

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

Part I. Property Taxes

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Introduction

What might the revenue impact on state, county, municipal, and school district budgets have been if Amazon had come to Pittsburgh under the original terms of HQ2 (“winner takes all”)?

To answer this question, we construct some plausible scenarios to illustrate direct revenue yields from one year of operations. The scenarios are based on: the contents of the original HQ2 RFP (heretofore “RFP”) released in the fall of 2017; Pittsburgh’s proposal (heretofore “bid”) released to the public a year later; relevant policies, prices, and assessed values as of 2017; and some guesswork.

This report is the first in a series, and estimates a range of revenue yields from property related taxes. Future reports will examine other revenue impacts.

General approach

Our analysis assumes that only one city (Pittsburgh) would have “won” HQ2, as was originally advertised. Since precise predictions of how HQ2 would have unfolded in Pittsburgh are not possible, we use high and low values for certain factors to construct the scenarios. Some of these are derived from the RFP, others from the bid, or other sources of information. In some cases, they represent our best guess. Along the way, we use simplifying assumptions and calculations as needed. While we make no claim that what follows is 100% accurate, it is at least plausible, that is, if Amazon had followed through with the plans implied by the original RFP.

We limit the assessment to the direct effects of Amazon’s direct capital investment in office space. This report focuses solely on the property tax related revenues that might be generated from the *construction of an HQ2 building*. In doing so we take into account state and local tax policies as of 2017.

Our approach is intentionally limited in focus, simple, and transparent, and the reader is free to disagree with it. Interested parties should contact the CED at www.cmu.edu/ced.

Key findings

This report estimates first year property tax yields for four municipalities and three school districts in Allegheny County related to five development sites featured in Pittsburgh's bid to the RFP. Our estimates are limited to improvements for "new construction" scenarios; the impacts from leasing are not considered.

We find that an HQ2 building's assessed value would likely be significantly less than its built cost. This finding is based on our understanding of standard appraisal practice, state and county assessment policies, the likelihood of appeal, the state of the relevant local market for Class A office space (with or without a new building), and especially the analogous case of the Tower at PNC Plaza.

That said we find that total local property tax yields would still be substantial, and could start out at \$2.6M to \$12M a year, depending on the size of the building, how the building is ultimately assessed and/or appealed, and the taxing districts in which it is located.

For school district tax revenues alone, we estimate annual yields would range from \$1.2M to \$3M a year for Pittsburgh Public Schools, from \$2.2M to \$5.6M a year for the West Allegheny school district (if the building were located near the airport) and from \$3M to \$7.7M for Woodland Hills school district if the building were located at the Carrie Furnace site in Rankin/Swissvale.

Given the information in the bid, we assume that a significant but unknown amount of these funds (up to 75%) could be diverted away from the general funds of relevant taxing authorities via mechanisms such as TIFs or TRIDs to meet the infrastructure needs of the development project.

Our estimates are based on what we believe to be a reasonable application of the cost method of property appraisal. They likely represent an upper bound, in that under current local market conditions for Class A office space; we do not believe that the sales or income approaches would generate a higher opinion of value.

Separately, we also estimate yields for local and state realty transfer taxes from a new building. We find that total yields from these taxes could range from \$2.9M to \$15.7M for one transfer of ownership for the structure, depending on the size, initial assessment value, and the municipality involved. Of the four municipalities, the City of Pittsburgh has the highest realty transfer tax rate and thus would receive the highest yields, from \$3.5 to \$8.7M. This is of note as the City recently designated this tax as a key revenue stream for its affordable housing trust fund.

However, the City does not appear to be legally obligated to use these revenues for the fund. We also found plausible development scenarios in which transfer taxes could be avoided entirely. Meanwhile, due to lower rates, we estimate that

municipal yields for locations outside of the city would only range from \$725K to \$1.7M (none of which would be obligated to affordable housing needs).

HQ2's real estate program

The RFP describes HQ2 as a project that could hire as many as 50,000 full-time employees within 10-15 years, and that could require up to 8M square feet of building space over 15-17 years. The RFP also indicates that it will fulfill its needs for building space through a large amount of capital investment, estimated to be over \$5B dollars. According to the RFP this investment was anticipated to take place over four chronologically undefined phases, presumably ending in 15-17 years.¹

As part of Phase 1 of the HQ2 project, the RFP indicated that Amazon would need at least 500,000 square feet of building space by 2019. It also indicated that "Building Phase I" of its capital investments could involve a building or buildings from 500K to 1M square feet and from \$300M to \$600M in capital investment.²

We assume this "capital budget" represents what Amazon intended to commit to building acquisition, rehabilitation, or new construction. The RFP does not preclude the possibility that some of Amazon's space needs for HQ2 would be addressed through leased space. At the same time, the RFP does not provide much detail on Amazon's expected plans for leasing.

For example, it is not clear whether Amazon intended for the \$5B capital budget to be used to fund operating or capital leases of office space, including its share of the cost of any required tenant improvements over allowances, or whether it would simply fund leases by other means.³

It seems likely that Amazon would have engaged in some leasing, either immediately or at least at some point in the process. However, this analysis ignores the possibility that Amazon would satisfy its Phase 1 space requirements via leasing to focus on construction scenarios.

The RFP implies that Amazon needs up to 8M square feet of "building space", but it does not specify the unit of measure this amount of space refers to.⁴ Given the nature of the project, we assume it refers to the *gross building area (GBA)* "within the walls" of an office building. A working definition of this metric is:

¹ "HQ2 Amazon RFP", Amazon Inc., September 7 2017, p. 2, link: https://images-na.ssl-images-amazon.com/images/G/01/Anything/test/images/usa/RFP_3_V516043504.pdf, accessed December 15, 2018.

² Ibid, p. 4.

³ Leasing arrangements for commercial property often include a provision for a tenant improvement allowance, often stated as fixed budget per square foot that the building's owner is willing to invest in improvements required by and negotiated with the lessee. Improvements in excess of this allowance are paid for directly by the lessee.

⁴ This is implied by the text in the table on page 2 of the RFP.

*Total floor area of a building, excluding unenclosed areas, measured from the exterior of the walls; includes both the superstructure floor area and the substructure or basement area.*⁵

Thus, we assume this space will be inclusive of office, work, and meeting space, but will also allow the possibility of space for first floor retail, restaurant, other business services, a parking garage, and other common areas within an office building (including space that would normally be considered to be non-leasable). We assume that all capital spending will go towards office buildings alone, not any other type of structure (ex: biodomes).⁶

Sites featured in Pittsburgh's bid

The Pittsburgh bid offered five featured sites for Amazon's consideration. Three were within city limits, including: "Hazelwood Green", a redeveloped brownfield site formerly called "Almono" in the Hazelwood neighborhood⁷; "Lower Hill", the site of the former Civic Arena in the Hill District⁸; and "The Strip" in the Strip District. The bid also offered the "Carrie Furnace" site, which is just outside of the city's east end, and straddles land in the boroughs of Rankin and Swissvale.⁹ Finally, the bid also offered the "Site@PIT", which is adjacent to the Pittsburgh International Airport in Findlay Township.¹⁰

We assume that Amazon's preferences for satisfying its immediate Phase 1 space needs would be to buy a suitable building if one could be found, rehab a suitable structure, build new, or to temporarily lease a building, in that order.

⁵ *The Appraisal of Real Estate: 14th Edition*, Appraisal Institute, 2013, p. 225.

⁶ See for example: "Amazon's Spheres: Lush nature paradise to adorn \$4 billion urban campus", Angel Gonzalez, *Seattle Times*, www.seattletimes.com, January 3 2017, link: <https://www.seattletimes.com/business/amazon/amazons-spheres-are-centerpiece-of-4-billion-effort-to-transform-seattles-urban-core/>, accessed 1/17/2016.

⁷ For more on Almono, see "Former Steel Site Almono Renamed Hazelwood Green", Jessica Federkeil, *Pittsburgh Post-Gazette*, October 13 2017, link: https://www.post-gazette.com/business/development/2017/10/13/steel-mill-site-Almono-renamed-Hazelwood-Green-pittsburgh/stories/201710130147?utm_source=newsletter&utm_medium=email&utm_content=recommended-business&utm_campaign=Headlines-Newsletter, accessed 2/20/2019.

⁸ For more on the Lower Hill see: <http://www.pgh-sea.com/LHROverview.htm>

⁹ For more about the Carrie Furnace see "The Carrie Furnaces site is ready for development. What will it become?", Sandra Tolliver, www.nextpittsburgh.com, March 7 2017, link: <https://www.nextpittsburgh.com/features/carrie-furnaces-site/> and "Carrie Furnace", Western Pennsylvania Brownfields Center, link: <https://www.cmu.edu/steinbrenner/brownfields/Case%20Studies/pdf/Carrie%20Furnace%20Case%20Study.pdf>

¹⁰ We assume the parcel offered is from the World Trade Center development site, which is adjacent to the Pittsburgh International Airport and currently owned by the Allegheny County Airport Authority. For more on the Site@PIT see: <http://www.flypittsburgh.com/getattachment/Newsroom/Opportunity-Trade-Advertising/Development/WTC-Website-Update-Oct-2017.pdf.aspx?lang=en-US>. While the airport straddles Moon and Findlay Townships, this parcel is within Findlay.

However, none of the five featured sites in the bid appeared to have a suitable “starter building” for purchase or for rehab, and instead Pittsburgh’s bid indicates that a 500K sq. ft. facility could be built in 24 months from the City’s selection.¹¹

The bid also indicates that over 1M sq. ft. in Class A office space is available to lease downtown, at an average of \$30 per square foot.¹² The availability of this space is featured in the profiles of the Lower Hill and Strip District sites, which are the closest featured sites to Pittsburgh’s CBD.¹³

The bid also lists thirty other possible sites, including: a “Parking Garage Assemblage” downtown owned by the Pittsburgh Parking Authority, Millcraft’s Esplanade development site in Pittsburgh’s Chateau neighborhood, three sites owned by the Regional Industrial Development Corporation (RIDC) elsewhere in Allegheny County, and a variety of other public and private sites out as far as Millennium Technology Park in Lawrence County PA.

We assume Amazon would begin by building a new office building in one of the five featured sites. Before this building opened, it might also lease space in the CBD, North Shore, Strip, or Oakland neighborhoods, but we do not assess this possibility here. We also ignore the other sites listed within city limits, as they were not strongly touted in the bid as featured locations.

Building or leasing structures outside of the city limits, particularly for Phase 1, seems less likely than building within them. Therefore we ignore all sites beyond the city limits, with the exception of the two featured locations of Site@PIT in Findlay, and the Carrie Furnace in Swissvale and Rankin.

