

Estimating state and local revenue impacts from meeting Phase 1 space needs for HQ2 if (Pittsburgh had won)

Part I. Appendices

Center for Economic Development

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architectural features. The replacement cost approach can be used on newer and older buildings alike.

What costs are included?

Whether reproduction or replacement cost estimates are used, the cost method requires more than the “updated” *hard costs* of construction (materials, labor, contractor and subcontractor fees/profits). The *soft costs* of replacing or reproducing the building must also be included, such as architectural, engineering, finance, and legal fees, and the developer’s profit, if applicable. A complete list of costs that should be theoretically accounted for is shown below.²¹

Direct costs (on site)

- Materials
- Equipment
- Labor

Indirect costs (off site)

- a. Professional services
 - Architect's fees
 - Engineer's fees
 - Surveyor's fees
 - Legal fees and expenses
 - Appraisal fees
- b. Developer's overhead
- c. Building permits and licenses
- d. Insurance premiums
- e. Interest
- f. Taxes
- g. Selling expenses (commissions, advertising, promotion)
- h. Carrying cost from time of completion to sale or occupancy
- i. Contractor's or subcontractor's overhead and profit (sometimes classified a direct cost)

How are costs estimated?

There are actually a range of methods available for estimating costs under the cost approach to value, and according to practitioners and regulators, they are not equally reliable. Four commonly used techniques include the quantity survey method, the unit-in-place method, the square foot method, and the cost index (factored historical) method.²²

The most comprehensive technique is the *quantity survey method*. Under this approach an inventory of the precise quantity and type of materials and labor used

²¹ List adapted from Georgia Department of Revenue, p. 38. Note that g. and h. may not apply to the HQ2 or Tower cases.

²² Discussion here derived from Georgia Department of Revenue, pp. 39-48, and "The Cost Approach", author unknown, August 17 2017, training power point preservation on the cost method, link: <https://tax.nv.gov/uploadedFiles/taxnv.gov/Content/LocalGovt/Education/6-2%20Cost%20Approach%20Powerpoint.pdf>, accessed 1/30/2019.

to construct the building is undertaken and updated with prices at the date of the appraisal to estimate the cost of replicating the building. Hard costs are accounted for “down to the nail” but soft costs (ex: overhead, fees) are also included in the estimate.²³

The approach is most commonly used by construction contractors to estimate the cost of projects. While viewed as the most accurate cost method, the extreme specificity of this approach comes at a high information gathering cost, and is the method appraisers are least likely to use.²⁴

Another approach is the *unit-in-place method*. This approach is used by contractors that routinely rely on subcontract work. Rather than take an inventory of detailed costs, this approach deconstructs the design of the building into components (ex: foundation, frame, walls, floor, HVAC). These are characterized and current component level price quotes can be sought from subcontractors who specialize in the component, which are summed to estimate the cost of reproducing the building. This variant of the method is sometimes referred to as the “subcontractor-method.” As described by the Georgia Department of Revenue in application to residential construction:

Many house contractors use numerous subcontractors, who have special expertise in certain areas and often can do the work better and cheaper than a general contractor. Typically, general contractors who use a substantial number of subcontractors figure the cost of a house by breaking it down into components corresponding to the work done by the various subcontractors.... It is based on the use of unit prices for the various building components, using workable units such as the square foot, linear foot or other appropriate basic unit. ²⁵

While not deemed as accurate as the quantity survey method, it is considered a relatively accurate method, assuming the unit costs quoted by subcontractors are accurate as of the appraisal date.²⁶

Importantly, cost services such as Marshall and Swift Valuation Service also provide their own standardized component level unit cost rates that can be used by unit-in-place estimates by general contractors or appraisers.²⁷ These are provided

²³ "The Cost Approach", p 12.

²⁴ As guidance from the Georgia Department of Revenue (p. 39) notes: “Except for unusual appraisals, this type of breakdown is beyond the scope normally required. When such a breakdown is required, the services of a trained cost estimator should be obtained.

²⁵ Georgia Department of Revenue, p. 23.

²⁶ "The Cost Approach", p 13. notes that this unit in place is considered the "2nd most accurate method". The Georgia Department of Revenue, p 43, notes that "Providing that the units accurately reflect costs, this estimate is a short cut to an actual quantity survey. The resulting figure should correspond in accuracy with that derived from a quantity survey."

²⁷ See for example: "Marshall & Swift Commercial Building Cost Data: Best Practices", Edward Martinez, CoreLogic, April 2018, p 1.

for a given year, and based on a broader set of information than individual subcontractor quotes.²⁸ Such services also include multipliers that can be used to adjust costs according to the project's location. This approach to unit-in-place estimates is also referred to as the "segregated cost method".²⁹

The *square foot method* relies on standardized unit cost to estimate the cost of an entire building at once. As noted by guidance from Montgomery County (AL) Alabama:

*The square foot method combines all the costs for a particular type and quality of structure into one value as a cost per square foot... This method produces a value based on the floor area of the structure.*³⁰

Such factors are available for different types and sizes of buildings from proprietary sources such as RS Means or the Marshall & Swift Valuation Service. Here the cost of the entire building is estimated based on gross square feet (or other unit) and an appropriate multiplier.

When little else about a building is known, square foot costs from RS Means can provide a contractor a useful first preliminary estimate of what a building might cost. By some accounts, it is most commonly used by residential appraisers.³¹ Marshall & Swift is frequently used for commercial appraisal, and provides a range of unit cost factors for a variety of office building types, scales, and quality levels, as well as adjustment factors for project year and location.³²

While considered credible, the square foot method is not considered as accurate as the aforementioned methods for appraising individual properties for obvious reasons.

The design, materials, and construction techniques required for a specific building may certainly differ from the average or median building projects that proprietary firms such as RS Means rely on upon to generate square foot estimates. Local costs may also vary significantly, even with local market adjustment factors applied, due to a number of reasons including but not limited to the availability (demand for) local contractors and materials at the time of the project.

²⁸ Per Martinez, p. 1: "The costs for construction materials, labor, and other costs related to construction of a building or residence, are continually researched; and the Marshall & Swift products are updated monthly, quarterly or annually. Methods of data collection used include: current Marshall & Swift subscribers, phone surveys, field surveys, mail programs, building construction trade associations, numerous trade publications, government statistics and reports, contractors, architects, lending institutions, labor halls and materials suppliers."

²⁹ Georgia Department of Revenue, p. 44.

³⁰ "Estimating Cost", Montgomery County (AL) web site, Real Property Page, link: <http://www.mc-ala.org/Departments/Appraisal/RealProperty/Pages/EstimatingCost.aspx>, accessed 1/31/2019.

³¹ "Comparative Unit Method", www.georgiaappraiser.com, link: <http://www.georgiaappraiser.com/glossary/comparativeunitmethod.htm>, accessed 1/31/2019

³² The Marshall and Swift Valuation Service uses the term "calculator method" to describe this approach. It also sometimes referred to as the "comparative unit method".

Nevertheless, the square foot method is routinely used to inform mass property appraisals for assessment purposes by local governments.³³

The *cost index method* or *factored historical cost method* relies on national cost indices of construction to inflate the original actual (historical) costs of a building to current costs. The calculations involved are simple:

Price index for appraisal year/price index for historical cost = multiplier

*Multiplier * historical cost = reproduction cost new.*³⁴

The only information this approach uses to estimate cost of the building is its original cost, its date of completion, and perhaps its property type (some indices are general, some are specific to property types). One practitioner notes that it is considered to be the least reliable of the four approaches for appraisal purposes under the cost method.³⁵ But it apparently does see some use in commercial appraisal.

As noted in the main report, our understanding (based on interviews) is that the comparative unit (square foot) approach and/or the segregated cost method was used to initially assess the value of the Tower at PNC Plaza via their computer assisted mass appraisal system, using data and functionality from the Marshall & Swift Valuation service (albeit using 2012 price levels). Information from Marshall and Swift was also clearly used by PNC's appraiser in the assessment appeal. Thus we assume this approach would be the one most likely used to ultimately determine an opinion of value under the cost method for a new HQ2 building.

³³ "The Cost Approach", p. 14.

³⁴ Adapted from "The Cost Approach", p. 16.

³⁵ Ibid., p. 15.

Differences in reproduction vs. replacement cost new for a new building

The appraised replacement cost of a thirty-year old structure will typically be very different from the original cost of the building, as unit prices for materials and labor will have changed, as will have construction techniques and technologies.

The reproduction cost of a building is often higher than the replacement cost, as the materials, construction methods, and even skilled labor required to create an exact duplicate of a building (particularly of a historical building) will likely be more expensive to obtain than their conventional counterparts in a current market.

We assume that an appraisal of an HQ2 building would be completed soon after construction and/or shortly after operations begin. Logically it might be assumed that the built cost of a new building - which should also be very close to its *reproduction cost new* - would also be very close to its appraised *replacement cost new*. However, the cost method allows for differences in actual built costs and its appraised replacement value, even for a brand new building, through the concept of *depreciation*.

Defining depreciation (a.k.a. obsolescence)

Depreciation has different meanings for the disciplines of appraisal, financial accounting, and economics, although their respective definitions of the term are conceptually related.

In *financial accounting*, depreciation refers to an allowance for the reduction in the value of an asset (such as capital buildings or equipment) from wear and tear made before the calculation of profit. Since the precise lifespan and rate of depreciation for an asset will not be known in advance, its decline in value is necessarily estimated using standardized assumptions about the asset's lifetime value, and one of several depreciation methods (ex: the straight-line method).³⁶

This “book keeping” depreciation does not anticipate or account for unexpected losses of value due to technological or economic reasons, which are instead written down as they occur.³⁷ Such circumstances might include when a capital plant loses value because the products it produces loses value due to changes in consumer tastes, or because of competitive cost pressures from new lower cost production processes.

In *economics*, depreciation simply refers to a loss of market value for any reason. One definition of “economic depreciation” describes it as “a loss in the value of an

³⁶ *The Penguin Dictionary of Economics: Fifth Edition*, Bannock, Baxter, and Davis, Penguin Books, 1992, p. 111.

³⁷ *Ibid.*

asset, whether due to physical changes, obsolescence, or factors outside of the asset.”³⁸

In the parlance of *real estate appraisal*, depreciation is specific to real property, and is sometimes referred to as *obsolescence*. For a building, deductions for obsolescence can stem from three sources: physical deterioration, functional obsolescence, or external obsolescence.³⁹

Physical deterioration refers to reductions in value of a structure due to age and/or wear and tear. This phenomenon is analogous with what accounting depreciation attempts to measure.

