AIR RIGHTS DEVELOPMENT AND PUBLIC ASSETS:

AN IMPLEMENTATION HANDBOOK FOR PUBLIC ENTITIES

by

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Abstract

Air rights development (ARD) above/below public assets can achieve a number of smart growth principles while also being a land value capture tool. However, there are several complexities associated with ARD, along with bureaucratic resistance to an unfamiliar form of development. This report will explore the different ways a public entity can address these challenges and build an effective implementation structure for ARD.

The research questions will explore the role of the public entity in ARD and the options available to address the associated challenges. For this exploratory research, the methodology will involve an academic literature scan, along with a jurisdictional scan of institutional literature with Boston, New York, Vancouver, and Washington D.C. as primary case studies. The report will be structured around the challenges of ARD, including political, regulatory, facilitation, and economic valuation issues. The report concludes with recommended steps in creating an implementation structure for ARD.

Key words: air rights development, air space, land value capture, implementation policy

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List of Acronyms

ANC	Advisory Neighbourhood Commission
ARD	Air Rights Development
ASP	Air Space Parcel
BRA	Boston Redevelopment Authority
CAC	Community Advisory Committee
CMP	Construction Management Plan
D.C.	District of Columbia
FHWA	Federal Highway Administration
HYDC	Hudson Yard Development Corporation
HYIC	Hudson Yard Infrastructure Corporation
MARTA	Metropolitan Atlanta Rapid Transit Authority
MassDOT	Massachusetts Department of Transportation
MBTA	Massachusetts Bay Transportation Authority
MDT	Miami-Dade Transit
MOU	Memorandum of Understanding
MTA	Metropolitan Transit Authority
MWAA	Metropolitan Washington Airport Authority
NIMBY	Not In My Back Yard
PD	Planned Development
PDA	Planned Development Area
PUD	Planned Unit Development
REOI	Request for Expressions of Interest
RFPE	Request for Prior Experience
RFP	Request for Proposals
RFQ	Request for Quotes
ROW	Right-of-Way
SCDC	Surrey City Development Corporation
TDR	Transferable Development Rights
TIEG	Tax Increment Equivalent Grant
TIF	Tax Increment Financing
TOD	Transit-Oriented Development
USN	Union Station North
VDOT	Virginia Department of Transportation
WMATA	Washington Metropolitan Area Transit Authority
ZC	Zoning Commission

1.0 Introduction

1.1 Urban Context

The past century has been a tumultuous time for cities. During the post-WWII era, North American cities experienced the proliferation of low-density, suburban development, supported by modern planning ideology. However, modern planning initiatives experienced backlash in the late 20th century, led by Jane Jacobs' scathing critique in *The Death and Life of Great American Cities* (Jacobs, 1961). These modern planning initiatives created divisive expressways in inner-city areas (particularly in the United States), segregated uses resulting in lifeless, underutilized, and unsafe environments, solely relied on the automobile for transportation thus causing congestion, and was increasingly costly to service for municipalities.

Today, cities are continuing to confront the challenges resulting from modern planning initiatives. Additionally, federal and provincial/state governments have downloaded the responsibility of services onto municipalities without the appropriate revenue sources, resulting in fiscally constrained municipal budgets (Slack, 2009). To address these challenges, there is a new age of city building that adopts an alternative form of planning, often called the New Urbanist or Smart Growth movement. Cities are beginning to adopt Smart Growth principles (Pim & Ornoy, 2003), which include:

- preserving greenspace;
- integrating land use and transportation;
- mixing land uses;
- fully utilizing existing urban land and infrastructure;
- ensuring compact building design;
- providing transportation options; and
- directing development within existing areas.

The type of urban development that Smart Growth proponents advocate for is more sustainable for cities: servicing costs decrease while tax revenues increase, farmland and natural areas are preserved, and access to amenities is increased to build healthy communities. This policy direction coincides with recent development trends. There are strong urbanization

trends in Canada and the United States as cities continue to grow (Warren et al., 2013). In particular, downtowns are beginning to see a resurgence in growth (Berg, 2012), and suburban locations are transforming into mixed-use, transit-oriented areas (Kelly, 2015). Additionally, empty-nesters and seniors are downsizing to condominiums in central areas (Lorinc, 2006), while the next generation of homebuyers, the Millenials, prefer mixed-use and higher density settings (Florida, 2005; Lachman et al., 2015). As cities welcome more residents, land supply becomes scarce resulting in higher land values. Due to Smart Growth policy, development trends, scarce land supply, and constrained municipal budgets, cities are looking to fully optimize the spaces within their boundaries.

It is within this urban context that municipalities are being called to explore air rights development (Beyer, 2014; Nursall, 2014; Edmonton, 2015). Air rights development (ARD) achieves a number of Smart Growth principles, coincides with current market demands, optimizes a city's land supply, and acts as a land value capture tool to secure revenues.

Public entities are beginning to explore various land value capture tools to address their financially-strained budgets. Land value capture is the "identification and capture of the increase in land value resulting from public investment in infrastructure" (Mathur & Smith, 2012, p.1). The Center for Transportation Studies at the University of Minnesota released a report comparing the various value capture tools available for transportation finance (Lari et al., 2009). The land value capture tools were evaluated on efficiency, equity, sustainability, and feasibility. In their evaluation, air rights was found to be highly efficient, as it is:

- a market-based strategy;
- highly equitable, as those who benefit from ARD pay for the benefit;
- moderately sustainable, as it is linked to market factors; and
- moderately feasible, depending on the political climate and administrative capabilities.

For a comparison of air rights with other land value capture tools, see Appendix A.

While more and more cities are implementing or exploring ARD, this type of development is not a new phenomenon.

1.2 History of Air Rights Development

The concept of air rights is based in the maxim *cujus est solum, ejus est usque ad coelom,* which translates to: 'whomever the soil belongs, he owns also to the sky and the depths'. The phrase is credited to Accursius in English law during the 13th century, though some argue that the maxim has roots in Roman and Jewish ancient law (Abramovitch, 1961). The historical applications of the maxim typically regulated the digging of wells or development over tombs, but later was used to define property ownership in English law (Abramovitch, 1961).

The first evidence of ARD is the Ponte de Vecchio in 14th century Florence, where merchants developed structures on the bridge that crosses the Arno River (Lillie, 1964). A similar development occurred in Paris with the Pont Au Change over the Seine River. This ARD featured mixed-use development with shops at the ground level and residences above (it was also the site of Inspector Javert's tragic death in Hugo's *Les Miserables).* Unfortunately, an edict ordered the development to be demolished in 1786 (Parsons, 2001).

In North America, the pioneering project that set the trend for ARD occurred in New York City with the Park Avenue development over the New York Central Terminal in 1913. The chief engineer of the New York Central and Hudson River Railroad, William J. Wilgus, envisioned buildings above the Grand Central rail yard, coining the phrase 'thus from the air would be taken wealth' (Gray, 1998). The development was made more feasible through rail electrification, leading to lower ventilation requirements (Goldschmidt, 1964). Several skyscrapers have been built above the rail yards, notably the Pan American Building (now known as the MetLife Building). Historically, ARD has mostly occurred over railways and highways in North America, due to the central location of the transportation routes where high land values justify the added economic costs of ARD (Lillie, 1964). Today, however, development has occurred over a wide variety of public assets.

In the Canadian context, there are several examples of ARD. Vancouver has seen development of the air space above/below its SkyTrain infrastructure, Ottawa's Lansdowne Park redevelopment utilizes air rights, parking lots have been built over downtown rail tracks in Calgary, and Place Bonaventure and Place Ville Marie are built over Canadian National rail

tracks in Montreal. The Toronto Parking Authority frequently sells air rights in the redevelopment of its surface parking lots. The City of Toronto proposed a large 17-hectare ARD project in South Parkdale over the rail and highway corridors, however the plans have since been abandoned (Toronto, 1980). Further developments above Toronto's transit infrastructure (Hall, 2002) and other developments over Toronto's central rail corridor have been proposed (Rider, 2012), but ARD has not been prominent, likely explained by the challenges of ARD as outlined in Section 1.5. Finally, in 2015 the City of Edmonton released a report exploring ARD opportunities above LRT stations, leading to further examination in 2016 (Edmonton, 2015).

1.3 Definition of Air Rights Development

A basic definition of ARD is the development of air space above or below a parcel of land's primary use (New York, 2008). In other words, new 'land' is created where the space around an asset is utilized as buildable space. As mentioned previously, the development above/below assets typically involve railways and expressways, but can include streets, parking lots, canals, or public buildings (i.e. stations, libraries, schools, offices).

This definition of ARD has multiple applications. Cities have implemented transferable development rights (TDR), where density and height is reallocated from one structure to another. This can be an effective preservation technique for heritage buildings, agricultural land, and natural areas by providing a source of revenue for landowners (Bozung, 1985). For more information on TDR, see Costonis (1973), Pedowitz (1974), Bozung (1985), Goelman (1999), and Kwasniak (2005).

Another popular application is constructing a deck over transportation routes to create green spaces above, referred to as 'cap parks'. There have been several successful cap parks, including Boston's Rose Fitzgerald Kennedy Greenway and Seattle's Freeway Park. Further proposed cap parks include a park over Freeway 101 in Los Angeles (Park 101, 2015) and a park over the I-35 in Austin (Reconnect Austin, n.d.). Air rights are secured for pedestrian connections between buildings over streets, such as Edmonton's City Centre Mall or Calgary's +15 network. Finally, governments have integrated various public facilities and uses with one another. For example,

Calgary's new central library will encapsulate an active LRT line, scheduled to open in 2018 (CMLC, n.d.).

While all of these are useful applications, these types of ARD will not be the focus of this report. That being said, some of the topics covered may be relevant to the above applications.

Instead, this report will focus on arguably the most complicated form of ARD, which is private market development of buildable space directly above/below public assets. ARD can occur over public assets such as infrastructure, buildings, and lands that belong to public entities. This paper speaks to a wide range of ARD projects, but specific comments will be provided for projects that require decking, as these are significant opportunities with significant challenges.

In regards to terminology used in this paper, public entity is a general term that encompasses any public body, including municipalities, higher orders of government, public transportation providers, public utility organizations, or other government agencies. Development agreement refers to the contract between the landowner and developer, that specifies the transaction and stipulations in the private acquisition of public air space. Master plans encompass any planning or policy document created by the local jurisdiction, including official or neighbourhood plans. Finally, this type of development can be referred to as air space development, vertical air rights, or overbuilding. For the sake of simplicity, this report will use the term ARD. While this type of ARD is the most complex, it also has significant benefits for public entities.

1.4 Benefits of Air Rights Development

The benefits and challenges associated with private market development of buildable space around public assets were analyzed in previous work by the author (Bunio, 2015). The benefits of ARD can be categorized within the three pillars of sustainability: environmental, social, and economic. Although separated into categories, many of the benefits crossover between pillars.

Environmental

Encourages a more compact and sustainable urban form while avoiding sprawling development.

Directing growth within existing urban areas and integrating development with transportation infrastructure supports a number of Smart Growth principles (Campbell, 2004). By doing so, land and services are more efficiently utilized, creating what Savvides (2002) calls an 'economy of space'. Furthermore, with greater demand for higher density areas and the continual growth of cities, ARD accommodates future populations in a sustainable way (New York, 2008).

Reduces the environmental impact of major transportation routes.

Major transportation routes, particularly highways, emit exhaust fumes that decrease the surrounding air quality. The required ventilation within the platform of an ARD project has the opportunity to capture or treat exhaust fumes, thereby improving the surrounding air quality. Additionally, the platform can mitigate negative impacts such as noise and vibration.

Provides density to support the transit network.

ARD involving transit infrastructure facilitates direct integration of other uses with public transit, thereby improving transit access (New York, 2008). This access increases ridership and reduces reliance on the automobile for transportation, thus reducing greenhouse gas emissions. Additionally, the increased density and ridership result in greater fare revenues, thereby supporting the transit network (Lari et al., 2009).

Social

Reconnects neighbourhoods and the urban fabric divided by transportation routes.

As mentioned in Section 1.1, urban renewal initiatives saw expressways cutting through inner-city areas. The platform above these expressways and other divisive transportation routes such as railways, facilitates connectivity between the neighbourhoods on either side. Therefore, the misfortunes of urban renewal projects may be reversed through ARD opportunities (Campbell, 2004; Pine, 1970).

Facilitates increased connectivity within the transportation network.

Similar to the above benefit, decking across transportation routes creates the opportunity to complete the local road network, thereby increasing connectivity and reducing congestion in

neighbourhoods. Additionally, the increased connectivity of the local road network facilitates faster response times for emergency vehicles (Pine, 1970).

Provides opportunity to improve transportation infrastructure.

It is common to integrate ARD with transportation improvements. The required route closures allow for development of both the transportation infrastructure below and the structures above. Furthermore, ARD agreements can include funding for, or construction of, transit infrastructure by the developer (Hauser, 1989). These transportation improvements allow for better connectivity and reduced congestion at the local and city scale, and may be a boon for the local economy.

Increases safety by providing separate crossings for pedestrians, cyclists, and vehicles.

The addition of separate crossings along the ARD platform reduces conflict between the transportation uses below and those trying to cross (Lillie, 1964). This increases safety for all transportation modes.