Estimating the built cost of a new Phase 1 HQ2 building

Assuming the entirety of Amazon’s 8M sq. ft. in space needs were addressed by the construction of office buildings alone, and the capital budget was limited to this purpose alone, one crude estimate of construction cost per gross building area square foot is simply \$5B/8M sq. ft. or \$600/sq. ft. This ratio also aligns with its Phase 1 budget and space needs, which again call for a building from 500K to 1M

¹¹ One exception might have been the Mill 19 building at Hazelwood Green, which as of the fall of 2018 was still under construction. Given the nature of the building and its size (264K sq. ft.), we assume that if Amazon had selected Hazelwood Green, it would have ultimately built a new structure regardless. See: <https://ridc.org/view-property/almono/>, accessed 2/20/2019.

¹² We assume the amount and price of leased space were measured in *gross leasable area (GLA)*. This refers to the “[T]otal floor area designed for the occupancy and exclusive use of tenants.” Definition from *The Appraisal of Real Estate: 14th Edition*, p. 225.

¹³ Presenting it as a means of accommodating Amazon’s needs prior to 2019, the bid also notes the availability of 600K sq. ft. of space at 525 William Place Place (also downtown), 500K sq. ft. of space at Nova Place on the North Side neighborhood, and 230K sq. ft. available between the Oakland Innovation District and The Strip. The bid does not indicate how much of this last amount of space is located in either neighborhood, nor is it featured in the actual profile of The Strip site.

sq. ft. and \$300 to \$600M in capital investment.¹⁴ Is \$600 per square feet a reasonable number?

A benchmark: the Tower at PNC Plaza

Consider the city's most comparable example to a theoretical HQ2 building: the Tower at PNC Plaza in downtown Pittsburgh ("the Tower"). The Tower was announced in 2011, completed in 2015, and was still brand new as of 2017. It currently serves as the corporate headquarters of PNC Bank, the ninth largest bank in America with estimated assets of \$380B.¹⁵

Claimed to be one of the greenest office towers in the world, the Tower is a LEED platinum certified, high performance office tower. It was reported to have a construction cost of \$400M in 2011.^{16,17,18} According to a press release by PNC, the building has approximately 800,000 gross sq. ft. of space, which we assume refers to GBA.¹⁹ Its thirty-three above ground floors include office, meeting, and other common area spaces, along with street level retail. Three below ground floors include a parking garage.²⁰

The Tower's green building features include a double skinned façade that controls building climate by mediating the amount of natural ventilation, fresh air, and natural light that passes into the building; supplemented by water-based heating (radiant) panels and cooling (chilled beam) systems, a solar chimney, and a rain and waste water recycling plant and accompanying control systems.²¹

In short, the Tower is a trophy office building constructed in Pittsburgh that serves as the corporate headquarters for a Fortune 500 company – this makes it a

¹⁴ The RFP does not specify whether the budget figures are in real or nominal dollars, or if the figures anticipate inflation effects on construction costs over the entirety of the project. While we assume the budget will apply only to office buildings, related land parcels, and related improvements, it is also not clear from the RFP whether all of the capital investment would go to "built property" vs. other building related capital investments such as furniture, fixtures, or equipment. More on this later.

¹⁵ "America's 15 Largest Banks", Amanda Dixon, bankrate.com, February 21, 2018, link: <https://www.bankrate.com/banking/americas-top-10-biggest-banks/#slide=1>, accessed 1/18/2019. Confirmed with PNC 2017 Annual Report, link: <http://nasdaqomx.mobular.net/nasdaqomx/7/3543/5051/>, accessed 2/11/2019.

¹⁶ "The Tower at PNC Plaza opens as the greenest office building in the world", Kim Lyons, www.nextpittsburgh.com, October 1 2016, link: <https://www.nextpittsburgh.com/city-design/the-tower-at-pnc-plaza-opens-as-the-greenest-office-building-in-the-world/>, accessed 1/18/2019.

¹⁷ "PNC planning 2012 start on new headquarters tower downtown", Mark Belko, [Pittsburgh Post-Gazette](http://www.post-gazette.com), May 24 2011, link: <https://www.post-gazette.com/business/businessnews/2011/05/24/PNC-planning-2012-start-on-new-headquarters-tower-Downtown/stories/201105240140>, accessed 1/18/2019.

¹⁸ "Tower at PNC Plaza Fact Sheet", PNC Bank press release, 2011 link: <http://pnc.mediaroom.com/download/The+Tower+at+PNC+Plaza+Fact+Sheet.pdf>

¹⁹ Ibid.

²⁰ See also "The Tower at PNC Plaza" profile at www.skyscrapercenter.com. Link <http://www.skyscrapercenter.com/building/the-tower-at-pnc-plaza/14069>, accessed 1/18/2019.

²¹ "PNC shows off tower, its 'crown jewel'", Mark Belko, [Pittsburgh Post-Gazette](http://www.post-gazette.com), October 1 2015, link: <https://www.post-gazette.com/business/development/2015/10/01/PNC-opens-new-400-million-Downtown-headquarters-pittsburgh/stories/201510010199>, accessed 1/21/2019 and <https://prismpub.com/the-tower-at-pnc-plaza-pittsburgh-pennsylvania/>, accessed 1/20/2019.

reasonable benchmark for estimating what an HQ2 building might cost to build in Pittsburgh.

What did the Tower actually cost to build?

We are not privy to the planned construction budget for the building, nor do we know what it *actually* cost.

According to the project's lead architectural firm, the building involved a five-year design and construction process, presumably from 2011 to 2015.²² Construction began in 2012, and the building opened in the fall of 2015.

For the purpose of this analysis, we assume the \$400M figure, labeled in the aforementioned press release as the Tower's "construction budget", is the best estimate of the building's actual cost, and is inclusive of both "hard" (materials, equipment, labor) and "soft" (architectural design, engineering, permits, etc.) costs associated with the building itself. This assumption ignores the possibility of unanticipated cost overruns.

While this is the best number we have, barring cost overruns, it might also be viewed as an upper bound, in that it is not certain that the entirety of it would go to construction costs alone.

Other possible expenditures that might have been included in this figure include land purchases for the development or the deconstruction/demolition of any buildings on such land to make way for the development.

For example, according to one press report, PNC and its agents spent \$19M on site assembly from 2000 to 2011 in anticipation of the Tower project.²³ This likely includes the parcel the building occupies today, which was sold to PNC for \$3.1M in 2010.²⁴ These funds may or may not have been included in the \$400M figure.

According to another press report, nine buildings in the area were deconstructed to make way for the Tower starting in 2012.²⁵ These costs, although likely smaller than the site assembly costs, may have also been included in the \$400M figure.

²² "The Tower at PNC Plaza – A Breath of Fresh Air", Hao Kao and Ben Tranel, <http://www.gensleron.com>, October 6 2015, link: <http://www.gensleron.com/cities/2015/10/6/the-tower-at-pnc-plaza-a-breath-of-fresh-air.html>, accessed 1/21/2019.

²³ "PNC paying URA \$1.1 million for 3 Downtown properties", Mark Belko, *Pittsburgh Post-Gazette*, May 27, 2011, link: <https://www.post-gazette.com/business/businessnews/2011/05/27/PNC-paying-URA-1-1-million-for-3-Downtown-properties/stories/201105270256>, accessed 12/31/2018. The parcel was ultimately sold to PNC for \$1 in 2011 (after a previous sale of \$3.1M) to an owner we assume was acting as PNC's agent. Source: Allegheny County Real Estate Portal, accessed 1/28/2019.

²⁴ Allegheny County Real Estate Portal, Parcel Search "300 5th", "Pittsburgh – All Wards", <http://www2.county.allegheny.pa.us/RealEstate/>, accessed 1/20/2019.

²⁵ PNC ready to deconstruct site for skyscraper, Mark Belko, *Pittsburgh Post-Gazette*, Feb 28 2012, link: <https://www.post-gazette.com/business/businessnews/2012/02/28/PNC-ready-to-deconstruct-site-for-skyscraper/stories/201202280391>, accessed 2/27/2019.

Another explanation might be the costs of furniture, fixtures, and equipment (FF&E). FF&E that is not permanently attached to the building or otherwise closely integrated with its structure or systems may be deemed *personal property* rather than real property and excluded from assessed value.²⁶ Such assets may still have appraisable value (ex: for insurance purposes) but are not assessable for property tax purposes. An example might be the cost to purchase and install computer servers or enterprise software for a corporate headquarters. Such an expenditure might be included in the reported cost of a building, but be excluded from county assessment.²⁷

While it is certainly possible that FF&E expenditures might have been included in the reported cost of the Tower, we have no way of determining whether this is so.

Instead, we estimate that the actual cost of the building itself ranged from an upper bound of \$400M down to \$370M, with the latter figure an arbitrary estimate that assumes that as much as \$30M was spent instead on some combination of site assembly/land acquisition, building deconstruction, and/or FF&E.

What would the Tower cost to build in 2017?

What would the Tower have cost in 2017? That is, at 2017 prices for materials, labor, etc.? If one accepts that the original built cost of the Tower was from \$370M to \$400M, it is possible to at least to make a rough guess of what the Tower cost in 2017 by using annual aggregate cost/price indices. To do so requires one to know what year the original “budget figure” was expressed in, so that an appropriate index can be applied to inflate construction cost estimates to 2017 price levels.

The nominal dollar value of the cost of the Tower is not clear from press accounts. For example, was the original \$400M figure based on the budgeted cost of labor and material as of 2011, or did this figure simply encompass year to year nominal expenditures (whether projected, actual, or both) over the life of the project? We do not know.

We also do not know in what proportion the budget was spent for each year of the project or on what, other than the bulk of design and engineering costs likely took place from 2011-2012, and that deconstruction and construction activities ran from 2012-2015.

To account for these uncertainties, we express budget amounts in two forms, each relying on separate assumptions. The first form simply assumes the budget

²⁶ According to the Dictionary of Real Estate Appraisal: 5th Edition, Appraisal Institute, 2010, p. 146, personal property “[c]onsists of every kind of property that is not real property; movable without damage to itself or the real estate. Also called *personalty*.” This includes individually or corporately owned equipment or inventory. Currently the Commonwealth of Pennsylvania does not tax personalty.

²⁷ On the other hand, servers used to control climate systems would likely be included.

(whether \$370M or \$400M) was set in 2011 dollars and based on 2011 price levels. The second form assumes the budget is merely the sum of expected or actual nominal year to year to expenditures on the project. Thus if expressed in 2011 dollars, this second budget amount would be smaller.