Functional obsolescence, as defined by the Dictionary of Real Estate Appraisal, refers to:

*a loss in value within a structure due to changes in tastes, preferences, technical innovations, or market standards.*⁴⁰

Or...

*[t]he impairment of [the] functional capacity of a property according to market tastes and standards.*⁴¹

Or as one practitioner more helpfully puts it:

*[a] decrease in value due to [a] property’s inability to perform the function for which it was intended.*⁴²

In the context of commercial property, functional obsolescence refers to the loss of value due to how the layout, design, or other functional features of the building itself compare to the *market for its property type* at the time of the appraisal.

Functional obsolescence is specific to the building and can take two forms: as a deficiency or as a superadequacy.

A *deficiency* refers to the lack of a property feature that other properties in the same market have and the buyer/tenant expects.

A *superadequacy* refers to a property feature that the market does not value, or value enough to cover its cost. Or as one definition more simply puts it, “a component of real estate that is beyond what is needed.”⁴³

³⁸ Dictionary of Business and Economics Terms: Fifth Edition, Jack P. Friedman et. al., Barron’s Educational Series, 2012, p. 194.

³⁹ Reilly, pp. 84-86.

⁴⁰ The Dictionary of Real Estate Appraisal: 5th Edition, p. 85.

⁴¹ *Ibid*, p. 249.

⁴² Reilly, p. 86.

⁴³ Dictionary of Real Estate Terms: 7th Edition, Friedman, Harris, and Lindeman, Barron’s Educational Services, 2008, p. 471.

While more commonly found in older structures as the market around them leaves them behind, deficiencies and superadequacies can also apply to brand new buildings.

For example, if a newly completed house lacks a kitchen sink, we would say it suffered a *deficiency*. There would likely be a deduction to its appraised market value under the cost method to account for the missing sink.⁴⁴

On the other hand, an otherwise identical house that featured a sink with solid gold faucets costing \$15,000 is an example of a *superadequacy*. Despite its higher cost, it is not likely that such a house could command a substantially higher market value compared to an identical apartment with standard faucets (let us assume the gold cannot be extracted).⁴⁵ This is because people do not typically look for or care about golden faucets when they buy houses.

A new office building for lease that featured an opulently designed and outfitted executive suite might also suffer from a superadequacy (depending on the market it resides in).⁴⁶

Appraisers classify functional obsolescences as *curable* or *incurable*. A curable functional obsolescence is “a curable defect caused by a flaw in the structure, materials, or design which can be practically and economically corrected.”⁴⁷ If the cost of “fixing” a deficiency is less than the anticipated increase in value, then it is curable, if not it is incurable.

Returning to our examples: the missing sink deficiency is surely curable, as the benefits of replacing it (in restored market value) will likely be greater than the cost of doing so. If this is the case, then the appraised value of the house would simply be its replacement cost new minus the cost of adding the lacked feature: the sink.

Superadequacies are typically more difficult to “cure” as they do not represent the lack of a valued feature, but the presence of a feature that is not valued enough given its cost.

The problem is that the feature is already in place. Removing a superadequate feature not only costs money, but doing so will not necessary increase the property’s value, and may reduce it.

If the feature is demanded by the market, but is excessive compared to what the market demands, then addressing the problem would not only theoretically require

⁴⁴ Explaining the full technical details of how deductions for deficiencies and superadequacies are computed for appraisals is beyond the scope of this report.

⁴⁵ Example adapted from: <http://www.georgiaappraiser.com/glossary/superadequacy.htm>, accessed 1/25/2019.

⁴⁶ Example adapted from: <https://financial-dictionary.thefreedictionary.com/superadequacy>, accessed 1/25/2019. Alternate citation: The Complete Real Estate Encyclopedia, Denise L. Evans, JD & O. William Evans, JD., The McGraw-Hill Companies, Inc, 2007.

⁴⁷ The Dictionary of Real Estate Appraisal: 5th Edition, p. 50.

the cost of removal, but the cost of replacing the feature with a more “standard” one as well.

One could rip out the opulent executive suite from the office building and replace it with one more in line with local market standards, but little or no increase over its current value would likely result despite the cost of doing so.⁴⁸

As long as market conditions hold, neither action will result in an increase in value equal or greater than the costs involved. The cost is not worth the benefits of “fixing” the problem, and so an appraiser would deem it an “incurable” superadequacy, as there is no sensible economic rationale for the fix.

All this said, an important point to remember about functional obsolescences is that while they have a functional aspect, they are ultimately determined by the market at the time of the appraisal. The core reason for the deduction in value of the missing sink is not technically that the kitchen does not provide tap water, but that homebuyers in the market currently expect that it should. Thus what is superadequate or deficient in one market in time or place may not be in another.

If for some (fantastic) reason, ten years hence, homebuyers no longer expected sinks, then a new appraisal would not need to deduct the cost of the sink from its replacement cost new. While the opulent executive suite may be a superadequate feature for the market for commercial office space in Erie PA, it may fit right in on Wall Street today (it might even be deficient)!

External obsolescence refers to reasons that a property can lose value that are *not* due to the property itself or its individual features, but are instead caused by other factors external to the site that are not under the property owner’s control. Like functional obsolescence, external obsolescence can stem from different causes.

Locational obsolescence is a form of external obsolescence that can result when a property is located near a declining neighborhood, or if a new landfill or hazardous waste dump opens nearby.

Economic obsolescence is a form of external obsolescence that can occur when the *market* for a real estate property changes (decreased demand or increased supply) such that the subject property can no longer generate a fair rate of return on operations (or as an investment). As with functional obsolescence, external obsolescence problems are more common with older structures, but can still impact new buildings (ex: via natural disasters or unanticipated market downturns for real estate).⁴⁹ By definition, since they are out of the owner’s control, they are incurable.

⁴⁸ If you could remove it, there is more hope for the curing the golden sink superadequacy as the gold has salvage value.

⁴⁹ Derived from Reilly, p. 86.

The formula below, suggested by a practitioner with Williamette Management Associates, a valuation firm, illustrates the mathematical relationships between reproduction cost new, replacement cost new, and all three forms of depreciation accounted for by the cost method.⁵⁰

$$\begin{aligned} & \text{Reproduction Cost New} \\ & - \text{Incurable Functional Obsolescence} \\ & = \text{Replacement Cost New} \\ & - \text{Physical Deterioration} \\ & - \text{Economic Obsolescence} \\ & - \text{Curable Functional Obsolescence} \\ & = \text{Market Value} \end{aligned}$$

Recall that the definition of “reproduction cost new” involves the cost to remake an exact duplicate of the building at current prices including any and all deficiencies and superadequacies present at the time of the appraisal.

If the building were instead merely replaced rather than reproduced, it is assumed that the owner would have no incentive to replicate the “incurable” deficiencies and superadequacies of the original building, since the value of doing so would not be worth the cost. Therefore the costs of reproducing or resolving these issues do not carry forward into the estimated cost to replace the building.

Under this formula, the difference between the estimated reproduction and replacement cost new for a building using modern methods, materials, designs etc. is assumed to be equal to the value of the building’s incurable functional deficiencies and superadequacies.

Meanwhile, the appraised market value of the building is the replacement cost new minus any loss of value due to depreciation for physical deterioration, external economic or locational factors, and/or a downward adjustment for the cost of fixing any curable deficiencies.

⁵⁰ “Functional Obsolescence Considerations in the Property Tax Valuation”, Scott R. Miller, Property Tax Evaluation Insights, Winter 2012, Williamette Management Associates, p. 69, link: http://www.willamette.com/insights_journal/12/winter_2012_6.pdf, accessed 1/26/2016.

Potential sources of depreciation for an HQ2 building

So...what kinds of depreciation might apply to a brand new HQ2 building?

First, the building would be new, so it seems unlikely that any *physical depreciation* would need to be accounted for at the start of operations.

As it is intended to serve as a long term corporate headquarters for a firm seemingly at the height of its economic powers, and not as an investment property seeking tenants - *at first glance* - there also seems to be little risk of *economic obsolescence* for an HQ2 building out of the gate (more on this in a moment).

We assume that such a building will be world-class in design, materials, and systems. While they are theoretically possible (mistakes can be made) significant *deficiencies* once the building opened seem improbable, and instead the structure and its features are likely to compare very favorably to other class A office buildings in the market, including higher end offices that currently serve as corporate headquarters for Pittsburgh's most important firms.

On the other hand it certainly seems possible, and probable, that an HQ2 building would include superadequacies right off the bat. Day One's biodomes feature workspaces, for example, but not every potential lessor or buyer of class A office space, including Fortune 500 firms looking for headquarters, may value this feature as much as Jeff Bezos apparently did. One does not need to be surrounded by rare plant species to have a productive meeting.⁵¹

One might think the costs associated with LEED certified buildings might be more generally valued by the market than a biodome, but even here there seems to be at least some risk of superadequacy. On the one hand, high end LEED buildings do appear to offer long term protection against eventual functional deficiency, in that the operating costs of high performance LEED certified buildings are often lower than their "brown" counterparts.

But superadequacies are *market-driven*, and not every urban market for office space appears to value green features the same way. As one Pennsylvania appraiser interviewed for this report noted, *developers* seem reluctant to invest in building high end LEED certified office space "on spec", as the current market does not appear to sufficiently value it enough over the alternatives to justify its perceived building cost. Referring to the Tower case, the appraiser also noted that most LEED Platinum buildings are owner occupied by high end firms, often with the end of projecting a certain image, which suggests that the actual market for such structures is very narrow.⁵²

⁵¹ "Amazon's expansive biodomes get their first 40,000 plants", Elizabeth Stinson, www.wired.com, September 17 2017, link: <https://www.wired.com/2017/05/amazons-expansive-biodomes-get-first-9000-plants/>, accessed 1/28/2019

⁵² Interview with commercial appraiser with experience with green buildings who operates in PA. December 2018.

Based on interview comments and published commentary from this and other appraisers, the appraisal industry currently appears to be grappling with how to value green building features in commercial property, a discussion which also apparently involves superadequacy concerns. As one practitioner's article on the subject notes:

A greywater system that harvests rainwater and sink water for re-use in flushing toilets adds to construction costs initially but lowers potable water use and thus the ongoing water expense used in the income approach will be lower. Since water is currently relatively inexpensive, the cost savings may or may not justify the original cost, so in the cost approach, superadequacy may need to be addressed.⁵³

As the same article notes, part of the difficulty for appraisers is that such buildings are still relatively rare in the stock of buildings, compared to conventional buildings, which makes detailed appraisals of the overall or feature level green value premiums difficult.⁵⁴ There is also debate and uncertainty over whether there *are* cost or price premiums for green buildings.⁵⁵

We were not in a good position to explore the implications of the emerging practice of appraising green features for this report. Instead, we simply assume that an appraisal of an HQ2 building using the cost method would include deductions for superadequacies. If so, we believe that they too would be incurable, and that a deduction for them would result in an estimated replacement cost new that was smaller than the structures built cost and/or its estimated reproduction cost new.