Accommodates growth without physical displacement of surrounding residents.

Unlike the urban renewal initiatives that displaced inner-city residents, redevelopment occurs on newly created land. Relocation may be required for the supports or access, and an ARD investment may raise surrounding land values that price out renters in the area. However, for the most part, displacement of existing residents does not occur with ARD (Campbell, 2004).

Revitalizes existing and surrounding areas.

ARD has the potential to raise surrounding land values, stimulating growth in sections of the city and can be targeted to higher-need areas (Campbell, 2004; Lillie, 1964). Savvides (2002) reveals these revitalization impacts where ARD has been proven to raise household income, household value, and rental value. It should be noted that there is a debate around whether raising local land values has positive or negative impacts.

Creates new amenities for existing and future residents.

As with any new development, municipalities are able to secure local amenities. ARD is able to provide new amenities in an existing area that has a shortage of land (Campbell, 2004). These new amenities can address park/open space deficiencies, affordable housing, retail or commercial needs, and employment opportunities. The creation of new land also provides flexibility for public facility siting, thereby increasing access to public services (New York, 2008).

Economic

Possesses several locational advantages.

The sites that are most feasible for ARD are located above transportation routes in central areas. As a result, new development in these areas will likely be in proximity to employment, commercial, and various cultural destinations. Additionally, ARD integrated with transportation uses will have direct access to these modes, further increasing the sites desirability. Therefore, ARD sites are likely to have high market demand, increasing marketability for the developer and raising revenue potential for the public entity landowner (Lillie, 1964).

ARD structures possess high visibility.

Another benefit of being located above transportation routes is the exposure to high traffic volumes and being located within significant view corridors (Lillie, 1964). This high visibility increases market demand for the project, along with the opportunity to create landmark buildings to advance the city's image.

Can provide the last large development opportunities in downtown areas.

Many downtowns of large, thriving cities have few underutilized sites. Additionally, assembling small land parcels from multiple landowners in these areas can be extremely difficult, thereby limiting development opportunities. However, ARD can provide large tracts of new land without the need for extensive land assembly or dealing with multiple landowners (Campbell, 2004; Lillie, 1964). ARD opens up large-scale development opportunities so that central areas can continue to grow and accommodate future populations.

Supports the private market.

By involving the private market in the development of public air space, ARD can have several economic spin-offs (Campbell, 2004). These include business opportunities for developers and financial institutions, and employment opportunities for construction workers, planning and engineering firms, and real-estate agencies.

Decking reduces the transportation corridor's exposure to weather events, thereby increasing service reliability and reducing maintenance costs.

The deck of an ARD provides the uses below protection from the elements (New York, 2008). During extreme weather events such as heavy snowfalls, transportation uses are unaffected below the deck of an ARD. Additionally, the wear and tear caused by weathering is reduced by this protective deck, decreasing maintenance costs of the infrastructure below.

Adds property tax value from land that previously did not generate tax revenue.

Transportation and other utility corridors are usually publicly owned and therefore do not generate property tax revenue. However, by selling air space above these public assets, tax value is created, either through property taxes or payments in lieu of taxes, thereby increasing revenue for local governments (Lillie, 1964).

Leverages public investments as a land value capture tool.

Public investments, whether in transit, transportation, or other categories, typically cause surrounding land values to rise. By using ARD as a land value capture tool, public entities who made the investment are able to capture part of this land value increase and generate revenue (Savvides, 2002). Securing this revenue stream increases the financial sustainability of the public investment and reduces the life cycle costs of the infrastructure. Cervero (1994) notes that for transportation agencies involved with ARD, air rights revenues are very small relative to the transit budgets and cannot be expected to be a significant contributor. However, air rights can be used to finance transportation improvements such as new stations, and as public entities become more familiar with air rights, these types of revenues are expected to increase (Lari et al., 2009).

The benefits can also be categorized by the stakeholders involved in the development process. Table 1 provides a brief summary of the benefits associated with each stakeholder.

Stakeholder	**Benefits**
Municipality	• Accommodates new growth within existing areas that have constrained land supplies • Achieves a number of Smart Growth principles • Increases connectivity of transportation networks • Generates new tax revenues • Generates revenues through land value capture for ARD above municipal assets
Government Agency (i.e. Transit, Utilities)	• Generates revenues through land value capture • Increases access to service (e.g. increase ridership base) • Decking reduces maintenance costs and increases service reliability
Community Residents	• Reconnects surrounding areas • Increases safety of crossing transportation routes • Stimulates growth and revitalizes surrounding areas • Integrated access to employment opportunities • Creates new amenities in the area
Developer	• Development opportunity in a desirable area • Easy land acquisition and assembly • High visibility of structures • Proximity to transportation infrastructure

Table 1: Summary of Benefits to Stakeholders Involved in ARD

Despite the multitude of benefits that are associated with ARD, there are several complexities that come with this type of development.

1.5 Challenges of Air Rights Development

Providing development opportunities around public assets involve a variety of complexities that often thwart ARD proposals. These challenges include economic, political, and community factors, with unique complexities associated with ARD projects that require decking.

Higher construction costs compared to terra firma development.

From the scan of literature and jurisdictional documents, the challenge that was often at the forefront was the economic cost of ARD involving a deck. Construction costs of building a deck range between $300 and $700 per square foot (Campbell, 2004; New York, 2008). The cost is largely influenced by the density of development above the deck. Boston's Turnpike Air Rights guidelines (BRA, 1998) estimate a deck span of 48 to 80 feet will cost $250 to $325/sq ft for a 5-storey structure, and $575 to $850/sq ft for a 35-storey structure (adjusted for 2016 American dollars). Further costs may be encountered for drainage, lighting, and ventilation (Lillie, 1964). The BRA (1998) estimates that these additional costs of lighting, ventilation, signage, and maintenance can be an additional $100 to $200/sq ft (adjusted for 2016 American dollars). The high cost of building the deck needs to be offset by increased densities, large development sites, and high market returns to ensure an appropriate return on investment.

Unique challenges to deck construction.

Developers may experience conditions that cause deck construction to be increasingly challenging, increasingly expensive, or even impossible. These challenges can include existing structures that protrude into the deck plane, erratic topography, or limited space for supporting columns (New York, 2008).

Involves complicated engineering, legal, and architecture components.

In addition to the hard costs, there are also soft costs. Added engineering costs for the structural platform and foundations, legal costs for the complex title instruments and the

negotiation of development agreements, and architectural costs for the design challenges of the structures are encountered in ARD (Lillie, 1964). In regards to timelines, the increased complexities tend to increase the design phase by 20%, and the construction period is extended by another year when compared to conventional development (Campbell, 2004).

Limited to areas with high land values.

The added costs associated with an ARD project necessitate high surrounding land values. This is known as the 'economic threshold', where surrounding land values exceed the cost of the ARD project (Hauser, 1989). If surrounding values do not exceed the costs of ARD, then the developer will likely opt for building on a regular parcel instead of incurring the costs of developing air space. These necessary high land values will limit the amount of appropriate locations for ARD, especially in small- to mid-size cities.

Required high densities of ARD may cause conflict with surrounding residents.

To offset the costs of ARD, developers need to have sufficient density to ensure a profit. However, the height and massing of buildings are common concerns of surrounding residents (Savvides, 2002). Community opposition to an ARD project can be a major deterrent to the proposal's approval, and may inhibit the density needed to make the project feasible.

Financing for ARD projects can be challenging.

Financial institutions may be less likely to support ARD projects due to their unconventional nature and the lack of precedents within a city (Campbell, 2004). This struggle has been evident in the Fenway Center ARD in Boston, where the developer lost its initial financing for the development and the project's future remains uncertain (Ross, 2014).

Appraising air space is a difficult process and can be a source of contention.

Typical land valuation methods of terra firma developments do not apply to ARD due to a number of factors. These include cost of the platform, maintenance of platform, limited expansion or improvement opportunities, and inability of reselling the land in a lease agreement (Lillie, 1964). This unfamiliarity and lack of an established air rights appraisal process

may lead to contention, require a significant negotiation process, and ultimately deter private market investment.

Compatibility between ground and air space uses.

With at least two different owners and different uses within an ARD, these uses must be compatible or have appropriate measures in place so as not to impede each other (Lillie, 1964). This is especially true for ARD projects above transportation routes where the movement of traffic must not be impeded by construction and development activities above, which likely requires a number of safety and risk management measures. Finally, accommodating the future expansion needs of both the ground and air space parcels may be a limiting factor within an ARD agreement.

Lack of a clear implementation structure around ARD.

Since ARD may be unfamiliar to cities with a lack of precedents, public entities may not have the legislation, policies, and procedures needed to facilitate ARD (Williams & McNichol, 1973). There also may be bureaucratic resistance to an unfamiliar and complex form of development such as ARD (Toronto Star, 2014). Unfamiliarity with ARD may also be evident within the local development industry, adding further challenges to ARD implementation.

This implementation handbook on ARD seeks to directly address the last challenge mentioned. While public entities do not have control over market conditions, they should have an effective implementation structure in place to accommodate ARD for when the opportunity arises. The challenges and the corresponding solutions will be explored through the research questions.

1.6 Research Questions and Methodology

This report explores the different ways that a public entity can address the challenges and complexities associated with ARD noted above in order to build an effective implementation structure. This report will be guided by three research questions:

- What is the role of public entities within ARD?
- What options are available to address these complexities in order to build an effective implementation structure for ARD?

- What are the steps public entities should take in order to build an effective implementation structure around ARD?

This ARD implementation handbook analyzes the considerations within an implementation structure, and details the options available to address specific complexities from a public entity's perspective. For this exploratory research, the report used a mixed-method approach in its methodology. This included an academic literature scan, which was completed previously by the author (Bunio, 2015). Additionally, the methodology included a jurisdictional scan of selected case studies and the relevant institutional literature on the various implementation structures. Informational interviews were conducted to ensure accuracy of information.

1.7 Selected Case Studies

Cities that have implemented ARD will typically possess general characteristics of being large in size, having a shortage of land at key locations, and containing barriers such as geographic landforms or transportation routes (Lillie, 1964). The literature scan revealed several municipalities implementing ARD. North American municipalities were focused on for the consistency of urban contexts. To further narrow down the municipalities, a set of criteria was developed in order to select the case studies for this report:

- **The case studies must have constructed an ARD project in the past.** There are many cities looking at ARD or have proposals, but only cities that have built or are in the process of constructing an ARD project were chosen.
- **Cities must have identifiable policies and processes around ARD.** These policy documents are needed to obtain information on the implementation structures.
- **Case studies selected must contain a diversity of models.** This includes at least one Canadian and one American city, models that are more proactive or reactive in their approach, and other differences between the implementation structures. The diversity of models provides a wide range of potential solutions to the associated ARD issues.

Based on these criteria, four primary case studies were chosen. Table 2 provides the city regions and a few examples of ARD projects that were involved in the analysis.

City	Project Examples
Boston	Copley Place, Prudential Centre, *Fenway Center*
New York	Hudson Yards, Manhattan West, Madison Square Gardens, the Bridge Apartments
Vancouver	Marine Gateway, Anvil Centre (New Westminster), Central City (Surrey), *900 Carnarvon (New Westminster)*
Washington D.C.	Capital Crossing, Bethesda Metro Station, Ballston Station, *Union Station North*

Table 2: Selected Primary Case Studies and Examples (Note: examples are completed or currently under construction with the exception of those in italics which are proposed)

In addition to these four primary case studies, other cities were included to provide supplementary information. These include: Atlanta, Chicago, Los Angeles, Miami, Minneapolis, Ottawa, and Toronto. This is by no means an exhaustive list of all municipalities that are involved with ARD. However, the information from these cities will aid in identifying ways to address ARD issues and to develop any recommendations.

1.8 Purpose and Scope

As mentioned in the definition section, this report focuses on private market development of buildable space directly above/below public assets, including specific comments on decking projects. The report seeks to create a handbook for public entities to address ARD issues and help build an effective implementation structure. The literature scan previously completed (Bunio, 2015) revealed the various issues of ARD that a public entity can influence. The issues are separated into four categories with further subcategories, which are detailed in Table 3:

Issue	Subcategories
Political	• Organizational structure of the public entity • Inter-governmental coordination • Benefit sharing amongst public entities • Locating ARD opportunities
Regulation	• Legal instruments • Regulatory controls • Planning and design guidelines • Construction guidelines • Approval process
Facilitation	• Public engagement • Development agreements
Economic	• Overview of cost-saving measures • Air space appraisal • Tax assessment • Incentives

Table 3: Scope of Issues Covered in Report.

The political issues encompass the considerations within the public entity and working with other public entities. The regulation issues include the various tools, such as zoning, building codes, and master plans, which can be used to regulate and approve ARD proposals. Facilitation involves how the public entity deals with stakeholders outside of government institutions, including the community and the developer. Finally, economic issues surround the costs and revenues generated from ARD, and the various incentives used to encourage ARD.

The following chapters are grouped by the four identified categories and will present the various ways that the case studies have addressed each issue. It is important to note that each jurisdiction has unique structures and challenges, and that there is not only one effective way of implementing ARD. Therefore, a range of solutions are presented so that a public entity can pick and choose which elements will work best in their respective jurisdiction. However, recommended steps that are applicable to all public entities are provided in the conclusion.