To set an upper bound, we assume the first budget does not anticipate inflation, and is naively based on 2011 price levels alone. We assume the second budget figure is inclusive of projected or actual construction cost inflation from year to year. We also arbitrarily assume that 20% of the construction effort would be evenly spent over the first two years of the project, with 80% evenly spent over the project’s last three years. We feel these two budgets are at least plausibly correct; many other permutations of other assumptions and budget values are of course possible.

Since we do not have precise information on the inputs used to create the Tower we looked at several broad based historical indexes of costs/prices for building construction that could be used to escalate what the building might have cost in 2017. These included the Turner Building Cost Index and RS Mean’s Historical Cost Index (both proprietary), the Bureau of Labor Statistics’ Producer Price Index for New Office Building Construction, and as a check, the BLS’s Consumer Price Index (CPI).

In the end, we opted to use the PPI index to inflate the two budget estimates to 2017 price levels. This resulted in a range of adjusted construction costs from \$398M to \$456M as shown in Table 1 below. Calculations for these adjustments and a comparison of the indexes are shown in the appendices.

Table 1. Base budget assumptions for Tower

Base Budget	\$370M	\$400M
If in 2011 prices, to 2017 dollars	\$422M	\$456M
If a sum of nominal y2y expenditures, to 2017 dollars	\$398M	\$430M

Estimating the Tower's escalated built cost per square foot

If any of these estimates accurately reflect the cost of the Tower in 2017 dollars, then a crude estimate of the Tower's built cost per square foot (of GBA) in 2017 would be between \$498 and \$570. These bounds certainly seem to be in the ballpark of the \$600 sq. ft. implied by HQ2's capital budget.²⁸

Estimated square foot and built costs of a Phase 1 HQ2 building

Based on the above, we assume a Phase 1 HQ2 building would have a maximum built cost per sq. ft. (GBA) of \$600.

Then again, for any number of reasons, it is also possible that the building would be less expensive to construct, or that some capital funds spent on its behalf might be directed to non-assessable uses (such as FF&E). To account for this possibility we assume a lower bound unit cost of \$400 per sq. ft.

Based on these bounds, we assume the actual cost of a 500K sq. ft. building could be as low as \$200M or as high as \$300M. These figures are in 2017 prices, and ignore any further cost escalation over the anticipated two-year construction period noted in the bid.

While the bid seems to focus on the need for a 500K+ sq. ft. building, the RFP also indicates that its Phase 1 construction budget could also fund a building up 1M sq. ft.²⁹ Therefore, we assume a separate scenario of a 1M sq. ft. office building.

Although there are known economies (and diseconomies) of scale in the construction of larger (especially taller) buildings, we ignore them for the moment and assume the actual cost of such a building would be from \$400M to \$600M.

²⁸ This assumes a gross square foot estimate of 800K, which is inclusive of PNC's underground garage and other spaces within the building apart from office/workspace.

²⁹ See bid, page 4.

County assessed value of the Tower

To get an idea of how a Phase 1 HQ2 building might be appraised and assessed, we turn once more to our benchmark property, the Tower at PNC Plaza.

Again, the reported cost of the Tower was \$400M. This figure was originally reported in 2011, and was repeated in subsequent news reports as late as 2015, when the building opened.³⁰

As of 2017, the County assessed fair market value of the development was \$147M, or 37% of its originally reported cost.³¹ If one assumes the \$400M refers only to improvements, and not land acquisition, and only the assessed value of improvements alone are considered, the assessed cost drops to \$142.5M, or 36% of reported cost.^{32,33} If, consistent with our earlier assumptions, one arbitrarily assumes that only \$370M was spent to improve the property, then the ratio rises, but only to 39 or 40%.

Why is the assessed value of the Tower so low compared to its reported cost? The answer has mainly to do with appraisal practice and market conditions, and to a lesser extent, state and county assessment policy.

Methods for appraising commercial real estate

There are three methods of appraising commercial real estate: the sales comparison approach, the income capitalization approach, and the cost approach.^{34,35} All three methods are complex, and for space, we can only provide a thumbnail sketch of each below.

The *sales comparison* approach works best when there are an adequate number of recent, arms-length sales of similar properties in the local market that the subject property can be reasonably compared to. Under this approach, a corporate owned and operated office building would be compared to other recent sales of other office buildings of similar size, location, and condition, etc. Due to the structure of the commercial office building market, such comparable sales are typically more likely to be investment/income producing properties than owner operated company headquarters. Under this approach, comparables are compared on the basis of a suitable unit of value, with adjustments made for dissimilar characteristics. In the

³⁰ See for example, Belko October 1, 2015.

³¹ Allegheny County Real Estate Portal, link: <http://www2.county.allegheny.pa.us/RealEstate/search.aspx>, accessed 12/5/2018.

³² Ibid.

³³ For this discussion we again ignore the real value of the \$400M figure. It would be lower or higher depending on what year the dollars were originally expressed in.

³⁴ "Understanding the Appraisal", The Appraisal Institute, 2013, pp. 11-13, link: [http://www.appraisalinstitute.org/assets/1/7/understand_appraisal_1109_\(1\).pdf](http://www.appraisalinstitute.org/assets/1/7/understand_appraisal_1109_(1).pdf), accessed 1/21/2019.

³⁵ To keep our analysis consistent we will assume the construction cost and the original RFP capital budget are both in 2017 dollars. Again this ignores the possibility of inflationary effects that might reduce the construction bang for buck over 24 months.

case of office buildings, a common metric of value used is sales price per square foot of leasable area.

The *income capitalization* approach, as the name implies, capitalizes the expected income from leasing for a building into its present value. It is most appropriate for income producing properties, but is also used for owner-operated facilities. For such buildings, income can be estimated based on information from comparable properties in the market. As with the sales comparison approach, comparable properties for lease are compared on a basis of suitable value (such as rent per square foot of leasable area), with adjustments made for dissimilar characteristics between the buildings, and dissimilar terms between leasing contracts. Income estimates also take into account average vacancy rates. Estimated operating expenses can be based on an operating statement specific to the building, expenses for other similar properties if known, or unit based aggregate metrics from proprietary sources (ex: average utility expense per square foot). The approach estimates net operating income for the building by deducting estimated expenses from revenues, and estimates the value of the building by applying the expected (average) capitalization rate for the market using one of two common capitalization techniques.

The *cost approach* determines a building's market value by estimating how much it would cost, at current prices, to reproduce the building or (more typically) replace it with a building of equal utility. It is considered suitable for appraising proposed construction, brand new buildings, special purpose buildings and/or rarely traded properties.³⁶ The idea behind the cost method is that in theory, no one should pay more for a building than what it would cost to build it, or build an acceptable substitute for it.

Professional appraisers of commercial property typically apply all three methods to a subject property, weighting each result differently to arrive at a final opinion of value through a process known as *reconciliation*.

Unpacking the story of the Tower's assessed value

Under state law, new construction qualifies as a "triggering event" that permits a re-assessment of an individual property by the County in between countywide comprehensive assessments.³⁷ Per state law, in assessing a property, the County

³⁶ "Replacement Cost, Reconstruction Cost, and Insurable Value: Which One?", presentation by Ed Martinez and Jim Seibers of CoreLogic to the Appraisal Institute, p 10., July 27 2016, link: https://www.appraisalinstitute.org/assets/1/7/Replacement_Cost_Reconstruction_Cost_Insurable_Value.pdf, accessed 1/21/2019.

³⁷ "Real Estate Assessment Process in Pennsylvania", *Pennsylvania Legislator's Municipal Deskbook: Third Edition Update (2007)*, p. 142. See Appendix B for a quick overview of state laws governing assessments and appeals.

must *consider* all three approaches to value, although it does not need to actually *use* all three to arrive at an assessment.³⁸

Per its parcel profile under Allegheny County's Real Estate Portal, no comparables are listed for the Tower, and instead the following entry can be found:

*This property is among the 3% of properties that did not have adequate comparable sales. The cost approach was used instead.*³⁹

Further investigation revealed that the original county assessment of the Tower upon completion was actually \$222M, with \$217M of this value due to improvements, and about \$4.5M for land. These initial values were found in a review of a data file of county property appeals for tax years 2015 to 2017 available from the Western Pennsylvania Regional Data Center (WPRDC).⁴⁰

Data in the WPRDC file indicated that PNC made and won an appeal to have this initial assessment reduced further. According to the file, the application for the appeal was submitted less than 30 days after the building opened, on October 29, 2015.⁴¹

This date appeared to anticipate the first known "Notice for Assessment Change" (hereafter "Notice") issued to PNC by the County.⁴² This notice, dated December 18 2015, indicates that the assessment change was due to a "building permit chang[e]", and that the building value for the building had moved from \$0 to \$217,770,300. To the best of our knowledge, this was the first county assessed value for the Tower, and it verifies the value reported in the WPRDC appeal data. The same notice indicated that assessed value of the land parcel was left unchanged at \$4,531,300. The Notice's total assessed value for the project as a whole was \$222,221,600.

Per the WPRDC file, a formal hearing for the property is listed as having occurred June 3 2016, or about eight months after the building opened. The owner was listed as the plaintiff. According to the listed disposition date, the decision to reduce the assessment was handed down 42 days after this hearing. According to the file, the assessed value of the Tower development was reduced from \$222M to \$147M, its current assessed value. The overall reduction was driven by a decrease in the

³⁸ Ibid. p. 143.

³⁹ Allegheny County Real Estate Portal, property search for "300 5th Ave", link: <http://www2.county.allegheny.pa.us/RealEstate/Comps.aspx?ParcelID=0001H00256000000&SearchType=2&CurrRow=0&SearchName=&SearchStreet=5th&SearchNum=300&SearchMuni=1&SearchParcel=&pin=0001H00256000000>, accessed 1/21/2019.

⁴⁰ Western Pennsylvania Regional Data Center, page link: <https://data.wprdc.org/dataset/alleggheny-county-property-assessment-appeals>, file link: <https://data.wprdc.org/dataset/alleggheny-county-property-assessment-appeals/resource/7ab02103-e022-4fae-abd2-5c5cff97c2d6>, accessed 2/13/2019. As noted by the page, this dataset only contains appeals filed and heard with the Board of Property Assessment Appeals and Review, and not include appeals heard at the Board of Viewers.

⁴¹ Permit number 15-BOA-00033 (for Board of Appeals Case #33-2015), which indicated a hearing was originally scheduled for November 17, 2015.

⁴² "Notice of Assessment Change" for Parcel ID 0001-H-00256-0000-00, Mailing Date: December 18, 2015.

building’s assessed value. The assessed value of the land parcel actually increased by just under 4%. The changes are shown in Table 2 below.