⁵³ "Integrating Sustainability and Green Building into the Appraisal Process", Tim Runde and Stacy Thoyre, Journal of Sustainable Real Estate, Vol 2, No. 1, 2010. pp. 244.

⁵⁴ Ibid. p 223.

⁵⁵ Ibid, p 222.

What cost metric? What means of measure?

We assume the appropriate measure under the cost method for appraising the construction cost of an Phase One HQ2 building would be the cost of replacing the building, accounting for depreciation (as appraisers define it), rather than the cost of reproducing it. Further, we assume the appraised market value of the building would be set according to this reduced formula:

$$\begin{aligned} & \text{Reproduction Cost New (or Built Cost in Year 0)} \\ & \text{– Incurable Superadequacies} \\ & \text{= Replacement Cost New} \\ & \text{= Market Value} \end{aligned}$$

This formula is pretty close to, but not precisely how the Tower at PNC Plaza appraised under the cost method.

The cost approach to value as applied to the Tower

Turning to the appraisal of the Tower once more, as already noted, candidate features for superadequacy in the Pittsburgh market might include the second façade, the solar chimney, or even the climate control system as a whole.⁵⁶ We assume such issues are not economically or practically curable. PNC’s appraiser appeared to agree, although their approach differed slightly from the formula above.

The following is summary of the steps and assumptions the appraiser took in applying the cost approach to value to the Tower. We outline the approach used at the conceptual level only, without reporting detailed figures. Instead we simply describe what the appraiser did, with the assumption that an appraisal of an HQ2 building under the cost method would be similarly applied and accepted by taxing authorities.

The appraiser opted to use the replacement cost new measure. To do so they appeared to use the comparative unit cost (i.e. square foot cost) approach, relying on unit costs and multipliers from the Marshall & Swift Valuation Service. The Service’s estimated cost per square foot for a “good quality” “Class A” office building served as the base unit cost, with multipliers applied to adjust for current construction prices, local (Pittsburgh) construction prices, and other multipliers related to basic building features and parameters such as height and perimeter.

⁵⁶ Again, this assumption is strictly based on the Pittsburgh market, as such features might not be candidates for superadequacy in, for example, the San Francisco market.

The cost of the Tower's underground parking garage was estimated separately based on relevant unit costs and multipliers from the same source.

Under the cost method, an estimate of entrepreneurial profit is often included as a cost. Since it was an owner occupied building, and not an investment property, costs associated with entrepreneurial profit were ignored. As might be expected, since the subject building was brand new, no deductions for depreciation from physical deterioration were taken.

One might have expected the appraiser to stop there. By basing the replacement cost of the Tower on a conventional "good quality" Class A office building as defined by Marshall and Swift, any hard and soft costs over and above this "average office building" were removed from consideration. Following the previously noted formula, these extra costs might be viewed as the Tower's incurable superadequacies vs. the market for Class A office space in Pittsburgh. Following the principle of substitution, the appraiser appeared to assume that a lower quality, more conventional building would still be an acceptable good substitute for the Tower under the cost method.

This decision might seem jarring to a layman, since such a hypothetical structure at first glance seems so starkly different - and cheaper - than the reported cost of the Tower.

Is a conventional office building really "a substitute" for PNC?

The answer to this question is clearly "no", but the question itself is not the relevant one.

Recall practitioner definitions of *replacement cost new* noted earlier:

Replacement cost new measures the total cost, in current prices, to develop a new property having the same functionality or utility as the taxpayer property.

...

Functionality is an engineering concept that describes the ability of a property to perform the task for which it was designed. Utility is an economics concept that describes the ability of a property to provide an equivalent amount of satisfaction to the owner or operator. (emphases added)⁵⁷

The Tower serves as a corporate headquarters for a Fortune 500 firm, and is owner occupied. Compared to local, regional, or even other national firms, Fortune 500

⁵⁷Reilly, p. 47.

firms have more assets to invest in their corporate headquarters, even as such buildings must also meet a broader and more demanding set of needs than a typical office building. Such buildings often include a higher quantity and quality of office and workspace, but also include features, spaces, and amenities designed to attract, motivate, and retain talent, and project a desired public image.

The Tower was not primarily built as an investment, whether for resale or for lease (apart from the first floor) to external anchor tenants. Its intended purpose was at least threefold: to serve PNC's basic functional need for office space, to fulfill a higher use as its corporate headquarters, and to serve as a statement of its corporate values - as an avatar of its corporate image. It could be reasonably argued that the building currently belongs to a market unto itself that no one else but PNC would want or be willing to pay for.

But appraisal practice does not appear to determine a suitable substitute for an office property under the cost method based on the needs of its *actual/current owner alone*. Instead, substitutes for a subject property are based on what appraisers believe that the *broader market* for office space in the same class in the same geographical market would *actually support* in terms of new construction. Thus, the “substitute building” conceived by the appraiser is based on what the appraiser believes that the *typical* prospective commercial property owner in the Pittsburgh market would want to build. In most urban markets, the market of “office builders” is not dominated by Fortune 500 owner operators, but developers, real estate firms, and institutional investors looking to build properties for income generation and/or as investments. The cost method implicitly assumes that they should be willing to build only what they believe the local market will support, given demand for space, competitive supply, and anticipated trends.

We assume the appraiser judged that at the date of appraisal, the actual market for Class A office space was not strong enough to support the construction of a building as “high end” as the tower Tower as an income generating property, and so a much more conventional substitute was used to estimate its replacement cost instead.

Some quibbles

Even if one accepts this approach to substitution, as with any appraisal, there is still a bit of room to quibble with the Tower appraisal.

Recall that although no deductions for physical deterioration were taken for the Tower, a substantial deduction for superadequacy is implied by virtue of the difference in the Tower's built cost and the proposed replacement cost of a conventional office building.

The quality of the construction for a substitute building could have been set at higher than “good”. This is the label used for a quality of construction rating of 3 in Marshall and Swift’s unit cost estimation tool, for a scale that goes to 4 (“Excellent”) and may accept values of 5. As shown by our appraisal estimates of an HQ2 building, these scores have a material impact on the assumed cost of the building.

We assume the best argument for the given rating of 3 is that it best represented the supply of buildings of this class in the local market at the time, and that given market conditions, the higher cost of a higher quality building would not result in a better return (on income or sale) to an investor, and so would not be financially feasible.

While the magnitude of this deduction might be quibbled over, the fact that it was taken at all appears defensible given the logic of appraisal practice.

That said, a third (and also substantial) deduction of value was taken that was not as easy to understand.

The deduction was taken to account for depreciation from external obsolescence and functional obsolescence, combined. Little explanation was given for why these deductions were combined into one number, rather than reported separately. Based on the appraisal report, the argument for the deduction for external (economic) obsolescence appeared to rest on the fact at the time of the appraisal, current local markets did not appear support speculative construction. No further evidence was provided to justify the extent of the deduction from this cause. Our best interpretation of this deduction is that this was the appraiser’s means of indicating that the market for Class A office space was such that even a “good quality” conventional building might not realistically be built as an investment property under market conditions at the time, and the deduction was applied as a means to split the difference between a “build” and “no build” scenario.

Meanwhile, the report’s argument for the building’s functional obsolescence appears to rest on the idea that the building was an “over improvement” for the market at the time. Although the term is not used in the appraisal, this appears to be a reference to superadequacy, although no further explanation as to how the building is more than adequate, or what features were superadequate, is provided. This aspect of the deduction appears to be the most difficult to interpret. In theory, the use of a conventional “good quality” building as a substitute building should have already accounted for great deal of “superadequacy”.

Adding it all up

Even after the use of a conventional building to compute replacement cost new, and these combined deductions, the cost method resulted in the highest estimate of value for the Tower generated by the three approaches

In describing how all three estimates of value were reconciled into an overall opinion of value, the report indicates that the income and cost approach were given the most weight, with more weight given to the former than the latter. The sales approach was only given limited weight.

Ultimately, across all three measures of value, the Tower was compared to buildings (real and theoretical) that may qualify as comparables under appraisal practice, but did not closely resemble the overall quality of the subject building itself. In fact there do not appear to be any buildings in the Pittsburgh market that closely resemble the Tower.

Instead, the appraiser used comparables that were representative of the current state of affairs in the market for class A office space or buildings in Pittsburgh at the time of the appraisal. Despite the buildings high design quality and high performance nature, the appraiser effectively assumed that if converted to an income producing property, or sold outright as such, it would not command a significant price premium compared to the local market on either front. Along the same lines, in their application of the cost method, the appraiser assumed that a more conventional office building would serve as an adequate replacement, and effectively provide the same amount of functionality and utility to “the market” if not PNC.

We assume that a similar approach to value would eventually be taken for HQ2. As noted in the main report, we use two scenarios to illustrate the difference in appraised and assessed value for an HQ2 building with “Good” vs. “Excellent” quality construction as defined by Marshall and Swift. We did not follow the PNC case in making further deductions for superadequacy or economic obsolescence.

Appendix B: Baseline assessments, the common level ratio and the uniformity clause

Why was PNC’s proposed opinion of value for the Tower at PNC Plaza ultimately further reduced by 92%? The answer has to do with something called the “common level ratio” and the design of Allegheny County’s mass appraisal system.

While an in-depth discussion of this system and controlling law is beyond the scope of this paper, we present a minimum sketch of the relevant policies here as an introduction to the uninitiated. The purpose is to put the computation and use of the common level ratio in the Tower case in context.

Pennsylvania law and jurisprudence concerning county tax and assessment policies are flexible on several points.⁵⁸

- Each county can choose whether to value property based on *current market values*, or on *base year values*, i.e. the value of the property as of the last countywide comprehensive assessment.⁵⁹
- Should it choose the latter option, there is no state level mandate on when or how often a county should undertake comprehensive property assessments. For example, the last comprehensive assessment for Fayette County was in 2001, eighteen years ago.⁶⁰
- Counties are also free to set the *rate* at which the market value of a property may be assessed for tax purposes. The administrative name for this rate is the “established pre-determined ratio” or PDR, which represents the ratio that assessed value bears to market value.⁶¹ While most counties (including Allegheny County) use a PDR of 100%, Armstrong County, for example, taxes only 50% of the total assessed value of its property base.⁶²
- Finally, counties (and other taxing authorities) are also free to set their own millage rates for property taxes, within limits defined by the state.⁶³ For example, York County’s current millage rate is 4.8 (tax

⁵⁸ The content of this appendix relies heavily on “Pennsylvania Property Assessment: A Self-Evaluation Guide for County Officials”, Pennsylvania Local Government Commission, pp. 1-8, June 13 2018, link: http://www.paassessors.org/Documents/Self_Evaluation_Guide_for_County_Officials_6-13-2018.pdf, accessed 4/1/2019.