The purpose of this handbook is to address the lack of a clear implementation structure around ARD. This report is meant to increase a public entity's understanding of how to use their ARD

implementation structure, and to help find the best implementation structure within their local context. By establishing regulations and policies around the various issues, the public entity builds administrative capacity and becomes more familiar with ARD, helping to reduce any bureaucratic resistance. Predictability around ARD is also enhanced, which in turn will help community residents and developers understand ARD, leading to smoother approvals, lower economic costs, and less contention surrounding ARD projects. Overall, public entities will be in a better position to capitalize on ARD opportunities when conditions are favourable.

The end goal of this report is to create a handbook detailing the steps taken to build an effective ARD implementation structure, providing an overview of the considerations, issues, and options that public entities have to facilitate this form of development. The audience for this handbook is public entities that are looking to initiate their own ARD implementation structure or to refine their existing structure. The handbook will serve as a resource of information, and as an initial step to create best practices around ARD implementation.

2.0 Political Issues

The political considerations of ARD involve the bureaucratic structure and the coordination between public entities. The expectations, roles, and responsibilities of each public entity should be identifiable for both the developer and the general public. This will bring predictability to the ARD implementation process, increasing the likelihood of an ARD project being built. This section looks at how public entities should organize themselves and how they should interact with one another within the ARD implementation process. Specifically, this section examines the organizational structure of the public entity, inter-governmental coordination, benefit-sharing amongst public entities, and locating ARD opportunities.

2.1 Organizational Structure of Public Entity

One of the first steps to creating an implementation structure is to determine the team that will oversee ARD proposals. Since ARD involves a wide range of complexities, the committee that is tasked with overseeing ARD should include an inter-disciplinary team of planners, architects, engineers, lawyers, and economists (Savvides, 2002). However, the organizational structure will be different for the various public entities involved, including higher orders of government (i.e. federal, provincial/state), municipalities, and government agencies (i.e. transit).

Federal and Provincial/State Structures

Within the higher orders of government, overseeing ARD projects is typically delegated to established subsidiaries or municipal governments. For the most part, there was limited evidence of separate structures within these higher order governments that were responsible for ARD implementation.

An example of a federal body that is involved in ARD is the Federal Highway Administration (FHWA), which is a part of the U.S. Department of Transportation. Within the FHWA, there is an Office of Planning, Environmental, & Realty which is responsible for overseeing ARD projects over the Interstate highway network. Since transportation infrastructure usually involve land holdings, it is common for transportation providers to have a committee responsible for its real estate and development inquiries. The FHWA Office of Planning, Environment, and Realty is

represented by a wide range of disciplines including community planners, environmental scientists, realty specialists, and transportation engineers (FHWA, 2016). The Office is responsible for providing policy, legislation, regulations, and research.

At the provincial/state level, the organizations that would be involved with ARD would be the various departments of transportation. Sometimes the departments of transportation will be directly involved with ARD projects, such as the Massachusetts Department of Transportation (MassDOT, which took over the Massachusetts Turnpike Authority) and the Virginia Department of Transportation (VDOT) for projects over highways. In particular, the VDOT has an Office of Transportation Public-Private Partnerships that is involved in ARD. However, typically the responsibility of overseeing ARD projects is further delegated to various government agencies such as transportation authorities. For example, TransLink in British Columbia, the Massachusetts Bay Transportation Authority (MBTA), and the Metropolitan Transportation Authority (MTA) in New York oversee ARD as it involves their respective infrastructure.

Government Agencies

The government agencies that are involved in ARD are usually subsidiaries of the province/state but have independent authority, and are typically transit agencies. Most of these transit agencies are regional in nature, such as TransLink serving the Lower Mainland, Washington Metropolitan Area Transit Authority (WMATA) with service across state boundaries, and the Metropolitan Atlanta Rapid Transit Authority (MARTA). As mentioned previously, since these transit networks have a series of land holdings, the transit agency typically has some sort of a real estate office that is responsible for development of its land assets, which includes overseeing ARD. TransLink has a Real Estate Division, MARTA has an Office of TOD and Real Estate, WMATA has an Office of Real Estate and Station Planning, and MTA has a Real Estate department. These real estate divisions create guidelines and regulations, seek developers through a request for proposal (RFP) process, and approve development agreements.

Municipalities

There are several models and options that cities can use to implement and oversee ARD. Some cities employ their existing planning offices to review ARD. In the 1960s, New York and Chicago used their planning commissions to review ARD proposals and provide recommendations to their councils (Goldschmidt, 1964). Today, municipalities in the Lower Mainland, such as Vancouver and Richmond, use their planning offices and city councils to approve ARD. However, some jurisdictions choose to delegate the ARD review process to separate organizations.

One option is to use a quasi-public development agency to be directly involved in the approval and construction of an ARD project. From the literature scan, Savvides (2002) suggests that forming a quasi-public corporation to acquire and assemble air rights sites for joint development projects can be an effective method of managing the ARD process. In the Lower Mainland, the City of Surrey created the Surrey City Development Corporation (SCDC). The SCDC was responsible for the Surrey City Centre development, which involved selling air rights. Using a quasi-public developer will provide more control over the project; however, there is more risk associated when the success of a public investment is dependent on the market response.

Other municipalities have committees that approve specific types of developments. In Boston, the Boston Redevelopment Authority (BRA) is the city's urban planning and economic development agency consisting of a wide range of professions. The BRA is responsible for reviewing large and small scale development projects between 20,000 to over 50,000 sq ft, new overlay zoning districts (planned development areas), and institutional master plans (i.e. post-secondary, hospitals). These development types have a specific review process outlined in Article 80 of the Zoning Code. The BRA reviews ARD projects in a similar manner to the process required under Article 80. As per a Memorandum of Understanding (MOU) signed in 1997 between the Massachusetts Turnpike Authority (now MassDOT) and the City of Boston, the BRA is responsible for design review of ARD over Boston's Turnpike. The BRA also acts as a liaison between the various City of Boston departments within the proposal review, and initiates the community review process (MassDOT, 2014). The benefit of this structure is that

the developer deals with one municipal agency and only needs to submit a single set of documents within the municipal approval process (BRA, 2015).

Washington D.C. has a similar structure. The Zoning Commission (ZC) is quasi-judicial body that oversees preparation, adoption, and amendments to the Zoning Regulation, campus plans, planned unit developments (provides zoning flexibility in exchange for density bonuses), and air rights development in public space (District of Columbia OP, n.d.). The Office of Planning, which is a municipal department, works closely with the applicant on an ARD proposal and provides support or recommendations to the Zoning Commission, who then is responsible for approving the proposal. Both the BRA and ZC have authority to approve ARD proposals, with ARD being one of multiple development application types that these bodies review.

In New York, special-purpose bodies were created for the Hudson Yards redevelopment due to its scale; it is one of the largest private real estate developments in U.S. history (Hudson Yards, 2016). The City of New York established the Hudson Yards Development Corporation (HYDC) which oversees the implementation of the City's Hudson Yards development program with direction from New York city council. The HYDC is made up of planning, development, and construction specialists, and acts as a liaison between the various City departments and State entities, including the MTA, that are involved in the project's financing, planning, development, and construction (HYDC, 2015). The board of the HYDC includes the Deputy Mayor for Operations, various City department commissioners, and community representatives. The City of New York also created the Hudson Yards Infrastructure Corporation (HYIC), which acts as a local development corporation that finances specific acquisition and infrastructure work (HYIC, 2014). The Hudson Yards project involves multiple large-scale public amenity projects, including the Line 7 subway extension and public parks, which are financed by bonds and recovered through future development revenues. In short, the HYIC acts as the bank for specific improvements and the HYDC oversees the planning and development of the project.

The choice for the appropriate organizational structure will depend on existing structures in place, the public entity's resources, and the scale of the ARD project. If there is a separate committee that reviews more specialized development proposals, such as the BRA or ZC, then it

would be advisable to use that committee for ARD review. For large scale projects that are of particular interest to the municipality and require public financing, employing special-purpose bodies or the municipality's quasi-public developer would be effective. Finally, for any government agency or municipality that has a series of land holdings, having some sort of real estate division would be beneficial to maximize its land assets, including exploring ARD opportunities.

Overall, the public entity needs to clarify which committee within the organization is responsible for reviewing ARD proposals. Furthermore, the responsible committee should act as a liaison between the developer and other public entities. This facilitates a smoother ARD implementation process and is also important for coordination between public entities.

2.2 Inter-Governmental Coordination

After the respective organizational structures have been created, it is important to determine how these public entities work together, establishing roles and responsibilities early on in the process (Goldschmidt, 1964). The province/state and municipalities will consistently have a regulatory role within ARD projects just as they do in any other development, although in different capacities. Government agencies will be involved if the project relates to their respective landholdings or infrastructure.

While the higher order governments play a role in ARD implementation, a significant relationship is between the government agency and the municipality. A partnership between these two entities is critical to the success of an ARD project. Roles need to be clearly defined between these two entities. Additionally, the question of which regulations apply to the ARD project has been a source of contention in the past, resulting in a major obstacle to ARD implementation.

The contention of applicable regulations arises from the government agency being a subsidiary of the province/state. In the Canadian context, municipalities are 'creatures of the province', implying that the province supersedes the powers of the municipality. A similar government hierarchy is seen in the United States. Therefore, province/state subsidiaries have questioned

whether local regulations apply to developments involving province/state-owned land. This has been a major source of contention in Boston's Big Dig Project, causing major delays in the approval of ARD. For development above the Turnpike in Boston, the Turnpike Authority was exempt from local zoning and other regulations (Goldschmidt, 1964; BRA, 1998). Meanwhile, pillars for ARD projects that were located on City of Boston land were under BRA control, leading to more conflict (Schulte, 2009). For the first ARD projects in Boston, local regulations did not apply, leading to developments like the Prudential Center, which is largely out of scale and is despised by local residents (BRA, 1998).

Today, some jurisdictions still refuse to apply local regulations to ARD. For example, in the Miami-Dade County, zoning authority is transferred from the municipality to the County for ARD above Miami-Dade Transit (MDT) infrastructure (Mathur & Smith, 2012). The argument for removing local authority is to ensure land uses around MDT infrastructure are coordinated along the entire corridor. However, shifting authority to higher levels of government goes against the 'subsidiarity principle', which states that effective service provision requires decision-making to be done at the level of government closest to the individual citizen (Slack, 2009). In fact, the Turnpike Authority signed an MOU with the City of Boston in 1997 that designated design review to the BRA (BRA, 1998). Local regulations apply in the Vancouver, New York, Washington D.C., Minneapolis, and Atlanta case studies as well, and is the apparent norm for ARD. By retaining local control of the development, the approval process will be smoother and the development is more likely to integrate with the surrounding areas to become a successful ARD project.

An overview of the typical roles and responsibilities of three public entities: municipality, government agency, and higher orders of government (federal, province/state) is provided below.

Municipalities

It is common practice for municipalities to be responsible for approving an ARD project and its design. The chosen committee of each municipality would take the lead role, and the project would undergo department review and be approved by their respective city council, similar to

other development proposals. Each primary case study had the municipality outlining the approval process of ARD, which makes it more clear for developers and community residents. If ARD is above/below a municipal asset or municipally-owned land, then the appropriate committee would also be tasked with creating a development agreement.

Government Agencies

ARD above/below infrastructure or land that belongs to a government agency will involve the appropriate committee within that organization, most likely the real estate division. The government agency's primary role is to select a developer and their proposal, and determine the development agreement, including the transaction (i.e. lease or sale). As part of that development agreement, government agencies will likely have construction guidelines to follow, so as not to interrupt service below and for safety purposes. For example, TransLink has Adjacent and Integrated Development Guidelines that regulate the construction activities of developers (TransLink, n.d.b). Similarly, MassDOT requires the proponent to submit a Construction Management Plan, detailing items such as schedules and parking areas for workers. Government agencies may also be active in preparing their assets for development. In Atlanta, MARTA has been involved in rezoning its land holdings, further facilitating ARD opportunities.

Coordinated Approach

Overall, for ARD involving a government agency, the municipality is primarily responsible for approving the design of the development while the government agency is responsible for approving the development agreement. This creates a two-shop stop for developers interested in an ARD project, one at the government agency and one at the municipality. This is certainly the case in Vancouver where there are two separate processes, one with the municipality and one with TransLink, as shown in Appendix B. However, there are options to create a more coordinated approach between the two public entities.

One of the leaders of this coordinated approach between the municipality and government agency is the WMATA in Washington D.C. The WMATA has created Joint Development Guidelines (WMATA, 2013) that specifically detail the role that the municipality plays in the

ARD process. The Guidelines suggest that the local jurisdiction designate a person or office as the liaison to the WMATA in joint development activities. When exploring sites for ARD opportunities, the WMATA staff creates a list of potential sites, while also allowing the local jurisdiction to determine sites. The WMATA then initiates station planning, which includes consultation within the department, community, and local jurisdiction. The WMATA and the local jurisdiction may also enter into an MOU on outreach procedures moving forward. The WMATA then looks at the zoning and market readiness of the sites. If changes to zoning are needed, then the WMATA staff will consult with the jurisdictional representatives. After releasing the RFP to developers, the developer must first meet with the local jurisdiction before it submits an application, and must include this consultation as part of its proposal. From then on, the local jurisdiction can participate in the developer presentations and in the evaluation of the proposals, with the exception of financial information which is kept confidential. While the WMATA maintains control over the development agreement and the selection of the developer, the local jurisdiction is included throughout the entire process and can provide input on how the development agreement is shaped. Additionally, the initial consultations with the local jurisdiction can lead to zoning changes if necessary, providing easier implementation of an ARD project. After the development agreement is established, the jurisdiction is then responsible for approving the project. Overall, the process becomes streamlined which increases the likelihood of success.