Table 2. Tower pre and post appeal assessment values

	Pre-appeal	Post Appeal	Change	% Change
Land	\$4,451,300	\$4,625,000	\$173,700	3.9%
Building	\$217,770,300	\$142,575,000	(\$75,195,300)	(34.5%)
Total	\$222,221,600	\$147,200,000	(\$75,021,600)	(33.8%)

We then turned to an examination of the evidence file for the appeal. This included a “Hearing Officer Report”, a page of logged notes for the hearing, an “Appeal Hearing Sign-In Sheet”, and a professional appraisal submitted as evidence.⁴³

The Hearing Officer Report indicates that the “[o]wner’s opinion of value” for the property was \$160M. It indicated that “all parties agreed with the data” (checked “yes”) and that the hearing officer did not “discount any of the testimony or evidence presented” (checked “no”). The officer approved a change of value, and indicated the primary valuation rationale for the decision was the “cost approach”.

The three log entries included in the evidence packet were as follows:

The appellant is PNC represented by their attorney and appraiser. The appellant stated that this is a current market appeal. The attorney requested that a CLR of 92% be applied. The appraiser elaborated in his opinion of value using the market, income, and cost approaches. He gave the greatest weight to the cost approach. The appraiser stated that this is an owner occupied building with 3 stor[i]jes of underground parking. There are two storefront rental that he included in the projected income approach.

The representatives for the school district and county had no evidence to present and requested the current assessed value be sustained.

The appraisal is well detailed with supporting evidence and the appraiser fully explained each approach used to establish his opinion. The solicitors for the school district and county had no question for the appraiser or attorney for the owner.

The report indicates that the \$160M figure was accepted, and consisted of \$4,625,000 for land (again a slight increase over the initially assessed value), and \$155,375,000 for the building. These figures were crossed out on the form and replaced with the figures of \$142,575,000 for the building, \$4,625,000 (again) for the land, and \$147,200,000 for the total value of the property. We assume this value

⁴³ Evidence file for hearing for parcel ID: 0001-H-00256-0000-00, June 3 2016 10AM, obtained February 2019.

was obtained by multiplying the figure by Allegheny County's Common Level Ratio for the period 7/1/2015 to 6/30/2016 (about 92%) to the owner's opinion of value of \$160,000,000.^{44,45}

These findings beg several additional questions.

1. What accounts for the difference in the reported cost of the development (\$400M) and its originally assessed value of \$222M?
2. Are appeals of assessments of new commercial properties common?
3. What was the nature of the evidence that persuaded the county to reduce the initial assessment down to \$147M?
4. Are such reductions typical? Should we expect an HQ2 building to receive a similar reduction?

What accounts for the difference in the reported and originally assessed value?

One possible answer to the first question was suggested by an appraiser interviewed for this report who practices in the Commonwealth, but did not work on the PNC case.⁴⁶ In their experience, the starting value that county assessors use is often simply based on the anticipated costs for all submitted building permits associated with the improvements.

Separately, a former assessor interviewed for the report also noted that in his experience, the explanatory note on the County's Real Estate Portal on the use of the cost method is often simply a default placeholder for new construction, and does not necessarily indicate a sophisticated application of the cost method has taken place (yet).⁴⁷

Available information on building permits associated with the Tower development indicate that at least \$215M in permitted costs were approved by the City, which is pretty close to the initial assessed value of \$217M for the structure.⁴⁸ If accurate,

⁴⁴ However, as noted, the land parcel's assessment was left unchanged. To make up for this, the buildings value was multiplied by figure slightly less than 92%, so that the new assessment for the total project would be consistent with 92% of the \$160M.

⁴⁵ We assume this is so as the date of the appraisal and the hearing fell between these dates, and the common level ratio factor for this period, according to the Pennsylvania Department of Revenue, was 1.09. This factor is the reciprocal of the CLR, which would be 91.7%. See Appendix B. for a brief explanation of the definition and application of CLRs in the appeal process.

⁴⁶ Interview with local appraiser, January 2019.

⁴⁷ Interview with former assessor, February 2019.

⁴⁸ We examined job costs reported construction permits associated with the Tower using data on city building permits from the Western Pennsylvania Regional Data Center. Between 2012 and 2014 we found only \$64M in permitted construction costs for the project for activities such as excavation, caisson, foundation, superstructure, and interior fit out. However, a second source, www.buildzoom.com maintains a national database of building permits. For some municipalities, their permit data goes back 50 years, for Pittsburgh, data was available from 2006 to 2016. This source indicated that permits with \$215M in value were associated with 310 5th Avenue. Incidental construction expenses were found for other parcels associated with the project, but no other evidence of major permitted costs could be found.

this suggests that the initially assessed value of the building may have been based largely on its anticipated cost as reported on construction permits.

If this were true, then the initial estimate only represents the sum of anticipated permitted costs, which would not account for any cost overruns from direct construction activities, nor any major soft costs for design and engineering. Such a procedure does not appear to resemble any accepted appraisal method. For example, the approach does not appear to conform to the cost approach to value, as it flatly ignores soft costs (see Appendix A for more on the cost method).

If on the other hand the \$222M resulted from an actual application of the cost method, then the results suggest two possibilities.

The first is that the figure represents “reproduction cost new” or the cost to create an exact duplicate of the building. Assuming the County asked for and received at least a summary of budgeted and actual costs for the building (including soft costs), and used it as a basis for the figure, barring cost overruns, this would suggest that the full built cost of the Tower was much less than \$400M or even \$370M.

The second possibility is that the County instead generated a “replacement cost new” estimate of the building’s cost. Under this scenario, the County would have estimated the cost of building an adequate substitute facility based on the size, configuration, construction market, and other parameters. This could have been done using a cost estimation or valuation software tool. While there are a number of techniques for applying the cost method, it is common for mass appraisal systems to rely on standardized software tools.

An example of such a tool is Marshall and Swift’s SwiftEstimator Commercial Estimator Program; an on-line service which can generate cost estimates for relatively complex structures for under \$50 an estimate. Interviews with regional appraisers and assessors confirmed that county governments routinely rely on Marshall and Swift for valuing commercial properties using the cost method. Depending on what the County considered a suitable substitute for the Tower to be, a much lower figure (than \$400M) could certainly have resulted.

To get to the bottom of the matter, we contacted the County’s Office of Property Assessments.⁴⁹

First, the Office strongly rejected the idea that the value of construction permits were used as the basis of an initial assessment of new large scale commercial construction. While acknowledging that other municipalities in PA may rely on this

⁴⁹ Phone interview with Office of Property Assessment.

approach, they noted it was not accepted practice in the City, and that doing so invites “low-balling” of reported construction costs in order to lower owner tax bills.

When asked how a theoretical HQ2 building might be treated, the Office noted that in general, initial assessments of new large scale commercial office construction would typically mainly rely on the income method, but that an owner occupied office building such as HQ2 might instead be assessed by the cost method. For such cases, the County relies on their computer assisted mass appraisal system, currently provided by Tyler Technologies, which in turn relies on data and functionality from Marshall and Swift to conduct appraisals using the cost method. The Office also noted that this procedure would involve using this feature to estimate the replacement cost of the building at 2012 price levels (to remain consistent with baseline assessment values).⁵⁰

When asked about the PNC case, the Office confirmed that such an approach was used to generate the initial assessment for the Tower, since the building was owner-occupied (and therefore more difficult to assess under the income method), because only a minor amount the building was leased (for first floor retail, and a cafeteria), and because it had unique features not typical to conventional office buildings in the market.

Are appeals for new commercial properties common?

In answer to this question, the former assessor interviewed for this report noted that owner appeals of assessments of new commercial office buildings were dependably routine, whether the building was owned and operated, or an investment property.⁵¹

What was the nature of the evidence?

As indicated by the log notes for the appeal, the appraisal report submitted on behalf of PNC contained estimates of valuation from all three appraisal methods. As noted in the Hearing Officer Report, the owner’s opinion of value was \$160M. All three opinions of value in the report were within about 10% of this value.

So why was it so low? For those that want to know the full details, the report was included in the evidence file for the appeal, and therefore is an accessible public record. Rather than focus on the details of the appraiser’s findings here, we will simply outline their reasoning, which do seem aligned with common practice for the most part.

⁵⁰ See Appendix B for more on baseline assessments.

⁵¹ Interview with former assessor, February 2019.

Each opinion of value produced by each method was ultimately constrained by what the appraiser believed the market would support at the date of appraisal. Within their analysis, “the market” was framed according to the availability of Class A office space for lease to tenants within the City as income producing properties, rather than as corporate headquarters. This approach effectively ignores the individual utility an owner occupier like PNC derives from the special features the of Tower, and instead considers its economic potential as if it were a more or less conventional multi-tenant office building for lease or sale.

Within the income approach, estimated rents were based on what the rest of the local market for Class A office space supported at the time of the appraisal in terms of asked and contracted rents. Within the sales approach, it was assumed the building (as an investment property) would not sell much more per square foot than what other conventional office properties in the market had recently sold for. Within the cost approach, the Tower’s actual cost was ignored on the grounds that in the market at that time, no developer or investor would build such a facility as an income generating investment property, and so the replacement cost of a more conventional structure aligned with current market conditions was used to construct an opinion of value instead.⁵²

Are such reductions typical? Should one expect an HQ2 building to receive a reduction?

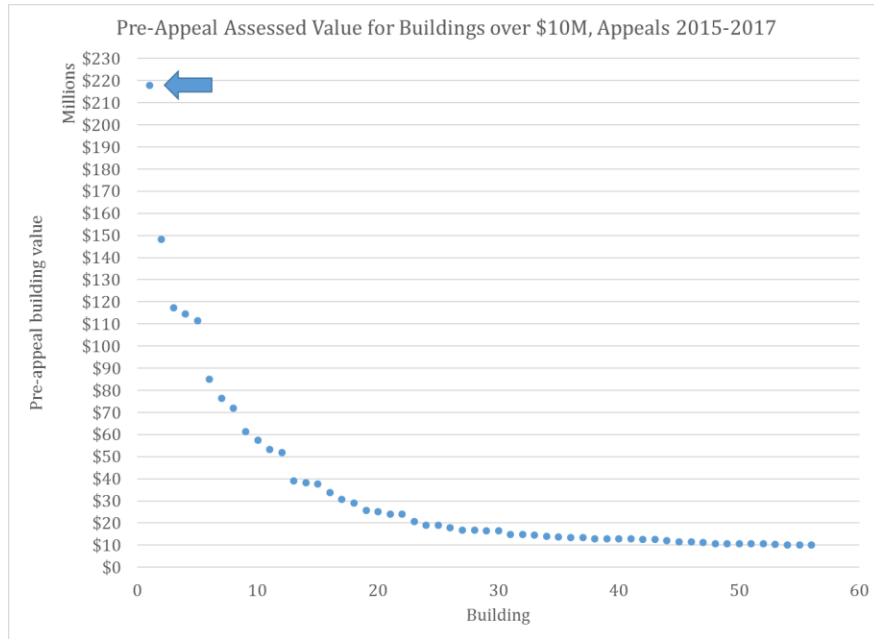
To better understand how typical the reduction in the Tower’s assessed was, we turned back to the WPRDC file to see how appeals for similar properties turned out.