⁵⁹ Ibid., p 4.

⁶⁰ See <http://property.co.fayette.pa.us/>, accessed 4/3/2019.

⁶¹ The “Established Pre-Determined Ratio shall mean the ratio of assessed value to market value established and uniformly applied in determining assessed value in any year.” Source: FAQ page for the State Tax Equalization Board and Tax Equalization Division. Link: <https://dced.pa.gov/local-government/boards-committees/steb-ted-faq/>, accessed 4/9/2019.

⁶² See <https://www.co.armstrong.pa.us/images/departments/assessment/commonlevelratio.pdf>, accessed 4/3/2019.

⁶³ These limits vary by class of county, municipality, etc. For example, the current millage rate limit for Allegheny County is 25 mills (current rate is 4.73 mills). Boroughs limits are currently set at 30 mills. PPS currently has no millage limit. See “Taxation Manual: 2018”, Pennsylvania Department of Economic and Community Development, p. 12, as archived by the Lincoln Land Institute at:

dollars per \$1,000 of assessed value) while Westmoreland County's is 20.99.^{64,65}

Uniformity

Despite these points of flexibility, state law as interpreted by the Pennsylvania State Supreme Court also dictates that all county tax assessment policies meet certain requirements and conform to certain standards. The most important of these is the overarching requirement of *uniformity*.

The concept of uniformity has its roots in Article VIII § 1 of the Pennsylvania Constitution which states:

*All taxes shall be uniform, upon the same class of subjects, within the territorial limits of the authority levying the tax, and shall be levied and collected under general laws.*⁶⁶

The Pennsylvania Supreme Court has interpreted this provision to mean that *all real estate* falls under the same class of subjects, such that taxation of real property must be uniform.⁶⁷ In effect, this means that within the same county, all residential, commercial, and industrial property must be effectively taxed at the *same* (not different) rates.⁶⁸ Thus in theory, the Tower at PNC Plaza should be taxed at the same rate of value as a two story brick home in the Pittsburgh neighborhood of Friendship.

In contrast, consider Fayette County TN, which uses a uniform countywide millage rate, but an assessment ratio (PDR) of 25% for residential property and 40% for commercial or industrial property.⁶⁹ As the effective tax rates (taking into account the PDR) are unequal, such a policy would not be allowable under Uniformity Clause of the Pennsylvania Constitution given controlling precedents.

The Court has also asserted that a uniform system of property assessment means that “taxpayers should pay no more or less than their proportionate share of government”.⁷⁰ And that “a taxpayer is entitled to relief under the Uniformity

https://www.lincolnst.edu/sites/default/files/gwipp/upload/sources/Pennsylvania/2017/2017_PA_TaxationManual_2018_Department%20of%20Community%20and%20Economic%20Development_Jun%202018.pdf, accessed 4/30/2019.

⁶⁴ See https://yorkcountypa.gov/images/pdf/assessment/2019_TAX_COLLECTORS_LIST.pdf, accessed 4/3/2019.

⁶⁵ See <https://www.co.westmoreland.pa.us/DocumentCenter/View/15958/2019-MILLAGE-RATES-See>, accessed 4/3/2019.

⁶⁶ See <https://codes.findlaw.com/pa/constitution-of-the-commonwealth-of-pennsylvania/pa-const-art-8-sect-1.html>, accessed 4/3/2019.

⁶⁷ Pennsylvania Legislator's Municipal Deskbook: 5th Edition (2017), p. 124.

⁶⁸ Ibid.

⁶⁹ See <https://fayettetn.us/departments/trustee/calculating-property-taxes/>, accessed 4/3/2019.

⁷⁰ Recently stated in *Clifton v. Allegheny*, 969 A.2d 1197 (Pa. 2009), as referenced in “Pennsylvania Property Assessment: A Self-Evaluation Guide for County Officials”, p 2. Case link: <https://www.courtlistener.com/opinion/1515917/downingtwn-v-chester-county-bd/>, accessed 4/4/2019.

Clause where his property is assessed at a higher percentage of fair market value than other properties throughout the taxing district.”⁷¹

In other words, all properties should be treated to the same *level of assessment*, such that the ratio between assessed and market values are similar. As a state guide on property assessment puts it:

*The level of assessment refers to the overall percentage or ratio of assessed values to market values, as determined by sale prices, at which properties are assessed. Uniformity is the degree to which properties or classes (types) of properties are assessed at equitable percentages of market value.*⁷²

Court opinions have also indicated that:

*..all properties must be evaluated using the same set of standards and all properties in the County must be reassessed at the same time. It is also a violation of the Uniformity Clause for properties to be treated differently by any governmental entity based on classifications of property type.*⁷³

Thus, in addition to requiring identical PDRs and tax rates across all classes of real estate, this also implies that a county government must not embark on a targeted campaign to appeal property values for certain classes of real estate, or for certain neighborhoods. For example, in 2017 the Court held that for a school district to target commercial properties exclusively for appeal is a violation of the Uniformity Clause.⁷⁴

Despite these rigidities, the Court has also acknowledged the reality that a system of property assessment cannot be perfectly uniform. As noted by the Court,

*Some practical inequalities are obviously anticipated, and so long as the taxing scheme does not impose substantially unequal tax burdens, rough uniformity with a limited amount of variation is permitted.*⁷⁵

Property assessment within a base year system

Allegheny County does not comprehensively assess properties on an annual basis such that assessed values are as close as possible to market values. Instead it uses

⁷¹ Recently stated in *Downingtown Area Sch. Dist. v. Chester Cty. Bd. of Assessment Appeals*, 590 Pa. 459, 466, 913 A.2d 194, 199 (2006), as referenced in “Pennsylvania Property Assessment: A Self-Evaluation Guide for County Officials”, p 3.

⁷² Ibid, p. C-1.

⁷³ “Pennsylvania Property Assessment: A Self-Evaluation Guide for County Officials”, p 3.

⁷⁴ *Valley Forge Towers Apartments v. Upper Merion School District*, 163 A.3d 962 (Pa. 2017), as referenced in “Pa Supreme Court Addresses Main Concern of HB 1213”, Pennsylvania School Boards Association, link: https://www.ppsba.org/wp-content/uploads/2018/01/ACL_assessment-appeals-Jan-2018.pdf.

⁷⁵ *Clifton v. Allegheny County*, as referenced in “Pennsylvania Property Assessment: A Self-Evaluation Guide for County Officials”, p 3.

a base year methodology to calculate assessed values for tax purposes. The base year used is 2012, the last year a countywide comprehensive assessment was undertaken.

In essence, this procedure essentially freezes the taxable value of properties in time, such that assessed property values are based on their county estimated market value as of 2012. Thus, the 2012 baseline assessment is fixed – it becomes the appraised value for a given property for all ensuing years until the county elects to conduct another countywide assessment.

In between these assessments, per state law, re-assessment of specific properties may only be initiated by the County when a “triggering event” occurs. Such events include major changes to improvements (including new construction), the subdivision of a property, catastrophic loss, or a change in tax-exempt status; but exclude the *sale* of a property.⁷⁶ Otherwise, the assessed value of a given property will remain frozen until the next comprehensive assessment (or a successful property appeal).

In fact by law the assessed value should remain unchanged even if the property is sold at a significantly higher price. In the past courts have found that the sale of a property (alone) does not constitute a triggering event, and that such “spot assessments” violate both state and federal constitutional law.⁷⁷ Despite this, a lower court state judge recently found the re-assessment of recently sold properties to be within the law. The issue is not yet settled and the case may go to the Pennsylvania Supreme Court.⁷⁸

While assessed values remain frozen across the County until the next “thaw”, actual market values change. This can result in two identical properties starting out with identical assessments, but over time ending up with very different market values, despite the fact that their owners pay the same baseline amount in taxes. The aforementioned state guide provides an example of how this can happen.

For example, in 2002, two taxpayers owned identical homes in a large township and school district. Both homes were assessed in 2002 at \$181,900. Taxpayer A’s home is located in a rapidly growing part of the township that includes excellent schools. Taxpayer B’s home is located in an older part of the township that includes the less desirable schools. Since the properties were assessed in 2002, taxpayer A’s home has increased in value by 60 percent while taxpayer B’s home value has not increased in value at all. Nonetheless, both homeowners will continue

⁷⁶ Pennsylvania Legislator’s Municipal Deskbook: 5th Edition (2017), p. 123

⁷⁷ Ibid., pp. 125-126.

⁷⁸ See “Not neighborly? Judge says school district appeals of home assessments are legal”, Mark Belko, [Pittsburgh Post-Gazette](https://www.post-gazette.com/business/development/2018/04/26/Judge-says-taxing-bodies-can-appeal-assessments-after-homes-sell/stories/201804260069), April 16 2018, link: <https://www.post-gazette.com/business/development/2018/04/26/Judge-says-taxing-bodies-can-appeal-assessments-after-homes-sell/stories/201804260069>, accessed 4/11/2019.

*to pay the same in property taxes to the township, school district and county based on their 2002 assessments, if the county has not revised its property values since 2002.*⁷⁹

Disparities in level of assessment

Despite the fact that both properties above share the same assessed value and tax bill, they are said to have a disparate *level of assessment*. Disparities in assessment can be originally “baked-in” based on the application of mass appraisal procedures during a baseline assessment, but are mainly driven by differential changes in market value as indicated by actual sales after the baseline year. These disparities can occur when sale prices in one neighborhood lag or lead another, when prices within a neighborhood diverge, when price trends in one category of real estate differ from another, and when price trends differ by property value (high vs. low).