There are other examples of government agencies working alongside local jurisdictions, notably within the RFP process. Government agencies in New York and Boston both consult local jurisdictions during the evaluation of the development proposals. By having both parties on the same page at the beginning of the process, the implementation of ARD will be much smoother.

Higher Orders of Government

For a higher order of government, since municipalities are ‘creatures of the province’, their role involves delegating powers to implement ARD. Provinces/states will grant the authority to government agencies or municipalities to enter in ARD agreements. For example, the Massachusetts General Laws grant the ability for MassDOT to lease air rights over land owned

by the department (Massachusetts, 2016). In British Columbia, the Province grants the authority to create air space parcels above highways to the municipality if the highway land title is vested solely in the municipality (British Columbia, 2016). The province/state can also stipulate that ARD follow local regulations or be approved by the locality. Examples of this can be found in the Massachusetts General Laws and the Code of Virginia.

Apart from the delegation role, the higher orders of government may directly be involved in approving ARD if it affects infrastructure directly under their control. For instance, the FHWA will approve ARD over the Interstate highway system, primarily to ensure development does not inhibit traffic below. Additionally, environmental reviews may be required under the National Environmental Policy Act and other legislation. The province/state can also have a conflict resolution role between the municipality and government agency. In Boston, the State Development Cabinet is tasked with resolving jurisdictional disputes (Hauser, 1989).

To determine what government agencies and other landholders should be involved in an ARD opportunity, an overview of ownership within the site needs to be conducted. Sometimes a right-of-way (ROW) will have several government agencies and easements involved, along with the site having multiple land owners, which Campbell (2004) refers to as “muddled jurisdictional authority” (p. 63). In this situation, Hauser (1989) suggests using the ‘master lease’ method, where the majority stakeholder would take the lead role and be responsible for negotiating the value of the air rights and development agreement.

2.3 Benefit Sharing Amongst Public Entities

Another factor that needs to be considered by public entities is how to distribute the financial benefits resulting from ARD. Disagreements on revenue sharing can be a major source of contention between public entities, and lead to decreased cooperation which creates obstacles to ARD. This section will highlight the typical distribution of ARD benefits amongst the affected government organizations.

There are four types of benefits that result from an ARD project:

- Air rights valuation

- Property taxes
- Community Amenities
- Density Bonusing and Incremental Land Lift

Air Rights Valuation

A revenue stream is created when the landowner sells or leases the air rights to a developer, where the amount is based on its valuation. As noted in the *cujus est solum, ejus est usque ad coelom* maxim, the owner of the surface of the land also owns the air rights above. By owning the title to the land, landowners are able to develop the air space above and create density. Therefore, the sale or lease of air rights and the resulting revenues generated from ARD belong to the landowner. Since the landowner receives the air space revenues, the development agreement and transaction (i.e. lease or sale) will be conducted by the landowner. If the ARD site contains multiple landowners, then the 'master lease' method (Hauser, 1989) can be used to determine the allocation of air rights revenues. The percentage of ownership within the site is used to distribute the air rights revenues among the landowners based on their proportion.

For the ROWs or easements running through the site, the corresponding stakeholders may be entitled to a portion of the air rights revenues. ROWs and easements are generally agreements that permit another party to use the landowner's property in some fashion (ALSA, 2016). While not being able to sell or lease the air space above the ROW or easement, these stakeholders are able to ensure that surrounding development does not hamper the use of that easement. Therefore, if an ARD project requires additional maintenance and operation costs to protect the use of an easement, then the air rights revenues need to be apportioned to that stakeholder to recover these costs. This ensures that ARD does not violate property rights and increases the likelihood that all stakeholders will cooperate with the development.

There are some subsidiaries of a public entity that have a level of independence in regards to its operations, but the landholdings remain under the ownership of the public entity. For example, the Toronto Parking Authority is a self-sustaining municipal agency that manages public parking infrastructure in Toronto. The Authority is involved in the redevelopment of its surface parking lots, selling the air rights above. However, the City of Toronto remains the owner of the Authority's landholdings. As a result, there is an income sharing agreement between the

Authority and the City, where 75% of the net income total of ARD belongs to the City and the remaining 25% belongs to the Authority (Persiko, 2011). Other arrangements involving a mismatch between ownership and operation can use income sharing agreements to determine revenue distribution.

Property Taxes

Similar to the issue of local regulations being applicable to ARD above provincial/state assets, local property taxes have also been challenged. This issue has been seen in Boston where the State exempted air rights from city property taxes (Frug & Barron, 2008). Today, most ARD projects are subject to property taxes that can generate significant revenues. In British Columbia under the Land Title Act (British Columbia, 2016), air space titles must be separately assessed for taxation. Additionally, the Massachusetts General Laws ensure tax provision or payments in lieu of taxes for jurisdictions involved in ARD (Massachusetts, 2016).

The property tax revenues should be provided to the local government (i.e. municipality or county) that is responsible for providing the services. This property tax revenue is significant for local governments because it creates revenue from a property that may not have generated tax revenue previously.

Community Amenities

Just like any new development, local governments can regulate the provision of community amenities. These can include parks and open spaces, schools, and cultural spaces, as seen in the Hudson Yards development (Hudson Yards, 2016). In Vancouver, the City may require that new developments transfer an air space parcel to the municipality, which is used for variety of public benefits such as libraries or day cares (Vancouver, 2016). These amenities that can greatly improve the services of the area and meet the needs of residents.

Another notable community benefit is the provision of affordable housing through ARD. The WMATA requires all new developments above its Metrorail stations to meet the affordable housing requirements set by the local jurisdiction (WMATA, 2013). MARTA's Transit-Oriented Development (TOD) criteria that affect ARD set a goal of 20% of units to be affordable housing

(MARTA, 2014). Washington D.C.'s Capital Crossing will have 30% of units as affordable housing (District of Columbia DMPED, n.d.). Additionally, the MBTA sold air rights over the South Station Tower in Boston, generating $10 million in linkage funds to construct affordable housing (Lari et al., 2009). There have been other examples of linkage in regards to job creation in Washington D.C. (District of Columbia DMPED, n.d.) and Minneapolis (Minneapolis, 2014) associated with ARD projects. This is a great example of inter-governmental cooperation wherein the government agency helps advance the goals of the municipality through ARD. It is recommended that the government agency require ARD to have community benefits in order to foster a healthy working relationship with the municipality and local community.

Density Bonusing and Incremental Land Lift

Municipalities commonly allow for increased density and heights in exchange for additional amenities or developer contributions, referred to as density bonusing. Planned Unit Developments (PUD) in Washington D.C. and Planned Developments in Boston are similar tools, where an overlay allows for flexible zoning regulations in exchange for public amenities. Both of these tools can be applied to ARD, with Capital Crossing in Washington D.C. as a notable example (Steingasser, 2010). As was the case with Capital Crossing, these overlays allow for much needed density to make ARD projects economically feasible. This added density is likely appropriate if the ARD site is located in a central area or above public transit. In return, municipalities receive further amenities or developer contributions.

Local jurisdictions may also capture the incremental land lift of a planning decision. In Vancouver, the City captures the rise in land values as a result of a rezoning, allowing increased density through Community Amenity Contributions. This is seen as a win-win situation where the developer increases its revenues by selling more units and the City captures a portion of the land lift to provide increased community amenities (Vancouver, 2011). To determine the incremental land lift, the City uses a 'before and after' method where the value of the land before the rezoning is compared to the value after. The increase in land value is then negotiated between the developer and the City, where the City typically acquires 70-80% of the land lift (Vancouver, 2011).

For developments that integrate with transit infrastructure, the Community Amenity Contributions need to be a win-win-win situation; benefits the municipality, developer, and infrastructure owner. For example, TransLink typically has ROWs and easements for its SkyTrain lines and does not own the land. For TransLink to participate in ARD, it needs to receive some sort of benefit from the project, or else it will not be incentivized to participate in development above/around its infrastructure. Therefore, Community Amenity Contributions need to be allocated appropriately, or the financial benefits that are secured by the municipality can be directly invested in transportation infrastructure in the community.

In an alternative scenario, if a developer proposes direct access to a transit station, then the government agency can negotiate with the developer to capture a portion of the land lift that results from that decision. To allocate the portions of incremental land lift, the stakeholders that are responsible for that land lift need to be determined in isolation. Land lift will occur because of a municipal rezoning, while also occurring because of a direct link to a transit station approved by the government agency. By determining the land lifts separately, it is then clear which stakeholder is able to capture the negotiated portion of that land lift. Overall, both density bonusing and incremental land lift capture can provide benefits for municipalities and government agencies.

In sum, it is important that each public entity affected by an ARD project receive some form of the resulting benefits. Without receiving any kind of benefit, there is no reason for that public entity to cooperate in the ARD process. Determining a fair allocation of benefits will help prevent contestation of revenues and ensure effective collaboration within the ARD process.

2.4 Locating Air Rights Development Opportunities

Another activity that public entities can participate in is the location of opportunities for ARD. The benefit of a public entity identifying ARD opportunities is to inform developers and further encourage this type of development. It can also help public entities prepare the site to be suitable for development, taking actions such as rezoning, land assembly, or establishing funds or financial tools for necessary improvements. These analyses can be done by government agencies or by the local jurisdiction.

Siting ARD locations can be conducted on a city-wide scale, such as the inventory of decking opportunities over transportation corridors created by the Department of City Planning in New York (New York, 2008). This inventory is a comprehensive review that acts as a preliminary analysis of potential corridors for future consideration without suggesting land use changes. It was completed by the local jurisdiction, but included properties owned by other public entities. The opportunities were categorized under rail/transit open cuts, rail/transit yards, and roadway open cuts. Evaluation criteria were applied to the corridor and areas within a quarter mile.

Other examples are more corridor or area specific. Just outside of Washington D.C. in Arlington, Virginia's Office of Transportation Public-Private Partnerships requested information on air rights opportunities in Arlington and found that the I-66 corridor in Rosslyn was the most promising. Arlington County chose to conduct their own review of ARD opportunities in Rosslyn, primarily using a pro forma analysis of the anticipated revenues and costs to evaluate the economic feasibility and appropriate timing of development (Arlington County, 2015). Other jurisdictions use a collaborative approach. The WMATA works with local jurisdictions to locate ARD opportunities over its infrastructure (WMATA, 2013).

The search for ARD opportunities can include various areas such as railroad properties, waterways, highways, off-street parking areas, or other public structures (Lillie, 1964). From the analyses that have been completed, multiple criteria have been used to evaluate ARD opportunities. Table 4 provides a summary of the criteria selected from the case studies and literature review.

New York City-Wide Inventory (New York, 2008)	Literature Scan (Lillie, 1964; Clancy, 1998)
• Location • Size • Surrounding zoning • Potential mapped/connecting streets (should the parcel be decked over) • Existing corridor use • Description of the corridor and its parcels • Ownership of parcels • Topography issues • Ventilation issues	• Accessibility to the site • Visibility of the site • Proximity to high amenity areas (i.e. downtown, universities, employment areas) • Existing land use below and beside • Elevated, ground level, or depressed land use • Nature of surrounding development • Ownership of transportation corridor and/or land • Size of potential ARD site (to create economies of scale) • Value of Land

Table 4: Summary of Criteria Used for Locating ARD Opportunities

Additional considerations not included in this table can involve jurisdictional policy direction and local community opposition or not-in-my-back-yard (NIMBY) concerns.

Each public entity will have unique and specific considerations that will need to be taken into account, however these past analyses can be used as guides. By comparing the lists in the table above, there are similarities in the criteria used to locate ARD opportunities. The public entity should consider the location, existing and surrounding land uses, ownership, zoning and policy context, economic feasibility, and any specific technical and legal challenges related to each site.

3.0 Regulatory Issues

This section details how public entities can control and regulate ARD. There are several tools that can be used to guide an ARD project. These tools include legal instruments affecting site ownership, municipal regulatory controls, and guidelines for planning, design, and construction. Additionally, an overview of ARD approval processes is provided.

3.1 Legal Instruments

The creation of air space parcels above a horizontal plane requires the appropriate legal tools. As previously seen, the legal basis of air rights is found in the maxim *cujus est solum, ejus est usque ad coelom,* implying the surface landowner also owns the air space above. Air rights are part of a 'bundle of rights' that are tied to property, which can be sold or leased by the landowner (Lillie, 1964). In North America, the horizontal stratification of air space is not a new phenomenon, where selling stratums of space has been evident since the mid-19th century (Bell, 1928).