Again, this file covered property appeals from tax years 2015 through 2017. Out of 22K rows in the file, 63 dealt with properties where the pre appeal building value was \$10M or more, and 56 of these were classed as commercial properties, with all but one flagged as taxable (rather than tax-exempt). Out of this subset, 23 were within city limits. Each row out of the 56 represented an appeal associated with a unique parcel, with the exception of five entries, which appeared to represent repeated appeals for two properties.

The distribution of pre-appeal values for these buildings are shown in Figure 1 below. Out of the 56 commercial properties, 25 entries had pre-appeal building values of around \$20M or less, and only five had values of \$100M or more. This included the Tower’s original assessed value of \$217M, which was clearly an outlier (first plot).

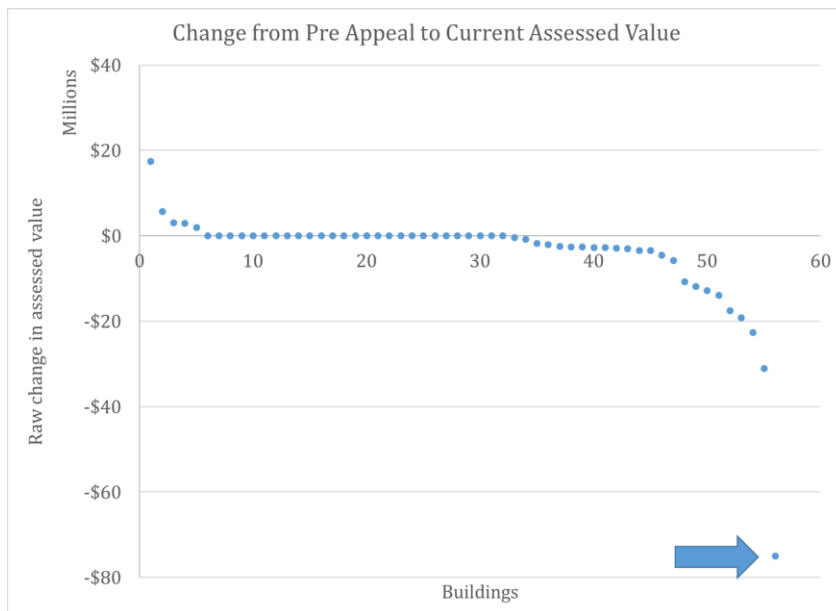
⁵² Appendix A of this report outlines the assumptions and steps involved in the cost approach to value and further elaborates on the reasoning behind the use of the conventional structure.

Figure 1



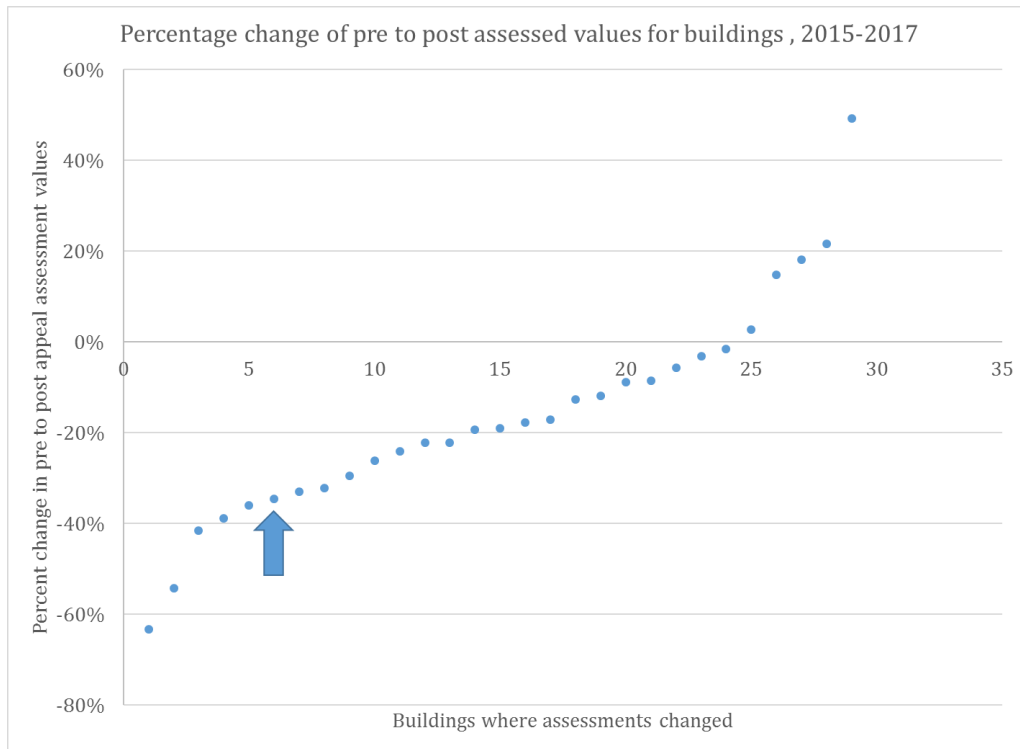
As shown in Figure 2, out of the 56 entries for commercial buildings in the set, 27 (48%) indicated that no adjustment (zero change) to the assessed value was made because of an appeal. This group included the aforementioned properties with multiple entries indicating multiple appeals. Five properties in the set (almost 9%) actually saw increases in assessed values from \$1.9 to 16.8M. Twenty-four entries (43%) saw reductions in value, ranging from \$405K to an outlier of \$75M, representing the Tower's reduction.

Figure 2



Of course, the absolute size of this decline is mostly due to the large valuation the building carried in the first place. Nevertheless, even in relative terms, the reduction was still large. For those properties where building values changed as a result of the appeal process, the Tower experienced the sixth largest decline as a percentage of its pre-appeal value.

Figure 3



While of interest, these results do not control for the fact that many of the properties in the set are located across the county, are properties other than office buildings, or are Class B and C office buildings. More pertinent questions would be: how common are appeals, and how typical are reductions, for Class A office buildings within the central business district (CBD)?

A useful set of Class A office buildings within the CBD is tracked by the Pittsburgh Skyline report by Jones, Lange, and LaSalle (JLL).⁵³ Per JLL:

*Pittsburgh’s Skyline includes office buildings that meet one or more of the following criteria: larger than 100,000 total square feet, built or significant renovations since 1985, high-profile location, recognized tenant profile and/or architectural significance.*⁵⁴

⁵³ “Pittsburgh Skyline 2018” report, JLL, downloaded from www.jll.com/Skyline on 3/9/2019.

⁵⁴ Ibid.

Seventeen buildings are in this set, which excludes the Tower itself. Although it otherwise qualifies as a Skyline building, it was excluded since it is 100% owner occupied, and not available for lease save for first floor retail etc. Two PNC Plaza, which also is fully owner occupied by PNC, is also excluded.⁵⁵ Thus with these two buildings added, there are nineteen “high profile” Class A buildings in the CBD.

Out of twenty-two taxable commercial buildings within city limits of a pre-appeal assessed value of \$10M or more, the first seven in descending pre-appeal building value were actually Class A office buildings within the CBD (1st or 2nd Ward). These were as follows, with appeal results included.

Table 3. Appeal results for “high profile” CBD office buildings

Building Name	Year Built/Recent Renovation	Complainant	Pre-appeal value (land + building)	Pre-appeal value vs. current value	% Change
The Tower at PNC Plaza	2015	Owner	\$222,221,600	-\$75,021,600	-33.76%
One Oxford Center	1983/2018	Owner	\$154,000,000	-\$17,529,450	-11.38%
Liberty Center	1986/2017	Owner	\$123,500,000	-\$3,500,000	-2.83%
Union Trust Building	1915-1916/2016	Owner	\$61,339,600	\$0	0.00%
Oliver Building	1908-1910	Owner	\$56,394,000	-\$19,174,000	-34.00%
525 William Penn Place (Citizen's Bank Tower)	1955/2018	School District	\$55,250,000	\$0	0.00%
Part of JLL Center w/o hotel	2016	Owner	\$39,027,200	-\$12,897,200	-33.05%

Thus seven of the 19 buildings of interest, or 37%, saw appeals between 2015 and 2017. Out of these seven, all but two (The Tower and JLL Center) were built before the turn of the century, but four had recently been renovated according to the Skyline Report.⁵⁶ Five out of the seven (71%) received reductions from hearings or court decisions, and three of these reductions were for more than 30% of the development’s pre-appeal value.

These results suggest that the Tower’s appeal results (in relative terms) might not be so unique compared to that of its closest peers.

Only one high profile appeal in this set was brought by a non-owner in 2017 (PPS), for 525 William Penn Place, and it did not succeed. According to the Skyline Report, this property had the highest vacancy rate in the set of 17, with less than 35% of the building leased.⁵⁷ The immediate reason for this was the departure of

⁵⁵ E-mail exchange with JLL Pittsburgh Office Personnel, March 12, 2019.

⁵⁶ “Pittsburgh Skyline 2018” report.

⁵⁷ Ibid.

BNY Mellon from the building to offices elsewhere in the CBD.⁵⁸ This property was one of the main buildings offered for lease to Amazon in the bid.

As for the remaining 16 property appeals within city limits, 10 saw no change in their assessed values, 5 saw declines, and only one saw an increase, a hotel assessment appealed by the school district (which was successful). Only one of these 16 records appeared to involve a Class A office building: the Arconic Corporate Center on the North Shore (currently used as a corporate headquarters for Alcoa/Arconic), which resulted in a successful owner appeal and an 8% reduction. The rest appeared to involve smaller Class B or C office buildings, hotels, or other types of commercial property across the city.

So to return to the question: are such appeals typical, and should we expect an HQ2 building to receive a reduction? Based on what we have found so far, we believe the best answers to these questions are “probably” and “probably”.⁵⁹

The dataset of appeals that we examined only covers a three-year window. However, within that narrow slice of time, no less than 37% of the nineteen high profile Class A properties within the CBD saw appeals. Seventy-one percent of those appeals resulted in a reduction of the development’s assessed value, and sixty percent of those reductions saw declines over 30%. At the same time, only one building housing a corporate headquarters for a Fortune 500 firm located outside the CBD (but within the city) submitted an appeal, but it was successful.