Ratio studies are undertaken by counties to systematically evaluate the uniformity of assessment levels across their property tax base in the wake of changing market prices. The primary purpose of such studies is to gauge disparities in level of assessment and determine whether or not a new comprehensive assessment is warranted. These studies gauge equity in the level of assessment across properties by examining *assessment ratios*. As noted by the aforementioned guide on the subject:

*The assessment ratio known as the assessment-sale price ratio (ASR) is used as a basis in ratio study statistics. As an example, the calculation of the ASR for a property that is assessed at \$90,000 and sells for \$100,000 is $\$90,000/\$100,000 = 0.90$ or 90%. After calculating the ASR for valid property sales in a ratio study sample, the level of assessment is computed using statistical measures of central tendency, the most common being the median, mean, and weighted mean.*⁸⁰

Ratio studies seek to detect significant disparities in ASRs across groups of properties by class, value, location, and other dimensions by which the level of assessment might significantly diverge. The point is to identify problems with uniformity across or within groups of properties. A variety of metrics and statistical techniques may be used to this end, which we will not cover here.

⁷⁹ “Pennsylvania Property Assessment: A Self-Evaluation Guide for County Officials”, p 6.

⁸⁰ Ibid.

The common level ratio

One measure of the average difference between assessed and market values across properties for an *entire county* is the Common Level Ratio (CLR). This is an administrative metric computed by the state for each county.

Each year, for each county, the state compares the previous year's property sales in the county to the county assessed value of those properties.⁸¹ The assessed value is divided by the sales value to get a ratio (the ASR) for that property. Ratios for all properties sold are then averaged to compute a mean ratio. Once outliers are removed, this ratio serves as the CLR for that county for that year.⁸² For example, in 2017 the CLR for Allegheny County was .877.⁸³ This means that on average baseline assessments for properties sold in the previous year were 87.7% of the value the properties sold for.

Unlike a ratio study, the calculations for the CLR are not specific to any class of property within the county, and the metric itself is only of limited use in flagging systematic disparities across groups of properties. Its primary use is within the property assessment appeal process. As outlined by Pennsylvania's State Tax Equalization Board:

The only use for this ratio is in the assessment appeal process and this ratio becomes relevant if it varies by more than 15% from the established predetermined ratio, it must be applied to secure assessment uniformity for the appealed property.

NOTE: With the exception of a county's interpretation of the Allegheny County and Downingtown court cases and that is, to use the current CLR at all times in appeals regardless of the variance.

The CLR is applied after the Board of Assessment Appeals/Revisions establishes a fair market value, based on evidence, to calculate a revised assessment value. The CLR is never used for any other purpose.⁸⁴

⁸¹ Adapted from "Current STEB CLR Policy and Procedures Manual", State Tax Equalization Board, PA Department of Economic and Community Development, last updated September 9, 2017, pp. 2-4, link: <https://dced.pa.gov/download/steb-policy-procedures-manual-clr/?wpdmdl=79959>, accessed 2/2/2019.

⁸² Ibid.

⁸³ "Pennsylvania Department of Revenue Realty Transfer Tax Common Level Ratio (CLR) Real Estate Valuation Factors", Pennsylvania Department of Revenue, p. 2., links: <https://www.revenue.pa.gov/GeneralTaxInformation/Tax%20Types%20and%20Information/RTT/Pages/Common%20Level%20Ratios.aspx> or https://www.revenue.pa.gov/GeneralTaxInformation/Tax%20Types%20and%20Information/RTT/Documents/clr_factor_historical.pdf, accessed 2/2/2019. The figures in this document are actually CLR "factors", and are the mathematical reciprocal of the actual CLRs. The CLR for Allegheny County in 2017, for example is 1.14, and $(1/1.14) = .877$.

⁸⁴ "Current STEB CLR Policy and Procedures Manual" p. 2.

This last statement does not appear to be entirely true as the CLR can also play an administrative role in computing realty transfer taxes (see Appendix E). It also serves as a rough indicator of potential assessment disparity problems across groups, in that the further it falls away from the PDR, the more likely such problems might be found “under the hood.” But its main use is in the appeals process. The following attempts to illustrate the usual role of the CLR in the appeals process, and implications of the court cases mentioned above.⁸⁵

How the CLR is used in the appeals process

In appealing the assessed value of their property, a property owner may elect to challenge the value using a base year or current market approach.

Under the *base year approach*, the owner presents evidence of a (lower) value from the base year. Such evidence could be based on comparable sales that transacted in the base year. This figure would then be multiplied by the established PDR to produce an owner proposed assessment.⁸⁶

In the case of Allegheny County, and regardless of the year the appeal was made, evidence presented using the sales approach to value would need to use comparable sales from (or near) 2012, with the resulting value multiplied by a PDR of 100%.

In contrast, the *current market approach* introduces evidence in the current year, but adjusts the resulting value back by the county’s current CLR.

In the case of Allegheny County, for an appeal made in late 2017, evidence presented using the sales approach would require the most recent comparable sales, with the resulting opinion of value multiplied by .877, the County’s CLR for 2017. This procedure essentially “deflates” the owner proposed value back to the base year of 2012. The extent of the deflation is determined by the average amount that recent property sales in the county fell short of originally assessed baseline values.

In the appeals process, the relevant authority, whether the Board of Property Assessments Appeals and Review (BPAAR) or the Court of Common Pleas, Board of Viewers (BOV), will consider the evidence for the values proposed by both sides and ultimately determine a final value, which may or may not change the property’s assessment. However, when the appellant uses the current market approach to make its case, in doing so, the authority must adhere to certain procedures.

⁸⁵ See for example: “How is the Common Level Ratio (CLR) used” under <https://dced.pa.gov/local-government/boards-committees/steb-ted-faq/>. For more on the history and purpose of the CLR, see “What’s a Common Level Ratio, and why should I care?”, David Pierce, *The Pocono Record*, originally published January 12, 2003, link: <https://www.poconorecord.com/article/99999999/NEWS090105/51216016>, accessed, 2/2/2019.

⁸⁶ The following relies heavily on “Pennsylvania Court Decision Bolsters Uniformity Challenges in Real Estate Tax Assessment Appeals”, Metz and Parker, Buchanan, Ingersol & Rooney, November 6 2015, link: <https://www.jdsupra.com/legalnews/pennsylvania-court-decision-bolsters-14662/>, accessed 4/4/2019.

Specifically, when a county's current CLR differs from the PDR by *more than 15%*, statutes indicate that "the appeal board must first determine the property's fair market value and then adjust it by the common level ratio to determine assessed value."⁸⁷ That is, the board must either accept and/or use evidence from either the owner or taxing authority (or both) to determine fair market value, and then adjust it back by the appropriate CLR. This may use the CLR from the previous year, since a more recent one may not be available at the time of the appeal. However, if the difference between the CLR and the current PDR is less than 15%, no CLR adjustment is required.

Once again, in 2017 Allegheny County's CLR was 87.7%, while its PDR was 100%. Thus its CLR and PDR differed by less than 100%, and therefore a CLR adjustment would not appear to be required for an appeal brought under the current market methodology during the period in which the 2017 CLR was in effect administratively.

However, two recent court cases have changed the conditions under which the CLR adjustment is applied in some counties. The first is *Downingtown Area School District v. Chester County Board of Assessment (2006)* in which the Pennsylvania Supreme Court found that the "15% difference" decision rule leads to systematic unequal treatment with regards to assessments, and is in and of itself a violation of the Uniformity Clause. As noted by the court:

In this event, so long as the CLR is no less than 85 percent of the EPR, such taxing authority is able to force the board to increase the assessment to the fair market value as of the year the appeal was taken...(omitted)... and merely apply the EPR to that figure, rather than to a figure expressed in base-year dollars. Because, however, for all other properties no corresponding adjustment is made, only the property owners targeted for appeal by the taxing authority are burdened with assessments representing the EPR as applied to present-year dollars.

...

⁸⁷ The relevant statute is 72 P.S. 5020-511(c), which can be found here: <https://codes.findlaw.com/pa/title-72-ps-taxation-and-fiscal-affairs/pa-st-sect-72-5020-511.html>. The quoted passage, and a most of the discussion of this section is from or derived from Metz and Parker (2015). This legal commentary on the law is useful although it refers to common level ratio factors as "common level ratios" (they are related, but not equivalent values, as one is the reciprocal of the other).

*Thus, in allowing use of the EPR rather than the CLR, the General Assembly has, in effect, carved out a class of taxpayers who are subjected to an unfairly high tax burden—namely, those whose assessment is appealed by any taxing district in which the property is located. Because this classification is not based on any legitimate distinction between the targeted and non-targeted properties, it is arbitrary, and thus, unconstitutional.*⁸⁸

Despite this finding, at least according to one source, in practice “county tax appeal boards have often continued to refuse to apply the common level ratio unless it exceeds the 15% watermark”.⁸⁹ This reality appeared to be acknowledged by the aforementioned guidance for the conditional application of the CLR from the STEB.

In *S&D Shah Corporation v. Allegheny County Board of Property Assessment Appeals (2015)*, the Court of Common Pleas of Allegheny County ordered that if (either) appellant uses a current market value approach to propose fair market value, that the CLR be applied to this regardless of whether the adjustment is sought by either party.⁹⁰ The decision was not appealed, and this ruling now applies to all such appeals in Allegheny County. To the best of our knowledge, other counties continue to vary to the extent in which they observe the +/-15% threshold before applying a CLR adjustment to fair market values established under the current market value approach.

So, returning to the benchmark case of the Tower, by the year of PNC’s appeal (2016), *Shah* was in effect, and so the appellant’s proposed opinion of value of \$160M, which relied on the current market based approach, and which was ultimately accepted, was also, at the appellant’s request, adjusted by 92%, the applicable CLR at the time. We assume that any successful appeal of an assessment of an HQ2 building would see a similar reduction, albeit with a different CLR.

⁸⁸ *Downington Area School District v. Chester County Board of Assessment Appeals and Lionville Station S.C. Associates*, Appeal of Lionville Station S.C. Associates, Pennsylvania Supreme Court, Decided December 26, 2006, link: <https://caselaw.findlaw.com/pa-supreme-court/1186821.html>, accessed 4/11/2019.

⁸⁹ Metz and Parker (2015)

⁹⁰ Ibid.

Appendix C: Assessed values for an alternative building design

The models of substitute properties we generated using Marshall and Swift assumed structures of 20 to 30 floors plus parking levels. While we assume such structures would be feasible for the Lower Hill or The Strip sites, zoning considerations might limit building heights at other sites, particularly for the Site@PIT, which is by the airport. To account for this we generated an alternative five floor model. This model has similar features, but is irregular in shape and lacks an underground parking garage. We were guided, to a degree, by the basic parameters of the corporate headquarters of Dick’s Sporting Goods. This building is located by the airport, and is reported to have 670K feet of space. It also has a large parking lot rather than a large underground garage.⁹¹ While we assume the 500K size would be more realistic, we computed the costs of a five floor building for both 500K and 1M sq. ft., and for both excellent and good quality grades of construction.