In order to create air space parcels, there needs to be supporting legislation from the province or state. This legislation can guide the creation of air space parcels and grant authority to municipalities or government agencies to form air space parcels. For example, under Part 9 of British Columbia's Land Title Act (British Columbia, 2016), submission requirements to the registrar to create a land title are outlined, while also granting the authority of municipalities to create air space parcels over highways. The Massachusetts General Laws (Massachusetts, 2016) grant authority to MassDOT to lease air rights over land owned by the department in connection with the Turnpike in Boston. It is recommended that the public entity landowner review the legal environment with their attorneys or legal authority to understand its own powers and options (Lillie, 1964). Additionally, it is common to restrict liens on the parcel for ARD to prevent encumbrances, as seen in Minneapolis' Centre Village ARD (Minneapolis, 1983).

From the literature jurisdictional scan, there are four main legal arrangements that public entities have used for ARD:

- Leasing air space

- Sale of land with easement
- Air space subdivision and sale of air space
- Condominium/Strata

Leasing Air Space

One of the most common legal arrangements used for ARD involves the public entity retaining ownership of the land (terra firma) and leasing the air space to a private entity while providing easements for columns and access. This is particularly common for ARD over highways or railroads (Clancy, 1998). Examples include the Hudson Yards development where the MTA leases air rights over its rail yards, Capital Crossing leasing air rights over Interstate 395 in Washington D.C., and MassDOT leasing air rights over the Turnpike in Boston.

There are a number of benefits from leasing air space. The public entity is able to retain control and ownership of the property, a revenue stream is created through rent, and the air space may appreciate in value over the term of the lease (Clancy, 1998). There may also be advantages for the developer and future tenants in a lease, including lower site control costs and being able to use lease payments as tax deductions (Clancy, 1998).

Sale of Land with Easement

In contrast to the lease arrangement, the public entity may sell the piece of land, transferring fee simple ownership to the developer, but retain an easement for the uses or infrastructure below. Examples include the Prudential Center in Boston (Clancy, 1998). The sale of air rights may be preferred by developers because it provides more control, and the land may appreciate in value over time. However, the public entity loses control over the property which may be problematic if there is a need to alter or expand the infrastructure below.

Air Space Subdivision and Sale of Air Space

Subdividing the air space horizontally into two or more parcels is another legal arrangement for ARD. This involves creating distinct titles in reference to a three-dimensional site plan. This allows for the public entity to retain ownership of the land (referred to as the 'remnant parcel') while the developer owns separately the air space above and associated column supports (referred to as the 'air space parcel'). This has become a common practice in Vancouver,

especially for mixed-use developments (Jones, 2007). Examples include Central City in Surrey, British Columbia (Jones, 2007) and the Lansdowne Park redevelopment in Ottawa (Kirkpatrick, 2012). This is an attractive option because it provides more freedom and control for both parties without needing to share common areas. Issues can include limited expansion opportunity for the remnant parcel and revenue being limited to a single, lump-sum payment.

Condominium/Strata

ARD ownership can also be arranged through a condominium or strata agreement. An ARD condominium arrangement would consist of the public entity owning the land and infrastructure below while the air space above can be divided into individual units to be sold. The difference between condominium and subdivision is that the public entity and individual owners would share common areas in a condominium agreement. These shared elements could include access to and maintenance of the platform or columns (Pine, 1970). An issue with the condominium arrangement is that the shared responsibility or common elements may be a source of contention among owners and may limit uses (Jones, 2007).

Since each locality is unique, some legal arrangements may be more appropriate than others depending on the local context. Developers may not be accustomed to leasing land or air space in a particular municipality, and therefore will be more inclined towards a sale of air rights. Furthermore, the options available to a public entity may be limited within the provincial or state legislation. Therefore, the choice of legal arrangement will be dependent on the legal environment and the local market.

3.2 Regulatory Controls

This section highlights the various ways that ARD is regulated and how it works with other tools that governments use to regulate development. These tools are primarily used by local governments, but it is important for government agencies, developers, and the general public to understand how ARD is regulated. Below is an overview of the tools that have been used to regulate ARD.

Higher Order Government Regulations

The previous sections showed that ARD above state- or federally-owned infrastructure requires approval from the respective governing body. An example is the Federal Highway Administration (FHWA), where all ARD projects above the interstate highway system need to follow established guidelines and are approved by the FHWA. Many ARD projects will also require environmental assessments to be submitted to provincial/state or federal governments. For example, ARD in Boston may require review by the United States Environmental Protection Agency and the State Office of Environmental Affairs for discharge and other environmental permits (Epsilon Associates, 2008). Federal environmental reviews are required for the proposed Union Station ARD in Washington D.C., which typically take between 3 and 7 years for complex projects (Neibauer, 2015). Having knowledge of these regulations and their respective timelines are important for ARD projects.

Master Plans

ARD can be incorporated within any local jurisdictional planning document guiding the greater area. These plans can be corridor specific, such as the master plan created for ARD opportunities over the Turnpike in Boston (BRA, 1998). ARD opportunities can also be incorporated into city official plans or neighbourhood plans. In Washington D.C., the city-wide Comprehensive Plan, under Central Washington Policy 2.5.6, promotes ARD over the I-395 (Steingasser, 2010). Chicago's Union Station Master Plan also has long-term provisions for air rights (TranSystems Corporation, 2012). Including ARD opportunities within master plans can increase awareness within the development community, help integrate the development within the surrounding areas, and encourage more sensitive development.

Zoning

This report has shown the importance of applying local regulations to ARD, which includes zoning. Before Massachusetts mandated development to follow local regulations, ARD over the Turnpike was essentially zoning-free. This was initially seen as a major benefit as it was perceived to provide more freedom for the developer. However, as Campbell (2004) shows with the Columbus Centre ARD in Boston, the lack of zoning actually became the project's

biggest disadvantage. Without a clear process identified and without providing any form of direction for the site, uncertainty grows, which is a major issue for developers and investors (Schulte, 2009). In fact, without applicable zoning, the developer of the Columbus Centre ARD had to contend with several stakeholder desires much later in the development process, leading to numerous redesigns and added public consultation costing over $3 million (Campbell, 2004). Not only does zoning help to ensure sensitive development in the local area, but it also provides a clear process and manages the expectations of the stakeholders.

There are several types of zoning that municipalities can use. Many municipalities use the existing zoning in place. For example, municipalities in the Lower Mainland do not have specific zones for ARD, but use existing zones to regulate the proposal as if the development was on terra firma. Often the ARD is regulated under site-specific zoning. The Marine Gateway development and the ARD near the Main Street SkyTrain Station are zoned as Comprehensive Development Districts (CD-1). CD-1 or other site-specific zones are tailor-made to the proposed development, often facilitating more flexibility for the developer with a lengthier and more involved review process. Additionally, it is common for local governments to treat the ARD as a single entity, even if it is split among different owners and titles. In New Westminster's Zoning Bylaw, the definition of site mentions that the air space parcels and land will be treated as a single site (New Westminster, 2001). This is important for calculations such as density or for parking requirements.

Other jurisdictions have general provisions for ARD in their zoning bylaws. In New York's Zoning Resolution (New York, 2016), provisions are made for air space development over railroad and transit ROWs involving residential (22-41), commercial (32-44), and industrial (42-462) uses. Essentially, these sections specify that development above these ROWs are limited to accessory uses or passenger stations. However, special permits may be granted over rail and transit (74-681) or streets (74-682) for other types of development. Conditions for granting these permits include:

- adequate street access;
- density and distribution of buildings do not adversely affect the surrounding area;
- uses do not conflict with one another; and

- development does not prevent future use or improvements to the ROW below.

Additionally, the Commissioner may determine appropriate parking and loading requirements, along with suitability of development with the surrounding area's character. The role of the Commissioner in these special permits provides flexibility and facilitates appropriate integration with the surrounding areas.

Other case studies use overlay districts as a form of density bonusing. Boston, Chicago, and Washington D.C. use this type of density bonusing overlay, known as Planned Development Areas (PDA), Planned Developments (PD), or Planned Unit Developments (PUD) respectively (Lopez & Hampton, 2014; Chicago, 2015; District of Columbia, 2002). These overlay districts follow the existing zoning, but provide flexibility for aspects such as density, height, and parking requirements. As a result, there is a separate development review used and the developer provides additional community benefits.

A final form of zoning is stand-alone zones that are catered to an ARD project. For example, the Hudson Yards Development is under the Special Hudson Yards District zoning (New York, 2005). Boston's Zoning Code contains the South Station Air Rights Development Sub-Area, which has specific height and FAR requirements (Article 40.7). In Washington D.C., the Union Station ARD is under the Union Station North (USN) zoning. Interestingly, the Union Station ARD considered split zoning where the ground parcel would remain industrial so Amtrak could continue to build structures, and a high-density zoning (USN) above for the ARD (Steingasser, 2009). These zones have specific regulations for ARD and establish a review process.

There are several zoning options for local governments. A key consideration with the zoning tool is to balance the need to ensure appropriate and sensitive development while providing sufficient flexibility to accommodate this complex form of development (Campbell, 2004). Each of the types explored above have some element of flexibility incorporated into the approach. Flexibility can be justified if there are additional community benefits provided or if the ARD is above public transit infrastructure.

Subdivision

If the legal arrangement involves a subdivision of air rights parcels, then the local jurisdiction will have a review and approval process. Both the City of Vancouver (Vancouver, 2016) and the City of Richmond (Richmond, 2015) in British Columbia have air space subdivision review processes. These generally involve an application fee, a title summary report with a lawyer's opinion on the subdivision impacts, a 3D site plan, architectural drawings, and a code report prepared by a code consultant or certified professional on how the air space parcel will comply with building codes.

Covenant Agreements

Sometimes the owners involved in an ARD project will be required to enter into an agreement with the municipality. Under British Columbia's Land Title Act, Section 219 Covenants allow local governments and government agencies to impose obligations or restrictions on the land or development. These agreements can ensure that future owners of air space parcels are bound by the initial agreement, and are typically done at the time of subdivision. For example, the City of Vancouver requires owners involved in an air space subdivision to grant a covenant to the City, where the owners release and indemnify the City of all liability from treating the building as a single entity, and owners agree to maintain common safety and maintenance systems and exits (Vancouver, 2016). These types of covenants can be flexible while adding another layer of control for local jurisdictions.

Building Codes

From the literature scan, Lillie (1964) suggests that national and regional building standards should be established for ARD. The City of Vancouver's Building By-Law has provisions for ARD under section 1.3.3.5: Air Space Subdivision (Vancouver, 2014). The building by-law states that the Chief Building Official should treat the subdivision of parcels as a single building, and generally ensures that owners have shared access to fire, life safety, and other systems.

Building Permits

As with other developments, the local governments will require a series of building permits. Additional permits that are required for ARD may include various foundational permits. In

Boston, permits include groundwater and sewer discharge, parking garage, building and occupancy, and tieback/earth retention (Epsilon Associates, 2008). From the jurisdictional scan, generally there are no special or unique permits required for ARD.

There are several tools that local jurisdictions can use to regulate ARD. A summary of all the anticipated approvals and permits for an ARD project in Boston can be found in Appendix C. The regulations need to have a balance of providing clear direction for the development but also being flexible to accommodate the unique challenges of the site. The amount of regulations can be daunting for potential developers, which is why it is important for the responsible organization to act as a liaison between the developer and other government agencies. In general, local governments should clarify the regulations surrounding ARD to increase awareness within the private sector and the general public.

3.3 Planning and Design Guidelines

There are several planning and design considerations involved with ARD. Most of these considerations are not unique to ARD; however, some are more emphasized. The majority of planning and design considerations are reviewed on a case-by-case basis. Guidelines can be established for a specific piece of infrastructure such as the FHWA's Airspace Guidelines (FHWA, 2010) or Los Angeles County's guidelines for overbuilding open channels (Los Angeles County, 2004). Other guidelines can be established for districts or corridors, such as the guidelines for development over the Turnpike in Boston (BRA, 1998). The Turnpike air rights guidelines separate the corridor into districts and provide recommendations in four main areas:

- Uses (upper floors, street level)
- Transportation (pedestrian circulation, parking, traffic management, public transportation, vehicular access and circulation, bicycle)
- Public Realm (public open spaces, connections, and sidewalks, view corridors)
- Form (building locations, scale and massing, height, design character)

Overall, there are two emphasized design considerations for ARD: integration with surrounding areas and the design of the platform.

ARD project proponents need to consider their surrounding areas and should be developed as part of a cohesive unit. It is important to apply design considerations to abutting lands to

facilitate a smooth transition and direct how the ARD can enhance its surroundings (Campbell, 2004). Public ownership of land around an ARD site can help ensure that the ARD and surrounding areas are developed holistically (Campbell, 2004).

One of the main considerations to ARD integration is the character of the surrounding area. This includes appropriate height, massing, and density, and an appropriate transition of building heights. The Turnpike air rights guidelines note that the ARD uses influence the massing of the buildings, with smaller and skinnier towers for residential and large floor plates for office uses (BRA, 1998). Design considerations also include complimentary building materials and architectural styles (Campbell, 2004). The Prudential Center in Boston is an example of an inappropriate development, as the 52-storey glass tower is adjacent to Victorian low-rise structures (Campbell, 2004). Instead, ARD structures should reflect the neighbourhood's style and density. The ARD structures themselves also have an opportunity to be landmark buildings if they are in high visibility areas (Lillie, 1964). These landmark structures can further build upon the identity of the neighbourhood.