Based on these findings, we assume that:

- (a) the *initial* assessment of an HQ2 building by the County would certainly be substantially smaller than the building’s built cost;
- (b) regardless of the initial assessment result, it seems likely, if not guaranteed, that an owner appeal would soon follow; and
- (c) if appealed, it seems more likely than not that a reduction would follow.

Our general reasoning for these assumptions, to paraphrase Peter Pan, is that “all of this has happened before, and all of it could happen again”; or to quote Edward Deming/Arthur Jones, “Every system is perfectly designed to get the result that it does”.

⁵⁸ “New York company buys William Penn Place, as BNY Mellon moves out”, Mark Belko, Pittsburgh Post-Gazette, September 19, 2016, link: <https://www.post-gazette.com/business/development/2016/09/29/Pearson-finalizes-purchase-of-downtown-s-William-Penn-Place/stories/201609280165>, accessed 3/28/2019.

⁵⁹ This is a good time to admit the weaknesses of the analysis we did manage. It was limited to a three year window, focused on properties the CBD (not the airport), and limited to appeals data from the Board of Property Assessment Appeals and Review. Appeals decided by the Board of Viewers were not included here. Finally, we were not in a position to conduct an empirical analysis that would controlled for relevant variables, although given the rarity of the properties of interest, sample sizes might have too small for methods to detect real effects.

We do not assume that assessment policy, appeal incentives, appraisal practices, or the local market for Class A office space have changed so much since 2016 to preclude similar outcomes for an HQ2 building moving forward.

That said, the size of such a reduction is not as easy to predict, and would presumably ultimately depend on how “overbuilt” the trophy headquarters was compared to the market for Class A office space. The next section attempts some informed guesses to this end.

Assessed value of an HQ2 building

Based on the Tower case, we assume the assessed value of an HQ2 building would be less than its budgeted and built cost. First, we do not believe the entirety of the funds spent to design and build the structure by Amazon would be reflected in its original assessment. Second, Amazon might spend some capital funds on things (like FF&E) that are not assessable as real property. Third, we also assume that an appeal would be likely, and would likely result in a further reduction.

Beyond that, we believe the magnitude of any reduction would ultimately depend on how “overbuilt” the HQ2 building appeared to be compared to the limits of the market for commercial space in Pittsburgh’s CBD. That is, the more costly the building was on square foot basis compared to the kind of Class A office building that a developer might invest in as an income producing property, the larger the reduction might be.

Rather than arbitrarily guess how much smaller the assessment would be than the budgeted or built cost, we used a cost estimation tool to explore what the bounds of the assessed values might be.

We used Marshall & Swift’s SwiftEstimator Commercial Estimator Program from CoreLogic to generate four cost estimates for a conventional office building.⁶⁰ Marshall and Swift’s estimates include final costs to owner including materials, labor and related taxes, but also *average* architect, engineering, construction finance costs, normal site preparation, etc. The costs of land assembly and developer’s profit are excluded.⁶¹

All four estimates took into account average building costs for the Pittsburgh area as of 2017. Each estimate represented a rectangular office tower with an underground garage, elevator, sprinkler, and HVAC systems, but no mezzanine, retail, or other types of occupancies. Two estimates each were generated based on buildings with 500,000 and 1M total floor area above ground, with below ground

⁶⁰ See www.swiftestimator.com.

⁶¹ “Program Reference: Marshall & Swift SwiftEstimator: Commercial Estimator Program”, June 2016, pp 1-2.

parking garages of 75,000 and 150,000 sq. ft. respectively. All four were generated based on “Class A” construction, but given one of two construction quality ratings of “good” or “excellent”.⁶² The results are as shown in Table 4 below. Table 5 compares these results with our estimated built costs for each building.

Table 4. Estimated costs for a conventional office building

Building size	Floors	Replacement cost new for a building of GOOD quality	Replacement cost new for a building of EXCELLENT quality
500K + parking	20 +3 parking levels	\$135M	\$165M
1M + parking	30 +6 parking levels	\$277M	\$345M

Table 5. Built vs. replacement cost new for a conventional office building

Actual Building size	Cost Per Sq. Ft.	Actual Built Cost	Quality of Construction Assumed for Replacement Building	Replacement Cost New Based on Quality of Construction	% of Cost Assessed
500K + parking	High	\$300M	Excellent	\$165M	55%
			Good	\$135M	45%
	Low	\$200M	Excellent	\$165M	82%
			Good	\$135M	68%
1M + parking	High	\$600M	Excellent	\$345M	58%
			Good	\$277M	46%
	Low	\$400M	Excellent	\$345M	86%
			Good	\$277M	69%

Actual built cost estimates can be interpreted as the full built cost of assessable improvements. For example, in the case of a 500K building with a higher cost of \$300M, this figure can be assumed to represent the full construction costs of the building, but not FF&E, etc. Again, additional expenditures for such purposes could certainly be spent out of Amazon’s capital budget on behalf of the building, but are ignored here.

With this said, if under the cost method, a similarly sized and outfitted Class A (construction) office tower of *good* quality were accepted as a substitute for the building, the resulting base opinion of value would be only 45% of its built cost.

⁶² The designation of “Class A” office construction is related to but not synonymous with “Class A” office space. As noted by the Dictionary of Real Estate Appraisal (p. 33): “national cost estimating services classify office buildings according to type of construction, whereas local markets classify office buildings according to quality and market position.” Here “Class A” refers to a fireproof structural steel frame. Marshall and Swift’s construction quality ratings have a significant impact on cost, and range from .4 (“Lowest”) to 4 (“Excellent”). A score of 3 is “Good”.

If instead a building of *excellent* construction quality were required as a substitute, the ratio would grow to 55%, since such a building would be more costly to produce. Similar ratios appear to apply to the 1M sq. ft. version of the higher cost building.

With the cheaper versions of these buildings, actual built costs are much closer to the costs predicted by Marshall & Swift, with assessments of value ranging from 68 to 86% of built costs, depending on the quality of construction assumed for the substitute building.

Certainly numerous other versions of a substitute building (in design, systems, and construction quality) could be assumed, which would result in different base opinions of value under the cost method. However, we feel these ranges of estimates are quite plausible. Within this range, we assume the “good” quality models would more likely be used, given what we know about the Tower case.

Would the income approach produce a higher opinion value?

The cost approach only generates one opinion of value, and in the case of an appeal, if an appraisal were submitted as evidence; there would be three to reconcile. In appraisal practice, the cost method often sets the upper bound on what a property is expected to sell for.⁶³ This certainly seemed to be the case in the appraisal of the Tower, and would likely be the case for an appraisal of an HQ2 building.

Sales of comparable office buildings in the Pittsburgh market have been few, and “not so comparable”, which is why the Tower’s appraisal gave the opinion of value produced by the sales method (which was the smallest of the three) the least weight. So it might be ignored here.

When appraising office property, standard practice typically gives the income capitalization approach the most weight. The Tower’s appraiser appeared to do so as well, and ultimately settled on a reconciled value close to it, which was lower than the value derived from the cost approach.

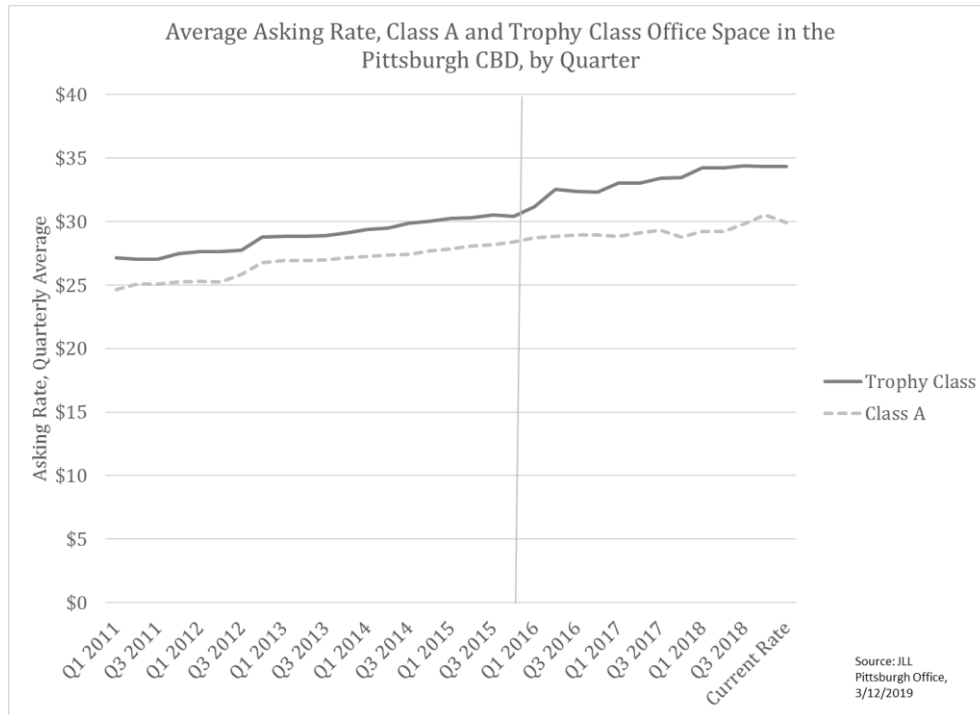
We are not in position to conduct our own estimate of what the value of an HQ2 building might be under the income approach. We will note however, that the main driver of this approach is the price and volume of leasing activity.

While data from JLL does indicate that asking rents for “Trophy Class” office space in Pittsburgh’s CBD have grown by 10 percent since early 2016 (the date of the appraisal), the asking rents for the remaining Class A office space tracked by the aforementioned Skyline Report in the CBD only grew by about 4 percent, and according to that report, the bulk of the available space for lease is actually within

⁶³ Martinez and Seibers, p. 8.

this subclass (and specifically, the William Penn building) as opposed to the Trophy subclass.⁶⁴

Figure 4.



The Skyline report also indicates that total vacancy for all Class A properties jumped from 10% or so in 2015 to over 16% in 2017, and as of 2018 stood at 14%, and that as of the report, no further major Class A properties were under development in the CBD.

These results differed somewhat with a recent report from the Pittsburgh Downtown Partnership that relied on data from CBRE, which indicated that vacancy rates for Class A office space downtown were only around 6% or so in 2015, but had drifted up to 8% by 2018, with rents up by about 9% for the same period.⁶⁵

Meanwhile, according to CBRE’s North American Cap Rate survey for latter half of 2018, capitalization rates for Class A office properties in the CBD for the Pittsburgh

⁶⁴ Data from JLL and the “Pittsburgh Skyline 2018” report.