Table 11. Replacement costs for alternative building designs (no parking)

Building size	Floors	Replacement cost new for a building of GOOD quality	Replacement cost new for a building of EXCELLENT quality
500K	5	\$111M	\$139M
1M	5	\$218M	\$274M

The resulting costs are noticeably smaller, in part because they do not account for any parking facilities, and in part because of the economies of scale the tool assumes to apply within the range of heights examined. Note that these alternative designs would require more land area than their original counterparts, both for the building, and any separate parking lot (for example, the parking lot for Dick’s is quite large compared to the building’s footprint). We do not attempt to compute land, parking lot, or other campus style improvement costs here, but we assume that overall, the CLR adjusted values and resulting tax yields of the development would still be lower than those produced for the original designs.⁹²

⁹¹ See for example: <https://www.mascaroconstruction.com/projects/buildings/offic-commercial/dicks-sporting-goods-headquarters>, and <https://www.dlaplus.com/pages/dick-s-sporting-goods-corporate-headquarters>. Accessed 3/28/2018.

⁹² For the record, according to the County’s website, the Full Market Value of this structure alone (no other improvements) is listed at \$85M. Accessed 4/1/2019.

Appendix D: Yield from realty transfer taxes

State and local realty transfer taxes apply to cases where real property changes hands. According to the PA Department of Revenue:

Pennsylvania realty transfer tax is imposed at a rate of 1 percent on the value of real estate (including contracted-for improvements to property) transferred by deed, instrument, long-term lease or other writing. Both grantor and grantee are held jointly and severally liable for payment of the tax.

Pennsylvania realty transfer tax is collected, often along with an additional local realty transfer tax, by county Recorders of Deeds. The Recorders of Deeds remit the commonwealth's 1 percent to the Department of Revenue, and the locals have the option to share their realty transfer tax among school districts and municipalities.⁹³

Realty transfer tax rates are applied to the greater of : (1) the amount paid (the consideration) for the property or (2) the county assessed value of the property adjusted *forward* to market value through the common level ratio factor. Essentially, this latter step inflates a baseline assessed value to an approximation of fair market value via the CLR factor.

In other words, while *property* tax rates are applied to what the fair market value would have been in the past (i.e. the baseline year), *realty transfer* tax rates are applied to current fair market values (actual or estimated). Even if a property is sold for \$1, the tax will still be applied on its assessed value for tax purposes, adjusted forward by the CLR factor to current fair market value.⁹⁴

Which transfers would be taxable?

We assume the development project might involve several transfers of land or improvements between the parties involved, but we do not assume every transfer will be taxable.

⁹³ Realty Transfer Tax web page, PA Department of Revenue, <https://www.revenue.pa.gov/GeneralTaxInformation/Tax%20Types%20and%20Information/RTT/Pages/default.aspx>, accessed 3/26/2019.

⁹⁴ Source: The Tax Compendium, March 2017, PA Department Of Revenue, p. 18 link: https://www.revenue.pa.gov/GeneralTaxInformation/News%20and%20Statistics/ReportsStats/TaxCompendium/Documents/2017_tax_compendium.pdf, accessed 3/26/2019. The CLR factor is the reciprocal value of the CLR. See Appendix B for a description of the CLR. This form illustrates how taxable value is calculated: <https://www.revenue.pa.gov/FormsandPublications/FormsforIndividuals/RTT/Documents/rev-183.pdf>

It seems possible, if not guaranteed, that the *land* for the development would be transferred to Amazon or a third party at some point in the construction process, and in such a case, realty transfer taxes could apply.

If on the other hand the land was *leased* to Amazon or a third party, it seems more likely that the transaction would be structured in a way that it would be exempt from the tax. Based on Pennsylvania’s Revenue Code, realty transfer taxes do not appear to apply unless “[t]he lease or occupancy agreement is for a term of 30 years or more”, i.e. (“a long-term lease”).⁹⁵ Further, a recent court decision suggests that there may be legal means to practically partially circumvent the 30 year limit via renewal options.⁹⁶

While any land owner might choose to lease land to Amazon, the site in which this would most likely happen is the Site@PIT. This site is currently owned by the Allegheny County Airport Authority, which owns a large amount of land outside the “fence” of the airport, some of which has already been privately developed into office parks, corporate headquarters, and other uses.⁹⁷ When contacted, a representative of the ACAA noted that while the airport is permitted to sell land designated for “non-aeronautical” use, if the land was acquired using federal aviation funds, the proceeds would have to be paid to the Federal Aviation Administration, not the ACAA. As a result, the representative noted that ACAA instead offers ground leases of land to third party developers, who pay taxes on the value of the ground lease and the buildings constructed. As the ACAA is tax-exempt, the land is not taxable until leased for such commercial purposes.⁹⁸ As noted in the main report, we assume these terms would also apply to an HQ2 building at the Site@PIT.

It seems less likely that the *building* would be subject to the realty transfer tax outright. This is because there are a number of circumstances in which the transfers of land and/or improvements at least appear to be exempt based on the face value of the language on the realty transfer tax in PA code.

- If Amazon *first* took possession of the land and then entered into a contract with a construction firm to build the building, and *then* took ownership of the completed building, then realty transfer taxes would apply to the land, but

⁹⁵ Chapter 91: The Realty Transfer Tax, The Pennsylvania Code, § 91.193. (24) (i) “Excluded transactions”, p. 58 of 73, link: https://www.revenue.pa.gov/GeneralTaxInformation/Tax%20Types%20and%20Information/RTT/Documents/revenue_code_chp_91.pdf

⁹⁶ See: “Pennsylvania Holds Extension Option Does Not Trigger Realty Transfer Tax”, Practical Law Real Estate, October 9 2017, Thomson Reuters, link: [https://content.next.westlaw.com/Document/I9ca674be876511e79bef99c0ee06c731/View/FullText.html?contextData=\(sc.Default\)&transitionType=Default&firstPage=true&bhcp=1](https://content.next.westlaw.com/Document/I9ca674be876511e79bef99c0ee06c731/View/FullText.html?contextData=(sc.Default)&transitionType=Default&firstPage=true&bhcp=1), accessed 3/26/2019.

⁹⁷ For a description of such developments, see “Pittsburgh International Airport, Allegheny County Airport and the Allegheny County Airport Authority Economic Impact Study”, Economic Development Research Group, Inc. and John J. Clark & Associates, Inc., March 2017, p. 34, link: http://www.flypittsburgh.com/getattachment/Newsroom/Economic-Impact/Economic-Impact-Study-Core-Report_Final.pdf.aspx?lang=en-US, 1/25/2019.

⁹⁸ Paraphrased from an e-mail exchange with ACAA personnel, January 2019.

not the improvements (as in this scenario, there is technically no transfer of ownership for the building).

- Property transfers due to *turnkey* projects in which the builder or developer temporarily takes possession of the land during construction may also be exempt from the tax. To paraphrase PA code, if the original owner, (or if Amazon, after taking possession of the land) transferred the property to a developer or contractor required by contract to build improvements and then reconveyed the property back to the owner, then neither transfer (of land and/or improvements to or from said developer/contractor) would be subject to the tax, as long as no “beneficial interest” in the property was transferred to the developer or contractor in the process.⁹⁹
- Situations in which an agent (ex: a developer) transfers property (whether land or building) to or from a principal (ex: Amazon) may also be exempt. To paraphrase PA code: a transfer of property without consideration to or from an agent or straw party acting for the exclusive benefit of a principal (ex: Amazon) is not subject to the tax. For example, if a developer buys property from a third party on behalf of Amazon, this would be a taxable transfer. Handing it over to Amazon for free (or for \$1), depending on the terms of the transaction, might not.¹⁰⁰

Based on PA code we assume transfers of property for commercial purposes from a philanthropic foundation to Amazon (or an agent acting on its behalf) *would* be taxable.¹⁰¹ Transfers from an industrial development authority (such as RIDC) to Amazon also appear taxable according to the law, with exceptions. Key passages from PA Code relating to this are below, with less relevant language omitted.

A transfer from an industrial development authority or a nonprofit industrial development agency is taxable unless one of the following applies:

(omitted)

(3) The transaction meets the following requirements:

(omitted)

(iii) The grantee shall directly use the realty for the primary purpose of manufacturing, fabricating, compounding, processing,

⁹⁹ Chapter 91: The Realty Transfer Tax, The Pennsylvania Code, § 91.162. “Turnkey projects”, p. 42.

¹⁰⁰ Chapter 91: The Realty Transfer Tax, The Pennsylvania Code, § 91.153. “Principal and agent.”, p. 34. Transfers involving principals and agents are not always exempt. For example, transfers to or from a third party from the agent on behalf of the principal would normally be taxable.

¹⁰¹ Chapter 91: The Realty Transfer Tax, The Pennsylvania Code § 91.161. “Charitable, religious and educational organizations”, p. 42, key passage: “A transfer of realty to or from charitable, religious, educational or other nonprofit organizations is taxable on the same basis as other deeds.”

*publishing, research and development, transportation, energy conversion, energy production, pollution control, warehousing or agriculture.*¹⁰²

Although based on the bid the proposed starter building could have a co-located space for R&D, HQ2 would have the primary purpose of a corporate headquarters, and we assume a transfer from such an authority would not be exempt from the realty transfer tax.

Finally, we also we assume that the realty transfer tax could apply in certain cases to structures which have yet to be built. Recall that no realty transfer taxes apply if Amazon entered into a construction contract for improvements *after* acquiring the land. PA code suggests that if a construction contract for improvements is in effect *before* or at the time title to the parcel is transferred, *and* the original owner and construction firm are “affiliated”, then the tax will apply to the land and the yet to be built structure. A contract between the owner and builder to make the improvements that was assigned to the purchaser as part of the transaction would constitute such an “affiliation”. So in this case, if the original site owner contracted with a construction firm to build HQ2, then transferred the land and contract to Amazon, the tax would still appear to apply.¹⁰³

Would any party be exempt from paying the tax?

Per PA Code the “Commonwealth and its governmental subdivisions, instrumentalities, agencies and other subordinate governmental bodies and the United States and its instrumentalities, agencies and other subordinate bodies are excluded from payment of the tax...”¹⁰⁴ However, as both parties in a transfer are jointly liable for the taxes due, this only exempts governments and government agencies from the tax bill, not the other parties involved in the transfer, nor does it reduce the amount owed. So for example, if Amazon or its agent purchased land at the (county owned) Carrie Furnace site from Allegheny County, it would be on the hook to pay the entire realty transfer tax bill, whereas it might negotiate a divvying up of the bill with the private owners of land in The Strip.