Another consideration is connectivity of the ARD. This includes complimenting and connecting the local street network, providing a comfortable pedestrian realm, and integrating with transportation infrastructure. The ARD should not impede the flow of traffic below. Additionally, the ARD should provide direct connections to public transit if it is located above such infrastructure. The project should also consider the long-term needs of the transportation system and identify any improvements or future expansion needs (Goldschmidt, 1964). In regards to the public realm, ARD proponents should consider multi-modal transportation connections, community amenities, parks and open spaces, and view corridors. These amenities may also lead to the community accepting higher densities and foster community support for the project (Campbell, 2004). Finally, connections need to be considered for utilities, and a servicing plan for the area is recommended. Lillie (1964) recalls an ARD project in Chicago that was prevented because it did not have the required utilities.

Consideration should also be given to the lifespan of the uses involved in an ARD project. Goldschmidt (1964) notes that the different uses involved in ARD may have differing rates of

obsolescence, where some uses will have an end date before others. Therefore, flexibility in the design of the ARD structures is encouraged to accommodate different uses or the expansion of current uses.

Finally, the design of the platform is an important consideration. The platform is one of the most significant investments within an ARD project and provides some of the greatest challenges. Design considerations of the infrastructure below can help ease some of these complexities. These include providing wide medians within the transportation route and land on either side for structural supports (Campbell, 2004). Without this adjacent land for foundations, the developer needs to build slurry walls and cantilever systems at the edge of the corridor which greatly increases the costs (Campbell, 2004). Additionally, depressing the transportation route can help ease the transition between the adjacent land and future platform (Hauser, 1989).

There are a number of safety considerations when designing a platform, including lighting, ventilation, and preventing objects falling onto the corridor below (Hauser, 1989). The design of the deck will be influenced by the transportation corridor (Williams & McNichol, 1973). For example, rail electrification leads to lower ventilation requirements. Additionally, the lack of a basement is an issue for underground parking, utilities and services, and mechanical equipment such as elevator pits (Campbell 2004; Hauser, 1989). The Union Station ARD zoning addresses these issues by allowing mechanical equipment and parking areas to be located in the platform itself (Steingasser, 2009). Other solutions require the mechanical equipment and parking to be located elsewhere.

Finally, the design of the platform must address environmental issues such as noise, vibration, fumes, drainage, and heat. The Hudson Yards platform provides an innovative design to address many of these issues.

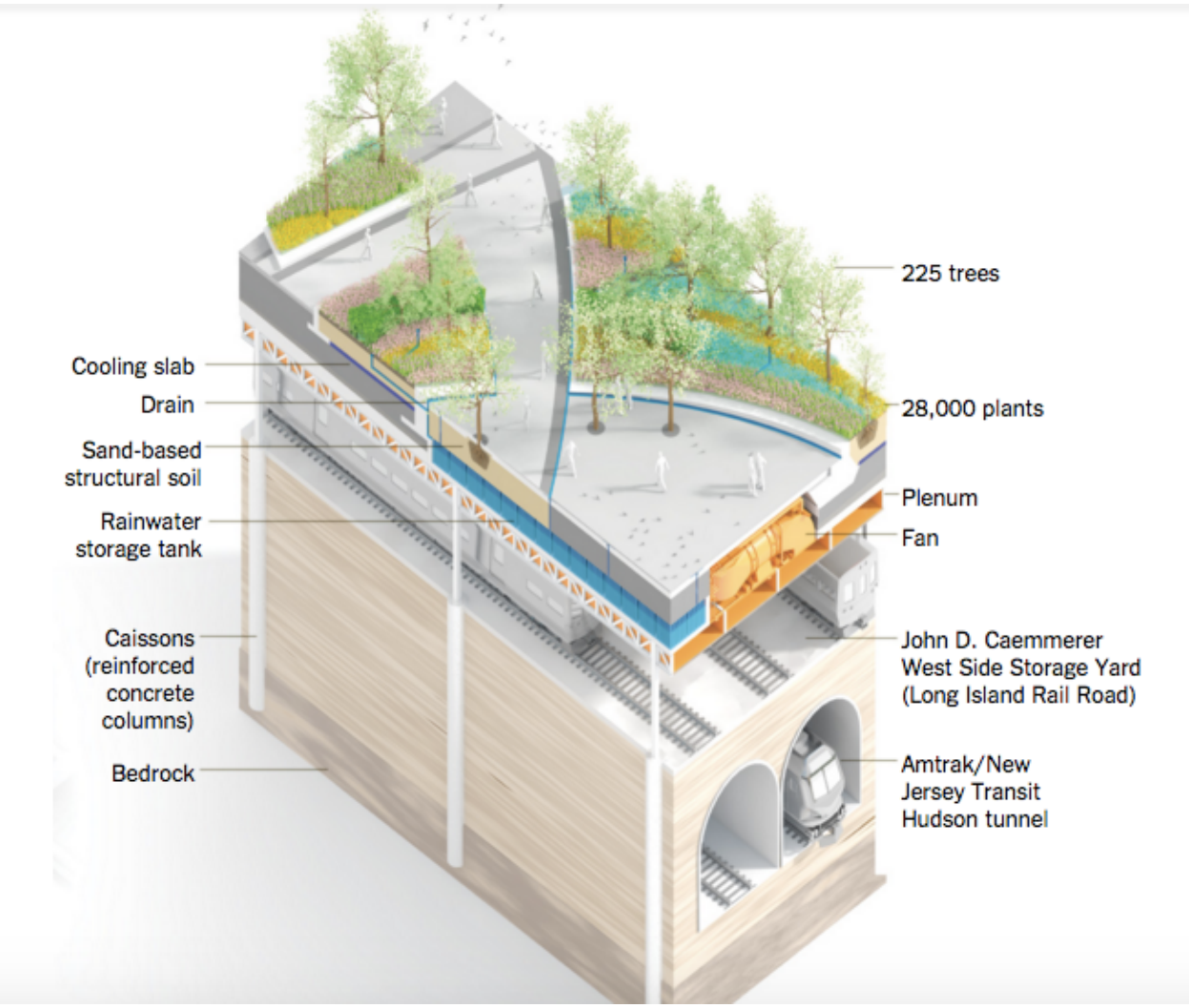


Figure 1: Cross-section of Hudson Yards Platform (Dunlap, 2015)

As seen in Figure 1, the platform consists of a series of layers. Clearance above transportation infrastructure can range between 16 and 24 feet. The first layer of the Hudson Yards platform above the rail yard is a six-foot high empty area known as the plenum that contains 15 powerful fans that ventilate and cool the rail yard (Dunlap, 2015). Above the plenum is a rainwater storage tank that irrigates the trees and plants above. The next layer is a concrete cooling slab that carries glycol coolant, similar to that of an ice-skating rink. This helps protect the above trees and platform from the heat generated below. The trees and plants are then planted in a sand-based structural soil and supplemented with compost and nutrients.

The platform in the Capitol Crossing ARD in Washington D.C. also features an innovative design. To address fumes from the highway below, vehicle exhaust is directed towards vents where the installed Eco-Chimneys, made of large plants, treat the vehicle exhaust and release clean air into the community (Capitol Crossing, n.d.). Additionally, water cisterns capture and treat 90% of storm water runoff, reducing landscaping water by 50% and potable water use by 40% (Capitol Crossing, n.d.).

Other design considerations can address environmental issues. For instance, a reinforced floor on the first level can help mitigate noise, vibrations, and fumes (Hauser, 1989). Overall, the design interventions will depend on the local context and financial feasibility.

3.4 Construction Guidelines

Building an ARD project has its challenges, including both the physical construction and the required coordination between the developer and public entities. Daily coordination between the developer's engineering team and public engineers is essential to the success of an ARD project (Hauser, 1989). Having clear construction guidelines will foster an effective working relationship between engineering teams, and keep everyone on the same page throughout the construction process. Construction guidelines have two general considerations: protecting the infrastructure and the managing the construction phase.

An example of construction guidelines protecting infrastructure is found in Vancouver. TransLink has established the Adjacent and Integrated Development process that reviews development around its SkyTrain infrastructure (TransLink, n.d.b). A developer's guide has been prepared for each of its SkyTrain lines, and the types of precautions taken are dependent on how close the development is to the infrastructure, known as the limits of approach. The guidelines cover construction aspects such as signage, safety personnel requirements, communication protocols, contact information, and construction hours. TransLink and the developer together create a monitoring program that is used to regulate construction activity.

An example of guidelines that manage the construction phase can be found in Boston. ARD proponents building over the Turnpike are required to submit a Construction Management Plan

(CMP) to the Boston Transportation Department. A CMP helps coordinate construction schedules and zones with other construction projects. It also regulates truck routing, protection of existing utilities, control of noise and dust, and construction parking or drop-off areas. For example, the Fenway Park CMP (Epsilon Associates, 2008) detailed that there won't be any construction parking in order to reduce vehicle trips; instead construction workers were encouraged to use public transportation. Overall, there is limited room provided for the construction phase, requiring engineers to create phased strategies within the work plan (Hauser, 1989). For ARD involving transportation routes, construction activities and storage cannot interfere with traffic. Therefore, construction may need to be done during off-peak hours such as nights or weekends, which may increase construction costs (Clancy, 1998).

There are many complexities associated with constructing an ARD project, which typically extends the construction period by an additional year (Campbell, 2004). However, establishing clear and identifiable construction guidelines and upfront agreements will increase safety, and help organize construction activity to foster an effective construction phase.

3.5 Approval Process

This section will provide an overview of the steps taken to approve an ARD project. Many of the case studies utilized review processes that were already established. For instance, the municipalities in the Lower Mainland did not have specific review procedures for ARD. The Union Station North zoning review in Washington D.C. is similar to its Planned Unit Development process. Additionally, Boston's review of ARD over the Turnpike is modeled after the Article 80 zoning review process. What is unique in the review process of ARD is the private development of a public asset and how the public good is solicited to the private market.

The ownership of land will determine the approach taken in the approval process. If the public entity owns the land and therefore the air space above, then a Request for Proposal (RFP) or Request for Quote (RFQ) process is used to select the developer and proposal for the site. The RFP competitive process is argued to be effective because it encourages innovative design, and the developer must show its competency to handle the complexities of ARD (Campbell, 2004). Examples of these ARD approval processes include Boston's Civic Vision for Turnpike Air Rights

(BRA, 1998), and the WMATA's development policies and guidelines (WMATA 2013), which are compared in the Table 5.

Boston's Civic Vision (BRA, 1998)	**WMATA Joint Development (WMATA, 2013)**
1. The Turnpike Authority notifies the Boston Redevelopment Authority of an ARD opportunity	1. Internal WMATA screening of potential joint development site(s)
2. RFQ is released, which includes specifying the design guidelines	2. Consultation with Local Jurisdiction
3. Community Advisory Committee (CAC) appointed	3. Station access plan
4. Developers respond to RFQ, detailing how they would meet the design guidelines	4. *Alternate Step*: Request for Prior Experience (''RFPE'') : to create shortlist of potential developers
5. CAC collects community comments and reviews developer's qualifications	5. Advertise solicitation; obtain WMATA Board approval
6. CAC submits comments to Turnpike Authority	6. Order appraisal from a third party
7. Turnpike Authority and Boston Mayor shortlist developers based on construction, use, and provision of amenities	7. Initial evaluation: **technical** (meets TOD principles, market viability, development experience, innovation, compatibility of development), **economic** (ridership, financial benefits), **ethics review**, **other non-direct benefits**
8. Short-listed developers submit detailed development and design proposals	8. Community forum
9. CAC reviews and collects community comments	9. Final evaluation (may request best and final proposals from developers)
10. CAC submits comments to Turnpike Authority	10. Select developer, negotiate Term Sheet, and obtain WMATA Board Approval
11. Turnpike Authority selects developer after another consultation with Boston Mayor	11. Negotiate Joint Development Agreement and related documents; obtain WMATA Board approval
	12. Hold Public Hearing; draft and finalize Staff Report; obtain WMATA Board approval
	13. Obtain Federal Transit Administration ("FTA'') approval, if required

Table 5: Comparison of Approval Process for Public Entities that have Ownership of Land

Once the developer has been selected, local jurisdictional approval would initiate after the RFP/RFQ process.

Both of these approval processes have an aspect of collaboration between the government agency and the municipality. They also incorporate public feedback throughout the process. Furthermore, the WMATA guidelines have multiple processes for various circumstances, including a process for unsolicited proposals. Overall, ARD approval processes share common themes. Savvides (2002) helps summarize these approval processes into four general steps:

1. Study corridor to determine areas of potential development.
2. Determine uses of the site informed by the issues of the use below.
3. Identify local planning, zoning, and community needs.
4. Finalize valuation of air rights and the development agreement.

