income to satisfy certain risk ratios such as the Debt Coverage Ratio (DCR) and the Default Ratio (DR).