What would the tax yield be (for year 1)?

Table 12 shows the realty transfer tax rates that appear to apply by site location.¹⁰⁵ There is no county realty transfer tax, but as noted there is a state realty transfer tax of 1%. The combined municipal rates for Rankin, Swissvale, and Findlay are

¹⁰² Chapter 91: The Realty Transfer Tax, The Pennsylvania Code § 91.158. “Industrial development authorities and agencies”, pp. 39-40.

¹⁰³ Chapter 91: The Realty Transfer Tax, The Pennsylvania Code § 91.137. “Construction contracts”, p. 28. See also: <https://www.revenue.pa.gov/FormsandPublications/FormsforIndividuals/RTT/Documents/rev-618.pdf>, accessed 3/27/2019.

¹⁰⁴ Chapter 91: The Realty Transfer Tax, The Pennsylvania Code § 91.192. “Excluded parties”, p. 52.

¹⁰⁵ Source: <https://www.alleghenycounty.us/real-estate/realty-transfer-tax-municipality-rates.aspx> , accessed 12/13/2018.

identical. Pittsburgh’s rate recently rose by .5% to 2.5% and by 2020 will rise again to 3%, thus eventually driving its combined rate to 5%.¹⁰⁶ Note that these are percentage, not millage rates, and are thus larger per unit than standard property tax rates.

Table 12. Realty transfer tax rates (2017)

Realty Transfer Tax Rates by Site Location	Municipality	School District	State	Combined Rate
City of Pittsburgh	2.5%	1%	1%	4.5%
Findlay, Rankin, Swissvale	.5%	.5%	1%	2%

To estimate the yields from one transfer, we use two “unsized” land parcels that we assume are transferred for the sum of \$5M to \$10M. To estimate the yield from a non-exempt transfer of the building, we use the previously estimated assessed costs of a 500K or 1M sq. ft. building, as we are not a position to predict what the building would sell for. Any combination of land and building values can be added to account for a scenario in which Amazon acquires both the land and building. As our original unadjusted assessed costs are already in 2017 terms, it is not necessary for us to apply the CLR factor to inflate them forward from assessed values. The results range from \$100K to \$450K in taxes for land transfers, and from \$2.9M to \$15.7M for the structure, depending on the size, initial assessment value, and municipality. The largest total yields were for Pittsburgh locations because of its higher municipal rate, with proceeds for the structure alone ranging from \$6.3M to \$15.7M. The lower rates for the other three municipalities result in yields from \$2.9M to \$7.1M

¹⁰⁶ Pittsburgh City Council agrees to transfer tax increase, Adam Smeltz, Pittsburgh Post-Gazette, December 19 2017, link: <https://www.post-gazette.com/local/city/2017/12/19/Pittsburgh-City-Council-realty-transfer-tax-increase-affordable-housing-trust-fund-Housing-Opportunity-Fund-Pittsburgh-United/stories/201712190228>, accessed 4/5/2019.

Table 13. Estimated realty transfer tax yields (for one transfer)

Municipality	Base		Est. Fair Market Value	Municipal	School District	State	Total Realty Transfer Taxes
City of Pittsburgh	500K sq ft + parking	Good	\$135M	\$3,500,000	\$1,400,000	\$1,400,000	\$6,300,000
		Excellent	\$165M	\$4,250,000	\$1,700,000	\$1,700,000	\$7,650,000
	1M sq ft + parking	Good	\$277M	\$7,050,000	\$2,820,000	\$2,820,000	\$12,690,000
		Excellent	\$345M	\$8,750,000	\$3,500,000	\$3,500,000	\$15,750,000
	\$5M Land		\$5M	\$125,000	\$50,000	\$50,000	\$225,000
	\$10M Land		\$10M	\$250,000	\$100,000	\$100,000	\$450,000
Findlay, Swissvale, or Rankin	500K sq ft + parking	Good	\$135M	\$725,000	\$725,000	\$1,450,000	\$2,900,000
		Excellent	\$165M	\$875,000	\$875,000	\$1,750,000	\$3,500,000
	1M sq ft + parking	Good	\$277M	\$1,485,000	\$1,485,000	\$2,970,000	\$5,940,000
		Excellent	\$345M	\$1,775,000	\$1,775,000	\$3,550,000	\$7,100,000
	\$5M Land		\$5M	\$25,000	\$25,000	\$50,000	\$100,000
	\$10M Land		\$10M	\$50,000	\$50,000	\$100,000	\$200,000

A final note on RTTs and affordable housing

The yield to the City's Affordable Housing Trust Fund is of special interest here, given the obvious risk of gentrification that a successful bid would have incurred.

The City's housing fund was established to address affordable housing issues across the city via a variety of means and programs, with an annual revenue goal of \$10M.¹⁰⁷ The legislation to establish the fund passed in 2016, but did not identify a funding stream. A year later the city's real estate transfer tax was increased by .5% (2 to 2.5%) as a means of working toward that revenue goal, with an additional increase from 2.5% to 3% slated for 2020.

While the .5% increase was passed in order to finance the fund, there is currently no legal obligation on the part of the City to use any part of the city's RTT revenue stream to that end. On the other hand nothing technically appears to preclude the City from using the entire RTT funding stream to support the fund.¹⁰⁸

We found that total estimated city RTT yields from an HQ2 building alone could be from \$3.5M to \$8.7M under the current RTT rate of 2.5%. While presumably a one-time inflow, any of these amounts would seem to represent a significant contribution to a fund with a legislated goal to maintain \$10M on housing programs annually. The proceeds from the development project alone would certainly be accompanied by an influx of additional transfer tax revenue as the residential market reacted to the news, as HQ2 employees started to move into the area, and as the commercial market for office space responded.

However, we have already noted that there are several plausible scenarios in which the tax might not apply to the building itself, even if it located within the City. At the same time, if HQ2 had located to one of the other municipalities, none of the resulting municipal transfer tax yields would redound to the city's fund. In any case, they would be much lower at the municipal level from \$725K to just over \$1.7M, depending on the size of the building and how it was ultimately assessed.

That said, a portion of the *state* realty transfer tax currently flows to affordable housing needs. In 2010 the state established its own housing fund, the Pennsylvania Housing Affordability and Rehabilitation Enhancement Program (PHARE), but as with the city, the legislation was passed without a dedicated

¹⁰⁷ For a good history of this fund, see "How Pittsburgh finally funded its affordable-housing trust fund", Ryan Deto, *City Paper*, December 21 2017, link: <https://www.pghcitypaper.com/Blog/archives/2017/12/21/how-pittsburgh-finally-funded-its-affordable-housing-trust-fund> accessed 4/17/2019. The legislation establishing the fund is here: https://www.ura.org/media/W1siZiIsIjIwMTg5MDMvMTkvODVzd3NzOHVpMl9MZWdpc2xhdGlvb19UZXBh0LnBkZiJdXQ/Legislation_Text.pdf while the legislation that changed the RTT is here: <https://pittsburgh.legistar.com/LegislationDetail.aspx?ID=3034648&GUID=D32943BA-C2E1-48CB-8BDF-F8A492029AAB&Options=ID%7cText%7c&Search=realty+transfer+tax>.

¹⁰⁸ Confirmed from correspondence with local economic development professional, April 2019.

source of state funding.¹⁰⁹ In 2012, the state passed a law dictating that a portion of impact fees from Marcellus Shale drilling be directed to the fund, and in 2015 the state passed legislation that allowed for a portion of state collected real estate transfer taxes to finance the fund for affordable housing, although the amount that can be redirected to the fund is currently capped at \$25M statewide. The program also coordinates and distributes pass through funding via the federal National Housing Trust Fund, which is itself funded by Freddie Mac and Fannie Mae earnings.

In its annual report for 2017, PHARE reported that revenues from all three sources totaled \$28.6M, with \$17.1M of this amount from statewide realty transfer tax, \$5.7M from shale impact fees, and \$5.8M from the National Housing Trust Fund.¹¹⁰ PHARE funds housing projects statewide. The report indicated that in 2017, the County received around \$2.3M in total funding for new projects. Thus while we found that HQ2 state RTT tax yields for a building alone could range from \$1.4 to almost \$3.5M, if the county's current share of state housing expenditures held, much of the project's contribution to the state fund would fund housing needs elsewhere.

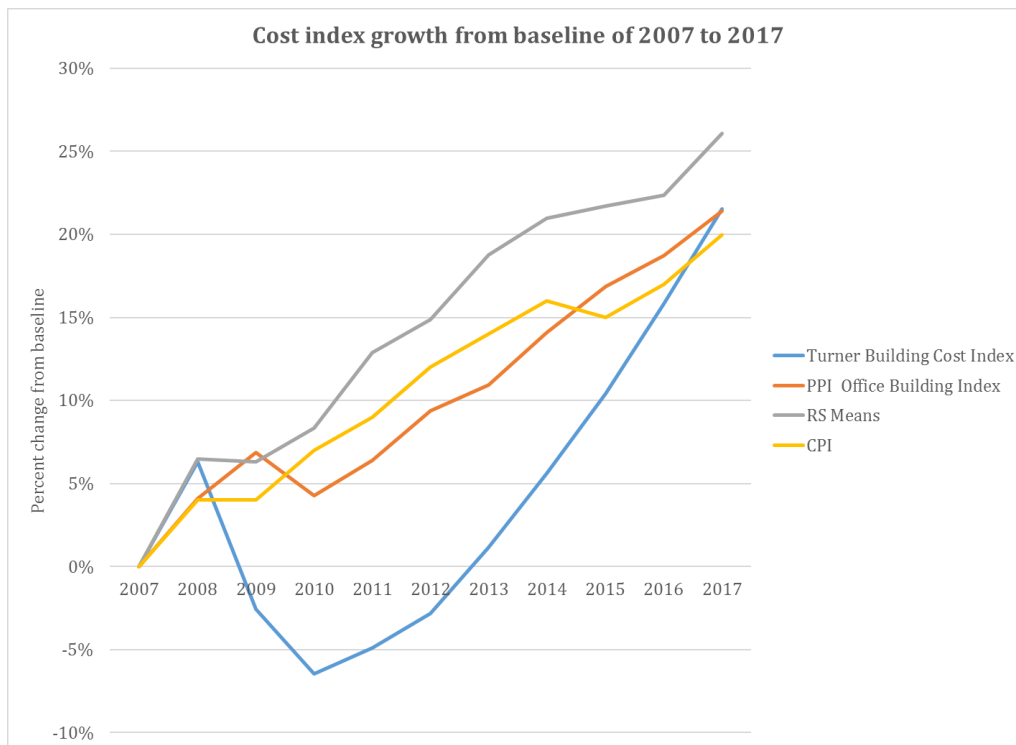
¹⁰⁹ This paragraph relies heavily on: "Victory in Pennsylvania: Legislature Dedicates Funds to Expand PHARE Statewide", Michael Anderson, Winter 2016, Housing Alliance of Pennsylvania, web article, link: <https://housingtrustfundproject.org/victory-in-pa-legislature-expands-phare-statewide/> , accessed 4/17/2019. See also: <https://www.phfa.org/legislation/act105.aspx>