The approval process is different if the government agency does not own the land. For example, Vancouver's TransLink has ROWs for some of its infrastructure, and therefore cannot sell density above it. TransLink's approval process is focused more on protecting its infrastructure by reviewing the proposal's design and construction phase. The approval process also includes recovering the cost for TransLink to review the proposal and to operate its infrastructure with the ARD. TransLink's process is as follows:

1. Project Overview and Scope Presentation: developer outlines project goals, plans, and objectives.
2. Funding Letter: developer agrees to reimburse TransLink for costs associated with the review.
3. Letter of Credit: developer provides Letter of Credit as interim security for review work costs. Amount is determined by TransLink.
4. Schematic Design: developer prepares and revises site plan, illustrations, renderings, and functional plans. This also coincides with the development permit phase of the municipality.
5. TransLink Preliminary Acceptance.
6. Detailed Design: developer prepares and revises construction drawings, specifications, phasing plans, and other permits as required. This also coincides with the building permit phase of the municipality.

7. Define Monitoring Program: TransLink and the developer agree to a mitigation and monitoring program for construction activities.
8. TransLink Final Acceptance.
9. Adjacent and Integrated Development Agreement: details TransLink's requirements for the full scope of work.
10. Construction and Monitoring: TransLink and the developer conduct ongoing project monitoring.

This process identifies points that coincide with the municipal reviews (i.e development and building permit phases). As mentioned previously, the municipal review process typically does not differ between ARD and other types of development. ARD goes through various department review stages and ultimately to council or the governing body.

One of the greatest sources of risk for a developer revolves around the regulatory approval of the project (Chu, 1985). Providing transparency around the approval process provides more predictability and reduces risk, thereby increasing the likelihood of ARD implementation.

4.0 Facilitation Issues

In addition to coordinating with other public entities, government agencies and municipalities need to effectively communicate with other stakeholders involved in the ARD process, particularly the developer and the general public. This section looks at the facilitation issues between these two important stakeholders and how public entities can foster efficient engagement.

A key tension between the general public and developers revolves around the needed density to make ARD economically feasible. The needed density may be at odds with the desires of the surrounding community. The analysis of the case studies provides examples of how public entities can address this tension.

4.1 Public Engagement

Local residents are a key stakeholder within the ARD process. The surrounding community plays a crucial role in whether an ARD project receives approval. ARD projects tend to be controversial as development is usually within a central and highly populated area, and it includes solicitation of a public good to the private market. As mentioned previously, the common tension involves the density of ARD, including the height, scale, and massing. Savvides (2002) provides additional community concerns, including neighbourhood gentrification, vehicle traffic, pedestrian circulation, site amenities and improvements, provision of jobs, and environmental concerns such as noise, wind, and air quality.

While both the government agency, municipality, and developer should engage with the general public, the municipality is typically responsible for the public engagement component of an ARD project. This is reasonable since the municipality has more experience in public consultation and will have staff that are more aware of local stakeholders. The WMATA Joint Development Guidelines request that the municipality present a list of community organizations to involve in the consultation (WMATA, 2013). Additionally, the WMATA may enter into an MOU with the local jurisdiction on outreach procedures. From the case studies, there are three considerations regarding the public engagement component of ARD: the

organization of community representatives, the level of involvement of the general public within the RFP process, and effective engagement with the community.

Beginning with the organization of community representatives, municipalities typically use established community engagement procedures. Some municipalities do not create a body that represents the community's interest but leave it open to the public. Others use community commissions or committees to conduct the community review of ARD proposals. Some committees are geographically-based. For example, in Minneapolis, the affected neighbourhood association is included in the public consultation of the ARD project. Additionally, Washington D.C. uses geographically-based Advisory Neighbourhood Commissions (ANC) to conduct the community review of ARD proposals. ANCs are locally elected community representatives within a jurisdiction that make up an advisory board, and are given party status for the application. The WMATA Joint Development Guidelines specify the role of the community, and specifically ask for feedback on community amenity needs, bike and pedestrian circulation, land use needs, and building height and density concerns (WMATA, 2013). Other committees are created on a project-specific basis. For example, Boston establishes Community Advisory Committees (CAC) to act as a voice for the community and as a liaison between the community and decision-makers. These ad hoc committees consist of neighbours, stakeholders, and government representatives. CACs review ARD proposals and create project goals in the initial stages. They also provide recommendations on physical design, land use, jobs, pedestrian circulation, traffic, housing, wind and shadows, and economic impact (BRA, 1998).

In regards to when the public is involved in the RFP/RFQ process, typically the community is consulted in the initial and final review stages. Some public entities choose to consult the public before the RFP is issued. In the Hudson Yards ARD, the MTA and HYDC held workshops and consultations with City and State departments and community organizations (MTA, n.d.). The WMATA guidelines also state that the WMATA staff may need to meet with potentially affected communities before solicitation of an ARD opportunity (WMATA, 2013). Other cities like Boston choose to form a CAC after an RFQ is released (BRA, 1998), however the public is still involved early on in the process. The public can then be involved in reviewing the submitted developer proposals. The Hudson Yards RFP included a public exhibition of the submitted proposals and

the MTA collected comments (MTA, n.d.). The WMATA approval process contains a community forum before a developer is chosen. Additionally, Boston's Turnpike Air Rights Guidelines have the CAC and the general public review the short-listed development proposals before the developer is chosen. Finally, the public may also be consulted after the developer and proposal has been selected for a final review, as seen in the WMATA approval process (WMATA, 2013). Afterwards, the local jurisdictional approval process would initiate the public consultation of the ARD project.

Lastly, it is important to effectively engage with the community for ARD. This includes careful consideration of the messaging within community consultations. The literature and jurisdictional scan revealed two important engagement considerations. The first consideration is educating the public on ARD issues (Savvides, 2002). It is important to communicate that the high costs of constructing a platform necessitate greater densities and that there must be this trade-off in order for ARD to occur (Campbell, 2004). Additionally, it is important to communicate the public benefits and future amenities that result from ARD. The benefits can be communicated through public consultations or press materials of the development, as seen with Washington D.C.'s Capitol Crossing (Capitol Crossing, n.d.) or New York's Hudson Yards (Hudson Yards, 2016). Public benefits can also be specified in the development agreement, which will be detailed in Section 4.2. Furthermore, some jurisdictions choose to include the public benefits within the ARD zoning. Both the Capitol Crossing and Hudson Yards zonings specify the required public amenities, such as open space and affordable housing. This helps to clearly communicate the benefits of ARD to the public while also securing these benefits. Overall, communicating the benefits of ARD can help the community to accept higher densities (Campbell, 2004). With effective communication about the issues and benefits of ARD, public support is likely to increase, leading to a smoother approval process.

4.2 Development Agreements

Public entities also need to have effective communication with developers. Earlier in the report, it was mentioned that the landowner of the ARD site is responsible for negotiating the development agreement. However, the landowner must also work with other public entities

when preparing the development agreement. Development agreements can cover a wide range of considerations, such as the sale or lease transaction, cost sharing, improvements, the approval process, and construction guidelines. These development agreements have different names, such as an Air Space Parcel agreement in Vancouver, or a Project Development Agreement in Boston. These ARD agreements often address site-specific issues and need to be prepared on a case-by-case basis (Clancy, 1998). Overall, there are three areas of consideration for effective engagement with developers: the solicitation process, the financial transaction, and the assignment of responsibilities.

The initial contact with developers is often the RFP solicitation process. Some jurisdictions, such as Virginia, Atlanta, and Ottawa, release a Request for Expressions of Interest (REOI) to gauge the level of interest from the private market. It is also used to educate the public entity on developer concerns about potential ARD projects, and to ultimately craft a future RFP. For example, the Virginia REOI for ARD opportunities in Rosslyn sought information about the size of platform required, the necessary studies, the preferred transaction structure, viability of development, and feasibility (Arlington County, 2015). The RFP can feature a number of aspects, including the objectives, background information on the site, development and lease agreements, required improvements (i.e. public open space, transportation infrastructure improvements, percentage of affordable housing), submission requirements (i.e. site plan, bid, construction plan), and details of the selection process. It can be helpful to establish guidelines or criteria for ARD that developers can reference, such as WMATA's Joint Development Guidelines (WMATA, 2013), MARTA's TOD Guidelines (MARTA, 2010), TransLink's Adjacent and Integrated Development Guidelines (TransLink, 2013), or Boston's Civic Vision for Turnpike Air Rights Guidelines (BRA, 1998). The more information that is included in an RFP, the more predictable the ARD implementation process and future development agreement become, which enables the developer to make informed decisions on its proposal.

The next consideration is the financial transaction. Firstly, the public entity needs to determine whether the air rights are sold or leased. Section 3.1 explained that developers may consider a sale more desirable and the public entity may wish to lease air rights to retain control over the site. After the transaction structure has been decided, the public entity and developer must

determine the valuation of the air rights, which is further detailed in Section 5.2. Ultimately, this valuation is determined by a third-party appraiser or is decided through a competitive bidding process. A competitive bidding process typically requires the developer to submit a pro forma analysis to the public entity with the agreement that the financial information is kept confidential (WMATA, 2013). This pro forma analysis can also help justify the density needed to offset the costs of ARD (Campbell, 2004).

The majority of ARD transactions in the case studies involved leasing air rights to a developer. These ARD leases require additional considerations. Firstly, the length of the term will need to be established. ARD leases are typically long term. For example, Massachusetts legislation allows leases up to 99 years. The payment installments must also be established. Payments are typically monthly, although some lease agreements may choose a lump-sum payment upfront. The developer of the One Financial Centre in Boston paid the lease upfront to avoid complications and rent increases (Clancy, 1998). Additionally, public entities may require a lump-sum payment to avoid the boom-and-bust cycles of the real estate market (Lari et al., 2009). Lease payments can also be skewed to support the development early on, where initial payments are lower and then escalate as the project generates higher revenues (Chu, 1985). Additionally, these lease payments should be inflation-adjusted (Mathur & Smith, 2012). The lease agreement may also specify renewal options where parties can renegotiate the value of the air rights.

The subordination of debt should also be clearly established to reduce financial risk (Campbell, 2004). Within any rental agreement, there is the landlord (i.e. public entity), tenant (i.e. developer), and the financial institution providing the mortgage (Clancy, 1998). If the tenant defaults on its lease payments, the landlord must notify the financial institution, which may cure the default and assign the space to a new party. Finally, end-of-lease terms need to be established, specifically what happens to the air rights and associated improvements. For example, the lease for the Gateway Center in Boston had provisions stipulating that the land, air rights, and any improvements be reverted back to the Turnpike Authority.

The development agreement must also specify the responsibilities of the parties involved. The responsibilities should be made clear, and can be distributed amongst the government agency, developer, and municipality. First, the public entity should protect the infrastructure and uses below the ARD. This can be achieved by requiring the developer to have enough insurance to cover the demolition of all buildings or improvements that affect the uses below. For example, the Copley Place ARD agreement with the Turnpike Authority in Boston stipulated in the lease that the developer must have enough insurance to cover the cost of demolishing the entire structure, and that the Turnpike Authority is able to eradicate any encumbrances to the corridor without the developer's approval (Clancy, 1998).

Second, the cost-sharing and responsibility for improvements need to be established. There can be many creative agreements within ARD. Public amenities are usually financed by the public entity. In the Hudson Yards redevelopment, the zoning specified open space requirements, which was financed by the HYIC. The HYIC was also responsible for the Line 7 subway extension. Public entities can also finance ARD construction costs by issuing bonds, which can help make ARD more financially feasible (Goldschmidt, 1964; Hauser, 1989). This can include financing the platform, where ARD revenues are used to pay the bonds. This was initially the plan in the Hudson Yards redevelopment, where the HYIC was going to finance the platform (HYIC, 2004); ultimately, however, this did not occur. Often when the public entity provides financing for the ARD construction, it receives development revenue streams in exchange. For example, the City of Minneapolis issued bonds for the construction of a new football stadium in exchange for the development rights over one of the parking ramps (Minneapolis, 2014). Additionally, since New York provided financing for the Line 7 subway extension, it received transferable development rights to sell to nearby properties (HYDC, n.d.).

Other development agreements feature the developer financing public amenities. For example, the Capitol Crossing ARD incorporates improvements to the I-395 Freeway and ramps (District of Columbia, 2011). Additionally, the Green Line extension in Medford, Massachusetts features a public-private partnership where the MBTA provides air rights over its land to Tufts University, while Tufts University provides security and maintenance of the new College Avenue station and land for MBTA's new station at no cost (Thurler, 2015).

Third, the development agreement should assign responsibility for maintenance and operations (Campbell, 2004; Clancy, 1998). In Vancouver, Air Space Parcel (ASP) agreements specify maintenance obligations, rights of access, cost-sharing between parties, insurance, repairing of damage, and a dispute resolution clause (Baker, 2015). There are also provisions to indemnify the local jurisdiction that regulates ARD. The Section 219 Covenant in Vancouver can include indemnification of the municipality from treating the building as a single entity. Additionally, other agreements require the developer to waive claim against the public entity on account of noise, vibration, fumes, odor, or other causes (Clancy, 1998). These provisions help to reduce the public entity's financial risks.

A final consideration when creating a development agreement is the timing within the real estate cycle. ARD should be pursued when land values exceed the additional construction costs of developing air space (Goldschmidt, 1964). Boston learned this lesson through the Copley Place ARD project, where land values at the time were not sufficient to justify ARD. The project went ahead anyway, resulting in the developer receiving $19.7 million in public funds to offset the ARD costs (Clancy, 1998). Boston's Turnpike Air Rights Guidelines now specify that ARD should only be pursued under favourable market conditions (BRA, 1998).