⁶⁵ “State of Downtown Pittsburgh 2018, Pittsburgh Downtown Partnership”, p. 10-11. Link: <https://downtownpittsburgh.com/wp-content/uploads/2018/05/PDP-updated-State-of-Downtown-2018.pdf>, accessed 3/16/2019. As noted by this report on page 5 the difference between the vacancy rates observed by JLL and CBRE might be due to the fact that JLL included some recently completed properties within the rate that CBRE did not. It also appears that the two sources may have classified certain buildings differently. For example, a major event in the CBD was the departure of Bank of New York Mellon from 525 William Penn Place. JLL considers the latter a Class A (but not Trophy Class) building, but CBRE currently treats its Class B space. See “CBRE Market View, Pittsburgh Office, Q4 2018”, p3.

market are not much different from the rates assumed by the appraiser for the Tower case back in 2016.⁶⁶

If these conditions basically held as of the appraisal of an HQ2 building, it does not seem likely that the opinion of value produced by the income capitalization method would greatly exceed the estimate produced by the cost method.

One might point out that the rollout of HQ2 would serve as a catalyst to the office market, such that demand would rise, rents would rise, vacancy rates would fall, and as a result, the income capitalized value of appraised office buildings (including HQ2) would increase.

It is true that business services, restaurants, and other potential suppliers of the firm or its employees might seek to relocate near HQ2, wherever it landed. More tech startups and established tech firms might seek to locate near Amazon (or at least within the same city) as well. Such spillover effects could certainly reduce the available supply of space, nudge up lease rates, and bump up revenues to income producing property owners. That said, not all these tenants would demand, or be able to afford, Class A space.

On the supply side, an HQ2 announcement would also surely lead to an increase construction of Class A space, including spec construction (and/or upgrading Class B space). Certainly HQ2's employees would create demand for housing in the immediate area, but this demand would not likely impact demand for Class A space on its own in the short run.

It is not our intention to pretend such things would not happen, but they are difficult to game out, and this analysis is limited to the *direct revenue effects* of the first HQ2 building. It ignores other effects, including economic (multiplier) impact of spending on construction, operations, and employee households, but also the secondary property value effects its existence would have on the Class A office market.

Further, for this report, we assume that Amazon would not lease space. Part of the reason why Seattle's market for Class A market space has taken off is that in addition to the fact that it has bought, built, and occupied numerous office buildings it has also leased a great deal of office space.⁶⁷

While it might have been assumed (at least until Amazon cancelled its original plans for a single HQ2 site) that winning HQ2 would also have led to a wave of

⁶⁶ "North American Cap Rate Survey, Second Half 2018", CBRE, p 7.

⁶⁷ According to one report, from 2013 to 2017 Amazon took up an average of 800,000 sq. ft. of office space *a year* in Seattle, and now owns or leases 12M sq. ft. in the region. "Amazon's future in Seattle uncertain as neighboring city looks more and more like HQ2, Monica Nickelsburg and Nat Levy, Geekwire.com, February 22, 2019, link:

<https://www.geekwire.com/2019/amazons-future-seattle-uncertain-neighboring-city-looks-like-hq2/>, accessed 3/18/2019

direct demand for office space, including leased space, we are pointedly ignoring that possibility here. In this scenario, Amazon begins its expansion into the market by building and occupying a building, no more.

Strictly speaking, the act of adding and fully occupying a Class A building to the market - in and of itself - does not represent an increase in demand at the margin for available Class A office space for lease relative to the amount of supply.

Therefore, we assume that the addition of the building would not lead to substantial increases in lease rates, and therefore, substantially higher appraisals of value for Class A office space (in the short term) under the income method.

If this seems myopic, look at this way. If HQ2 landed at Hazelwood Green, would the market for Class A office space in the CBD still be “transformed”? This is where the bulk of the inventory for such space is, where the comparables are, and represents the center of gravity for the entire market. We think not, but obviously, other assumptions are possible.

As one professional observer of the local commercial real estate market noted when asked to comment on the “build only” scenario:

Price is a result of supply and demand. If an office user took 100% occupancy of a building built for them, the available inventory would not change. However, the total market vacancy percentage would decline because you’ve added to the total inventory and absorbed it at the same time. This fact would be used as an opportunity to raise asking rates in anticipation of continued demand, but if no one else leases space, price would correct itself.⁶⁸

⁶⁸ E-mail exchange, March 18, 2019.

Could the HQ2 development be exempt from local property taxes?

Property taxes would not be generated if the development were tax-exempt.

As the bid makes clear, only one of the five sites offered appeared to be in (mostly) private, for profit hands. The Hazelwood Green site is currently owned by a consortium of local non-profit foundations. While non-profit owned real estate is typically tax exempt under Pennsylvania law, the exemption depends on the actual use of the property. Since it was originally purchased by the Almono Partnership in 2002, the site's intended use has been for "property development", and has remained on the tax rolls since.⁶⁹

The Carrie Furnace site is currently owned by Allegheny County, and the Site@PIT is currently owned by the Allegheny County Airport Authority (ACAA). The Lower Hill site is jointly owned by the Sports & Exhibition Authority of Pittsburgh, Allegheny County, and the City of Pittsburgh, although a private concern, the Pittsburgh Penguins, currently holds development rights for the site.⁷⁰

Only the Strip District site appears to be (mostly) privately owned, but even in this case, according to the bid, the land involved is apparently owned by a mix of public and private entities, led by Oxford Development.

For the purposes of property tax analysis, we assume that the building and land would ultimately be privately owned by the first year of operation. An exception would be the Site@PIT, where the structure would be owned by a third party property developer and taxed normally, but where the land would be leased to the developer by the ACAA, with taxes paid on the value of the ground lease.⁷¹

⁶⁹ "Nonprofits work behind the scenes to influence city government and control development", Rich Lord and Mark Belko, *Pittsburgh Post Gazette*, September 11 2017, link: <https://newsinteractive.post-gazette.com/nonprofit/>, accessed 2/19/2016

⁷⁰ There are local precedents that have kept real property off the tax rolls to accommodate private business operations: sports facilities. Much of the formerly privately owned land used to build PNC park is now technically tax exempt, despite the fact that a private firm (the Pittsburgh Pirates) operates a business on this publicly owned facility. The land and facility for the PPG Paints Arena, home of the Pittsburgh Penguins, currently assessed at over \$212M, is also tax exempt. Source: PNC Park, brownfield profile, Zhe Zhuang, 2010, Steinbrenner Institute, Carnegie Mellon University, link: <https://www.cmu.edu/steinbrenner/brownfields/Case%20Studies/pdf/pnc-park.pdf>, accessed 2/19/2019 and Allegheny County Real Estate Portal.

⁷¹ E-mail exchange with ACAA personnel, Jan/May 2019. Another exception to our assumption might be the 15,000 square foot co-location space proposed by the Pittsburgh's bid to go along with the first building. Since the bid does not make clear who would own/use/manage and for what activities, we ignore it for the purposes of this analysis.

Year 1 property taxes from of a new phase 1 building

Based on estimates of assessed values, we can generate estimates of Year 1 property tax yields for the first year of the buildings operation.

Millage rates

Millage rates for 2017 were used, on the assumption that 2018 rates were not available at the time of the bid. Rates for the four possible municipal locations are shown in Table 6 below.⁷² County rates are of course identical, and the other rates are comparable, except that the city has a substantially lower school district millage rate than the others, while Findlay has a significantly lower municipal rate.

Table 6. 2017 millage rates

Millage Rates by Site Location	County	Municipality	School District
City of Pittsburgh	4.73	8.06	9.84
Rankin	4.73	9.6928	25.35
Swissvale	4.73	8	25.35
Findlay	4.73	1.6	18.51

Adjusting assessed values via the Common Level Ratio

The estimates of assessed value in Table 5 are based on the replacement cost new for substitute buildings as of 2017. To keep our estimates consistent with the County’s mass appraisal system, and to account for the possibility of appeals, we adjust them using the County’s common level ratio for 2017. Per the Pennsylvania Department of Revenue, the common level ratio factor for Allegheny County from July 2017 to June 2018 was 1.14, and the actual common level ratio is the reciprocal of this value or .877 (rounded).⁷³ Multiplying the original estimates of assessed values results in the adjusted values shown below in Table 7. Appendix B provides a brief explanation of the how the common level ratio is computed and why and how it is used.

⁷² For the record, a reported 70% of the Carrie Furnace site lies within Rankin Borough, with 30% in Swissvale (source: <https://www.nextpittsburgh.com/features/carrie-furnaces-site/>). Developments there might well cross into both municipalities, but since both lie within the Woodland Hills School District, the only obvious consequence of a dual location would be the slight difference in municipal millage rates between the two.

⁷³ “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.

Table 7. Adjusted assessed values for a conventional office building

Actual Building size	Quality of Construction Assumed for Replacement Building	Replacement Cost New Based on Quality of Construction	Multiplied by CLR = .877
500K sq ft + parking	Good	\$135M	\$118M
	Excellent	\$165M	\$145M
1M sq ft + parking	Good	\$277M	\$243M
	Excellent	\$345M	\$303M

Multiplying the figures in the last column by the millage rates results in Table 8 below, with figures rounded to the nearest thousand.

Table 8. Year 1 property tax yields (rounded)

Actual Building size	Quality of Construction Assumed for Replacement Building	Estimated Assessed Value	Municipality	County Property Taxes	Municipal Property Taxes	School District Property Taxes	Total Property Taxes
500K + parking	Good	\$118M	Pittsburgh	\$560,000	\$954,000	\$1,165,000	\$2,679,000
			Findlay	\$560,000	\$189,000	\$2,191,000	\$2,941,000
			Swissvale	\$560,000	\$947,000	\$3,001,000	\$4,508,000
			Rankin	\$560,000	\$1,148,000	\$3,001,000	\$4,709,000
	Excellent	\$145M	Pittsburgh	\$684,000	\$1,166,000	\$1,424,000	\$3,275,000
			Findlay	\$684,000	\$232,000	\$2,678,000	\$3,594,000
			Swissvale	\$684,000	\$1,158,000	\$3,668,000	\$5,510,000
			Rankin	\$684,000	\$1,403,000	\$3,668,000	\$5,755,000
1M + parking	Good	\$243M	Pittsburgh	\$1,149,000	\$1,958,000	\$2,390,000	\$5,497,000
			Findlay	\$1,149,000	\$389,000	\$4,497,000	\$6,034,000
			Swissvale	\$1,149,000	\$1,943,000	\$6,158,000	\$9,251,000
			Rankin	\$1,149,000	\$2,355,000	\$6,158,000	\$9,662,000
	Excellent	\$303M	Pittsburgh	\$1,431,000	\$2,439,000	\$2,977,000	\$6,847,000
			Findlay	\$1,431,000	\$484,000	\$5,600,000	\$7,516,000
			Swissvale	\$1,431,000	\$2,421,000	\$7,670,000	\$11,522,000
			Rankin	\$1,431,000	\$2,933,000	\$7,670,000	\$12,034,000

Sites in the City of Pittsburgh would yield the lowest property tax revenues, primarily because its school district millage rate is smaller. Total property yields for the City range from about \$2.6M to \$6.8M (rounded) depending on the size of the building and how it is assessed. The highest yields are produced at Rankin (assuming the entirety of the development would be located there) and range from \$4.7M to \$12M.