¹¹⁰ PHARE annual report 2017, link: https://www.phfa.org/forms/phare_program_phare_fund/annual_report/2017_phare_annual_report.pdf

Appendix E: The Tower’s estimated cost at 2017 price levels

To explore inflation effects on the original cost of the Tower at PNC Plaza, we examined the Turner Building Cost Index and RS Mean’s Historical Cost Index, the Bureau of Labor Statistics’ (BLS’s) Producer Price Index for New Office Building Construction, and the BLS’s Consumer Price Index (CPI). We rescaled each of these metrics to a baseline year of 2007, with growth (as a percentage change from baseline year) shown through 2017. While each metric trended differently, the path followed by the Turner Building Cost Index appeared to be more extreme than the others, dipping farther in the wake of the recession yet increasing more rapidly thereafter.¹¹¹

Figure 5



Each of these indexes measures different things. The Turner and RS Means index track construction costs for non-residential buildings, including but not limited to office buildings.^{112,113} The PPI Office Building index is, as the name applies, specific

¹¹¹ See Turner Cost Indices at Turner Construction: <http://www.turnerconstruction.com/cost-index> and <http://www.turnerconstruction.com/download-document/CostIndex2017Qrtr4.pdf> accessed 12/17/2018.

¹¹² Construction inflation index tables, blog post, Ed Zarenski, Construction Analytics (blog), October 24 2016, link: <https://edzarenski.com/2016/10/24/construction-inflation-index-tables-02-19/>

¹¹³ RS Means historical cost index data from, link: <https://www.rsmeansonline.com/references/unit/refpdf/hci.pdf>, accessed 2/2/2019.

to office buildings. The CPI does not actually track construction costs at all, and instead monitors the price of a standard basket of consumer goods. We include it here for comparison purposes only.¹¹⁴

The construction indexes differ methodologically in ways which are somewhat opaque. One observer of construction cost indexes notes that the Turner index is “presumably” an output index, which is inclusive of input prices but which also may include the full price of what a buyer paid for a building (including profit margins). The observer also implies that since profit margins are more easily adjustable by construction firms than input costs, output indexes tend to be more responsive to business cycles than input based indexes. This would help explain the more extreme path taken by the Turner index in the chart.¹¹⁵ RS Means’s Historical Cost Index, on the other hand is considered an input index, wherein margins are not included. The same observer notes that PPI Nonresidential Construction Index (this includes the Office index) “attempts to measure subcontractor pricing for items, introducing aspects of an output index”.¹¹⁶ General contractor markups are also included in the PPI index.¹¹⁷

In the end we decided to rely on the PPI index since it was at least specific to office building construction, and occupied the middle ground compared to the other indexes for most of the period shown in Figure 6. Had we instead used the Turner index, which exhibits much a steeper slope from 2011 to 2017, the inflation adjusted estimated cost would have been much higher. However, we suspect that this index is driven by the country’s most active commercial construction markets, and does not reflect local trends in Pittsburgh.

According to the PPI new office building costs rose nationally by about 21% between 2007 and 2017, and by 14% from 2011 to 2017.¹¹⁸ Thus if one assumes that the figure of \$400M was based on current costs as of 2011 (our first budget scenario), then the same building would cost \$456M at 2017 prices. If instead one assumes

¹¹⁴ As one long time observer of construction cost indexes notes, “[l]ong term construction cost inflation is normally about double consumer price inflation (CPI).” Source: Construction Analytics (blog), link: <https://edzarenski.com/2015/11/17/construction-inflation/>, accessed 2/6/2019.

¹¹⁵ Turner Construction describes its own index as follows: “Turner has prepared the construction cost forecast for more than 80 years. Used widely by the construction industry and Federal and State governments, the building costs and price trends tracked by The Turner Building Cost Index may or may not reflect regional conditions in any given quarter. The Cost Index is determined by several factors considered on a nationwide basis, including labor rates and productivity, material prices and the competitive condition of the marketplace. This index does not necessarily conform to other published indices because others do not generally take all of these factors into account.” <http://www.turnerconstruction.com/cost-index>, accessed 2/2/2019.

¹¹⁶ Source: “Construction Cost Indices: Their Creation and Use”, Tom Wiggins, Faithful+Gould website, March 8 2016, link: <https://www.fgould.com/americas/articles/construction-cost-indices-their-creation-and-use/>, accessed 2/6/2019. For more on the subject of markups, see “Nonresidential building construction overhead and profit markups: an update”, Derek T. Wasilewski <https://www.bls.gov/opub/btn/volume-8/nonresidential-building-construction-overhead-and-profit-markups-an-update.htm>, accessed 2/6/2019. For more comparing construction cost indices, see <https://edzarenski.com/2016/10/24/construction-inflation-index-tables-2017/>, accessed 12/17/2018.

¹¹⁷ Confirmed via e-mail correspondence with personnel from the PPI Nonresidential Construction Index program, May 2019.

¹¹⁸ Source: <https://www.bls.gov/ppi/ppinaics236223.htm> and <https://www.bls.gov/ppi/ppinaics236223.htm>, accessed 3/4/2019.

that only \$370M was spent toward construction, then the same building would cost \$422M.

To generate an estimate for the second scenario, wherein the reported cost is assumed to be in year to year nominal dollars, we took the following steps.

First, we assumed that 20% of construction effort (in *units* of labor, material, etc.) was “spent” evenly over the first two years of the project, with the remaining 80% spent evenly over the last three years. This is an arbitrary guess and others are possible. This is shown in row a. in Table 14 below.

Table 14. Calculation of alternative budget scenario

Year		2011	2012	2013	2014	2015	TOTAL
a.	ANTICIPATED SHARE OF EFFORT	10.0%	10.0%	26.7%	26.7%	26.7%	100%
b.	PPI OFFICE BUILDING INDEX	114.70	117.90	119.60	123.00	126.00	N/A
c.	RELATIVE EFFORT COSTS	100.0%	102.8%	104.3%	107.2%	109.9%	N/A
d.	DISTRIBUTION OF ESCALATED EFFORT	10.0%	10.3%	27.8%	28.6%	29.3%	106%
e.	RESCALING OF ESCALATED EFFORT	9.4%	9.7%	26.2%	27.0%	27.6%	100.00%
f.	NOMINAL YEAR TO YEAR EXPENDITURES	\$37,744,749	\$38,797,784	\$104,952,559	\$107,936,160	\$110,568,749	\$400,000,000
g.	IN 2011 DOLLARS	\$37,744,749	\$37,744,749	\$100,652,663	\$100,652,663	\$100,652,663	\$377,447,485
h.	IN 2017 DOLLARS	\$43,075,742	\$43,075,742	\$114,868,645	\$114,868,645	\$114,868,645	\$430,757,418

We assume that effort will get more expensive after the first year. To account for this, using 2011 as a baseline, we use the PPI index (row b.) to adjust the relative “cost of effort” as follows. We compute the “relative nominal cost” of a percentage of effort compared to a baseline year of 2011 for each year of the project. Thus in 2011 1% of the planned effort for the project would still be 1%, but the same absolute amount of effort would cost 110% by 2015. Results are shown in row c. as “relative effort costs”. Multiplying row c. by the anticipated share of effort in row a. results in a “distribution of escalated effort” shown in row d. As shown in d., the share of the nominal cost of anticipated effort now ramps slowly up to account for construction cost changes, such that the effort in 2015 will cost more effort (nominally) than 2014. This results in a total over 100%, but since we assume the \$400M is a year-to-year nominal total, we can rescale these figures to add up to 100%, and apply them to this figure to get the expenditures in row f., “Nominal Year-to-Year Expenditures.”

With these figures in hand, using the PPI Office Building Index again, we can re-express expenditures in 2011 and 2017 construction dollars (rows g. and h.). This budget assumption is equivalent to \$377M in 2011 dollars, or \$430M in 2017 dollars. If instead we assume that the base construction expenditure was \$370M

rather than \$400M, and that this figure also represented a year to year nominal total, repeating the procedure results in \$349M in 2011 dollars, or \$398M in 2017 dollars.

Again, these are just informed, if plausible guesses. The Tower likely had an atypical cost structure with relatively high designer and engineering costs, and higher costs for green features and systems. For these and other reasons, changes in aggregate indexes may not accurately reflect what it might have cost to build the Tower in 2017.

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The Heinz College of Information Systems and Public Policy at Carnegie Mellon University was established in 1968 and renamed in 1992 in honor of the late U.S. Senator from Pennsylvania, John Heinz III. Heinz College improves the ability of the public, private and nonprofit sectors to address important problems and issues facing society. The College is home to two internationally recognized graduate-level institutions at Carnegie Mellon University: the School of Information Systems and Management and the School of Public Policy and Management. This unique colocation combined with its expertise in analytics set Heinz College apart in the areas of cybersecurity, health care, the future of work, smart cities, and arts & entertainment. In 2016, INFORMS named Heinz College the #1 academic program for Analytics Education.

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About this report

The conclusions and opinions of this report are the authors alone. This report does not represent the conclusions, views, or official positions of Carnegie Mellon University or any of its corporate officers.

General caveats

This report and its appendices attempt rough estimates of the property tax yields of a hypothetical building that will never be built. The scenarios examined were purposely narrow in scope, and exclude consideration of other factors likely to emerge from an HQ2 deal to influence yields; such as but not limited to additional buildings, leasing effects, spending multiplier effects, and other indirect effects. Even within this limited scope, the information available to make estimates was (to varying degrees) incomplete, uncertain, and influenced by a complicated and

unfixed set of policies, practices, systems, and conditions that we may have not characterized fully accurately, that may interact in unpredicted ways, and that in any case are surely subject to change moving forward. Thus, we make no assurances as to the *accuracy* of our estimates and predictions. Further, nothing in this report and its appendices should be construed as legal advice, tax advice, investment or business advice. The information, estimation, prediction, or interpretations offered in this report and its appendices should not be used as a basis for making decisions about the real estate market, real estate investment decisions, filing taxes, or property appeals.