Pittsburgh Public Schools would receive from \$1.2M to \$3M in tax revenue, West Allegheny School District (Findlay) would receive \$2.2M to \$5.6M, and Woodland Hills (Rankin or Swissvale) would receive \$3M to \$7.7M.

These numbers do not account for the County's discount of 2% for prompt payment of property taxes. Although the yields are potentially large, since our scenario does not assume the building would be initially assessed through a countywide assessment, and since it represents new construction, we assume windfall revenue limits would not apply.⁷⁴

These figures are only estimates, but they provide a sense of what the first and following direct tax yields might be for a single HQ2 building. Importantly, they do not include yields for additional buildings, yields for land values, nor do they take into account the other incentives or subsidies noted in the bid.

So far as we can tell, the bid offers no property tax abatements for Amazon outright. However, the bid does assume that a significant amount of property tax revenue from the HQ2 development would be diverted to service bonds for development related infrastructure spending needs through a mechanism such as a TIF or TRID (up to \$426M over twenty years). As noted by the bid:

*\$426 million from Tax Increment Financing District (TIF) or Transit Revitalization Investment District (TRID) financing committed by the City, County, and Pittsburgh Public Schools. Bonds will be issued to pay for a broad range of public infrastructure improvements and is regularly used to provide low-cost financing for economic development projects. Under the TIF program, a specific geographic area, the TIF district, is established, within which up to 75% of the incremental real estate tax revenue generated by new development can be used to finance public infrastructure. TRID functions similarly to TIF, and is a structure used to provide low-cost financing for transit-oriented development.*⁷⁵

We assume that this \$426M figure would be drawn from the assessed value of more than one building and parcel within a TIF district, although the precise assumptions behind this are not included in the bid. The table below shows the net yields to county, municipal, and district taxing authority's general funds from an HQ2 building after the diversion of 75% of tax increment proceeds from the improvement of a new building to the infrastructure needs of the project.

⁷⁴ According to Allegheny County legal codes, "Following any annual reassessment or change in the predetermined ratio, the total amount of real estate tax revenue that can be received by reason of the reassessment or change in the ratio by the County from existing land, buildings and structures shall not exceed 105% of the total amount of real estate tax revenue received by the County in the preceding year from that land, and those buildings and structures. If necessary, the County shall reduce the real estate tax rate to accomplish this." and "In calculating the 105% limit, the amount to be levied on newly constructed buildings or structures, or from increased valuations based on new improvements made to existing buildings and structures, shall not be considered." Source: <https://ecode360.com/8453335>, accessed 2/19/2019.

⁷⁵ Pittsburgh bid, page 58-59.

Table 9. Year 1 property tax yields to taxing authorities net of a theoretical TIF diversion (at 75% rate)

Actual Building size	Quality of Construction Assumed for Replacement Building	Estimated Assessed Value	Municipality	County Property Taxes	Municipal Property Taxes	School District Property Taxes	Total Property Taxes
500K + parking	Good	\$118M	Pittsburgh	\$140K	\$239K	\$291K	\$670K
			Findlay	\$140K	\$47K	\$548K	\$735K
			Swissvale	\$140K	\$237K	\$750K	\$1,1M
			Rankin	\$140K	\$287K	\$750K	\$1.2M
	Excellent	\$145M	Pittsburgh	\$171K	\$292K	\$356K	\$819K
			Findlay	\$171K	\$58K	\$670K	\$899K
			Swissvale	\$171K	\$290K	\$917K	\$1.4M
			Rankin	\$171K	\$351K	\$917K	\$1.4M
1M + parking	Good	\$243M	Pittsburgh	\$287K	\$490K	\$598K	\$1.4M
			Findlay	\$287K	\$97K	\$1.1M	\$1.5M
			Swissvale	\$287K	\$486K	\$1.5M	\$2.3M
			Rankin	\$287K	\$589K	\$1.5M	\$2.4M
	Excellent	\$303M	Pittsburgh	\$358K	\$610K	\$744K	\$1.7M
			Findlay	\$358K	\$121K	\$1.4M	\$1.9M
			Swissvale	\$358K	\$605K	\$1.9M	\$2.9M
			Rankin	\$358K	\$733K	\$1.9M	\$3M

To get a sense of how much a TIF might be designed, and what it would pay for, one might look to a 2013 plan for the TIF district at the Hazelwood Green site, which proposed that 65% of local property taxes be diverted to fund the bonds necessary to pay the infrastructure needs to make proposed developments possible.⁷⁶ This plan was ultimately passed by city council in 2013.⁷⁷

⁷⁶ “Urban Redevelopment Authority of Pittsburgh: Proposed Hazelwood - Almono TIF District Tax Increment Financing Plan, Urban Redevelopment Authority, 2013, link: http://apps.pittsburghpa.gov/ura-files/Hazelwood-Almono_TIF_Plan_-_Final_-_6-2-2014.pdf, accessed 4/27/2019.

⁷⁷ “City council tentatively OKs TIF plan for Hazelwood project”, Tom Fontain, *Pittsburgh Tribune*, October 17, 2013, link: <https://archive.triblive.com/local/pittsburgh-allegheeny/city-council-tentatively-oks-tif-plan-for-hazelwood-project/>.

Amazon HQ1 office towers as benchmarks

Two other relevant benchmark buildings include Amazon's recently completed Doppler and Day One office towers in Seattle WA. While the actual built cost of each is not known, in 2017 the assessed value of the Doppler building and an adjacent meeting center was about \$595M.⁷⁸ For Day One, the assessed value of the tower and adjacent biodomes was about \$628M.⁷⁹ If one divides these figures by the reported gross square foot per building it works out to \$402 and \$410 per gross square foot respectively. These figures exclude land values.⁸⁰ While Seattle's market has been more dynamic than Pittsburgh's over the last decade (in part due to Amazon's expansion within the city), it still seems unlikely that the assessed value of these trophy office buildings exceeded the actual built cost of the towers, and we assume the built costs per square foot were likely higher.

For example, according to Buildzoom.com as of late 2017, Amazon had filed \$653M worth of construction permits for Block 19, the site of the Day One building and biodomes.⁸¹ Similarly, \$277M permits (so far) were filed for Block 14, the site of Amazon's Doppler building. These are only pre-construction permits for hard costs and may not reflect actual (or even completed) construction costs, but on this basis alone, the permitted costs appear to be \$593 per gross square foot for Day One but \$251 for Doppler.

Both buildings' Wikipedia entries indicate they are "on track" for LEED Gold certification.⁸² The source for this claim is a single web article (since deleted, but available from The Wayback Machine internet archive) and the building's architectural firm's web page. Neither building appears to have achieved LEED Gold certification yet, although they both include significant green building features and are both Energy Star certified, and many other buildings occupied by Amazon in Seattle reportedly have achieved LEED certification.⁸³ According to the King County Department of Assessments property website, between 2010 and 2019, ten

⁷⁸ King County Department of Assessments, eReal Property Search, link: <https://blue.kingcounty.com/Assessor/eRealProperty/default.aspx>, accessed 1/20/2019.

⁷⁹ Ibid.

⁸⁰ It is unclear whether the reported 65,000 sq feet of meeting and workspace in the biodomes is included in the King County estimate of gross square area for Day One estimate or not. See: "Amazon's Seattle spheres are set for public opening", Jonah Hillberg, The Architect's Newspaper, January 26, 2018. Links: <https://archpaper.com/2018/01/amazon-seattle-biospheres-opening/> accessed 1/15/2019.

⁸¹ "Anticipating Amazon's HQ2: Learnings From Seattle's HQ1", Sasha David, Buildzoom.com, November 29, 2017. link: <https://www.buildzoom.com/blog/amazon-hq2>, accessed 1/3/2019.

⁸² For example: [https://en.wikipedia.org/wiki/Doppler_\(building\)](https://en.wikipedia.org/wiki/Doppler_(building)), and <http://www.nbbj.com/work/amazon/> accessed 2/7/2019.

⁸³ Twenty of Amazon's buildings in Seattle are LEED certified, and six have obtained LEED gold certification. See for example: <https://blog.aboutamazon.com/sustainability/the-super-efficient-heat-source-hidden-below-amazons-new-headquarters>, <https://www.greenmatters.com/news/2017/11/22/Z2tmzwQ/amazon-seattle-data-center-heat>, <https://web.archive.org/web/20151026063215/http://www.ecopedia.com/design/amazon-new-seattle-office-aiming-for-leed-gold-status/> and <https://www.alconlighting.com/blog/lighting-news/growing-green-amazon-seattles-new-green-giant/>. Energy Star (and lack of LEED Gold) certifications found at <http://www.gbig.org/buildings/56373> and <http://www.gbig.org/buildings/1388790>, accessed 2/6/2019.

separate appeal actions by state and local governments appeared to be directed at Doppler alone. None were successful.

Appendix A of this report further outlines the basics of the cost method of appraisal and how it would likely be applied to an HQ2 building. Appendix B discusses state property assessment and appeals policy and the use of the CLR ratio in the appeals process. Since it must be admitted that a 20 to 30-story office tower might not be compatible with a location by the airport, Appendix C provides estimates of the assessed value (under the cost method) of an alternative design with fewer floors. Appendix D estimates the yield from realty transfer taxes for a transfer of HQ2 property. Finally, Appendix E outlines the budget assumptions made to escalate the Tower's built cost to 2017 price levels.

About Heinz College

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.

About the CED

The Center for Economic Development at the College exists to help local institutions and the public understand economic and community development challenges and opportunities facing the Pittsburgh region and the Commonwealth of Pennsylvania. Since its inception under the College in 1987, the Center has followed an interdisciplinary approach to conduct research in in economic, workforce, and community development. Our toolkit includes economic, demographic, geographic, and institutional data analysis, economic and statistical modeling, survey design and analysis, performance measurement, program design and evaluation, and policy research. Since 2008, with the assistance of its EDO partners and C-level Executive Fellows, the CED has also provided a steady pipeline of academic, extracurricular, and experiential learning opportunities for master's students at the College interested in economic and community development in the U.S. context. For more information, please visit www.heinz.cmu.edu and www.cmu.edu/ced.

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 should not be used as a basis for making decisions about the real estate market, real estate investment decisions, filing taxes, or property appeals.