The development agreement is unique to each jurisdiction and to each ARD project. Including information on what the development agreement entails in the early stages of the ARD process helps developers to understand the public entity's expectations and to make informed decisions. Additionally, development agreements require flexibility and creativity to address specific issues, but measures should be taken to protect the public entity from financial risks or damages to the uses below.

5.0 Economic Valuation Issues

A central issue within ARD concerns the economics of such projects. A significant challenge is the exorbitant cost of developing above another land use, while one of the significant benefits is the potential revenue gained. This last section examines how public entities can address both the costs and revenues of ARD to find the right balance. The economic factors analyzed include an overview of cost-saving measures that public entities can employ, the valuation of air space, property tax assessment, and incentives public entities can utilize to encourage ARD.

5.1 Overview of Cost-Saving Measures

The significant costs of developing air space have been noted as one of the greatest disincentives for developers. However, there are several ways that public entities can reduce the costs of ARD in order to make these projects more economically feasible, and therefore more attractive to the private market. These cost-saving measures include:

- Designing infrastructure to accommodate ARD
- Design of the platform
- Considering ARD opportunities for new development
- Treating the platform as a piece of public infrastructure
- Public financing of ARD construction
- Incentives

Designing Infrastructure to Accommodate Future ARD

Public entities should have a long-range planning focus when it comes to infrastructure investments. This includes considering opportunities for ARD, particularly opportunities for building a platform above another land use or transportation corridor (Pine, 1970). There are two general ways to design infrastructure that will reduce the costs of building a platform. First, depressing the transportation corridor will facilitate an easier transition between adjoining lands and the future platform (Hauser, 1989). In Boston's Big Dig project, depressing the highway allowed adjacent roads to extend along the platforms at-grade, thereby creating a smoother transition without needing to raise the platform. Second, land can be set aside for structural supports (Campbell, 2004). Providing wide medians within the corridor, providing land on either side of the corridor, and setting aside non-vehicular ROWs allow for optimal

location of structural supports. Having structural supports in the right locations allows for less expensive construction techniques and can support higher weight loads and densities.

Integrating ARD Opportunities with New Development

When constructing a new development, it can be economically efficient to construct the land surface structure and the air space structure together. For example, the Metropolitan Washington Airport Authority (MWAA) explored ARD opportunities over new Silver Line Metro stations along Dulles Toll Road. It estimated that if the ARD structures were incorporated into the initial design and build contract, the foundation and column support costs would be $34 million (MWAA, 2011). If the foundations were built after the Metrorail became operational, however, the foundation and column supports would need to be outside the Metrorail ROW, costing $60 million (MWAA, 2011). By including the ARD opportunities in the construction of the new rail infrastructure, the foundational and column support costs were nearly halved. The same forward-thinking strategy can be applied to new public buildings. New public investments should consider ARD opportunities in the early stages to maximize benefits and reduce costs.

Design of the Platform

Typically, the most expensive component to ARD is the platform. Brookfield's Manhattan West ARD project, just east of Hudson Yards, features an innovative construction technique that reduces platform costs. Brookfield is using post-tension, precast segmental bridge technology to build the deck over a rail corridor (Manhattan West, 2016). Essentially, concrete segments are created off-site and then placed by a launcher and fused together through steel cables to create a portion of the bridge span (see Figure 2). The launcher continues to move across the rail corridor to incrementally build the other portions for the platform (see Figure 3). This construction technology limits the disruption of the rail corridor below. Additionally, using the precast concrete segments saves time and money, reducing the platform costs from $600 million to $300 million (Levitt, 2011). Public entities can provide information to developers or develop best practices of construction technologies that reduce ARD costs.

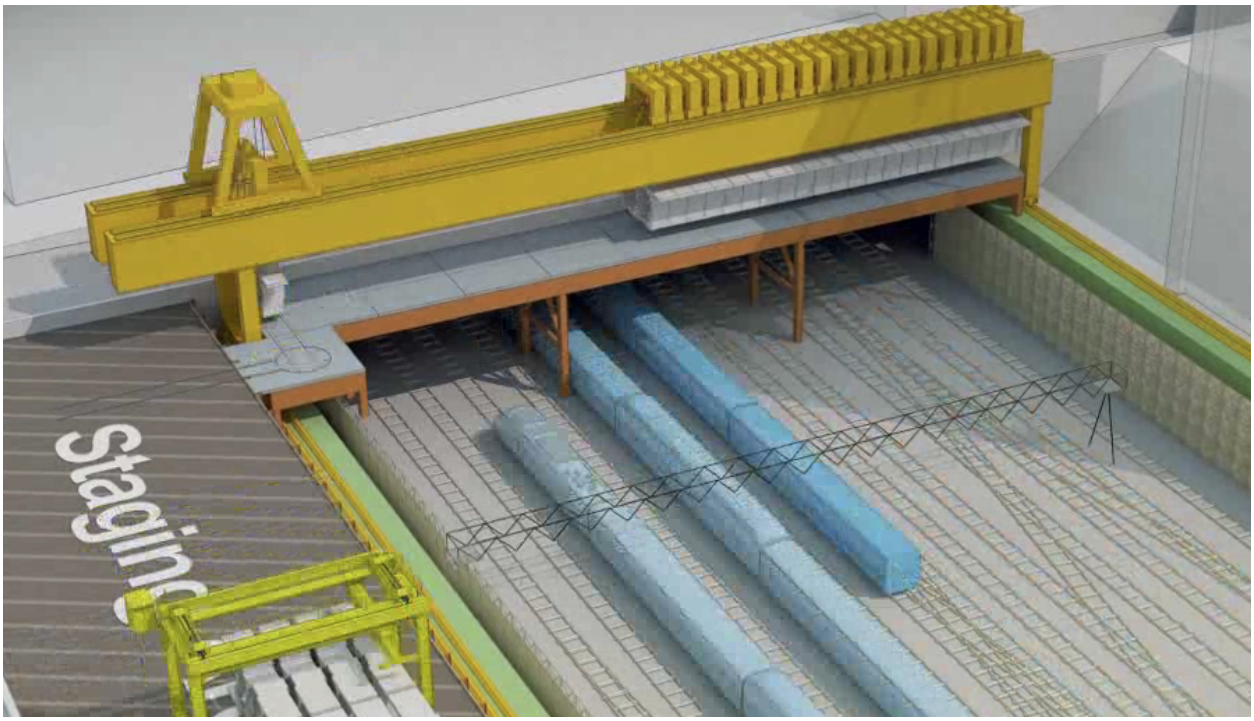


Figure 2: Precast Concrete Segments Placed Together by Launcher for Manhattan West Project Platform (Manhattan West, 2016)

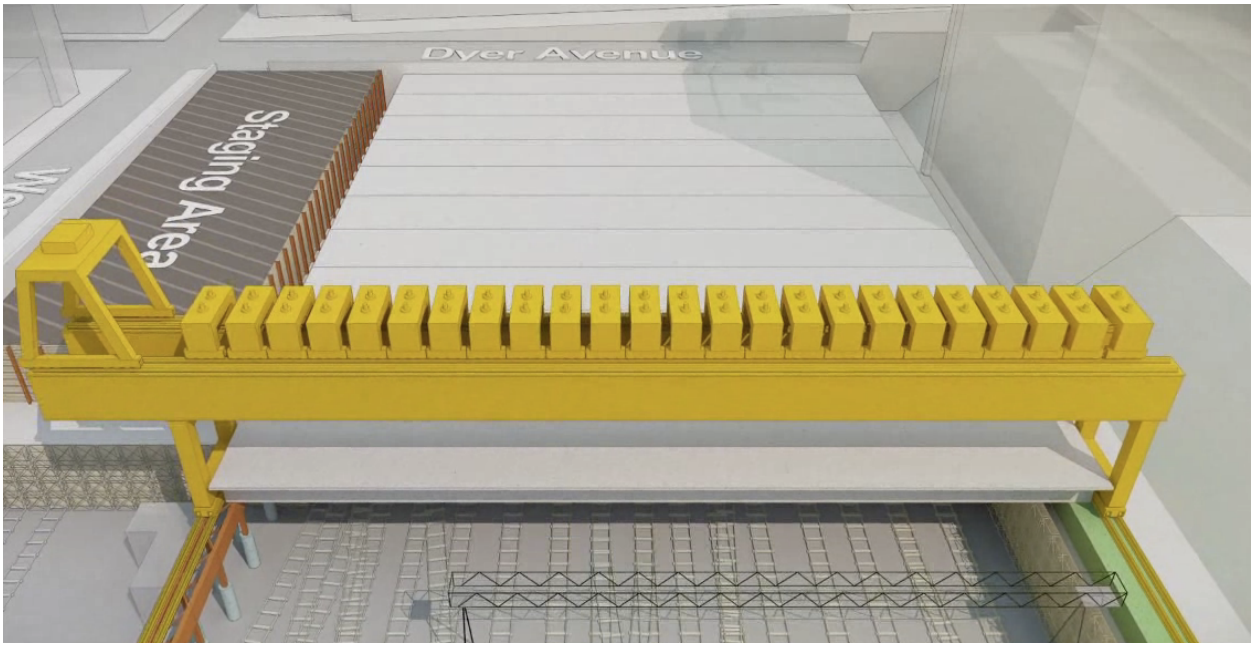


Figure 3: Continuation of Incremental Construction of the Manhattan West Platform (Manhattan West, 2016)

Treating the Platform as a Piece of Public Infrastructure

Like other public investments, a platform is piece of infrastructure that unlocks private investment by allowing structures to be built upon it. Therefore, the developer should be reimbursed for building the platform. In Boston's Fenway Center ARD, MassDOT will reimburse the developer for the platform costs through rent credits on its monthly lease payments. This essentially erases the platform costs, thereby making ARD competitive with terra firma development (McMorrow, 2012). Alternatively, the arrangement can be similar to Ontario's Tax Increment Equivalent Grants (TIEG), where developers receive annually a portion of the property tax increase over ten years. Both the developer and public entities benefit from these arrangements. The developer does not have to bear the cost of building a platform, making ARD more economically feasible. Meanwhile, public entities do not need to provide the upfront capital for the platform, and the landowner still receives air rights revenues, and regulator or local jurisdiction receives property tax revenues and other benefits.

Public Financing of ARD Construction

In contrast to the above arrangement, the public entity can provide financing for the ARD construction costs by issuing bonds (Goldschmidt, 1964; Hauser, 1989). The developer then pays off these bonds through development revenues when the project is generating profits. This can be seen in Minneapolis' new football stadium development, where the City issued bonds for construction in exchange for the air rights over a parking ramp, developer payments over the next ten years covering the anticipated debt service, and 2% of the net operating income after the ten years (Minneapolis, 2014). Another comparable arrangement would be Tax Increment Financing (TIF), where the municipality recoups the costs of a public investment through the increase in property taxes. This reduces the economic burden on the developer of ARD projects, while the public entity is reimbursed over the long run and receives additional revenues from the ARD project.

Incentives

Section 5.4 will look into incentives in more detail.

5.2 Air Space Appraisal

Assigning a value to air space can be difficult. ARD is very different in comparison to terra firma development, and established valuation approaches may not be applicable to determining the value of air space. There are several approaches that can be used to appraise air space.

One of the simpler approaches to valuating air space is to use rule-of-thumb calculations. For example, the Turnpike Authority has a history of valuating air rights at 10% of total development costs (Hauser, 1989). Meanwhile, Pine (1970) suggests that the value of air rights should be no more than half of the adjoining land value. While these approaches are simple, they do not capture ARD complexities and the unique qualities of each ARD site.

Another approach is to auction the air rights to the private market to determine the valuation (Pine, 1970). New York has a history of auctioning air rights, including the air rights for the Bridge Apartments over the Trans-Manhattan expressway which was one of the first ARDs over a highway (Chen, 2004). Some cities choose to determine the valuation through the RFP process where developers competitively bid on the air rights. This approach has been used for New York's Hudson Yards and Ottawa's Lansdowne Park. In this case, the valuation of air space is determined by the developer, and is one of the deciding factors within the RFP evaluation.

A more formulaic approach is to use the comparative land value method (Williams and McNichol, 1973). This method is based on the value of nearby land, incorporates various factors associated with ARD, and is premised on the 'highest and best use' of the site (Dumfries, 1995; Williams & McNichol, 1973). The formula is provided below.

V + D + S + P – X – Y – I = A

V = comparative land value

D = savings due to absent reduction in demolition and foundation costs

S = value attributed to site prominence or improved access

P = savings due to readily assembled large parcel

X = reduction in utility of structure due to design

Y = excess construction costs due to underlying corridor

I = additional interest incurred over a longer construction period

A = appraised air rights value

Many of these factors are estimates and are open to interpretation (Hauser, 1989). Another issue with this approach is that it is not flexible enough to accommodate the unique characteristics and complexities of each ARD site. Instead, it is suggested to be used as a complimentary and supportive approach to the residual income approach.

The residual income approach uses a pro forma analysis to determine the air space value. Hard and soft costs and profit margins are deducted, and the resulting amount is then established as the air rights rent. This approach is more flexible and accommodates ARD site complexities (Hauser, 1989).

Another option is to allow a third-party to determine the fair market appraisal of the air space. This approach has been used by the City of Minneapolis, where a professional real estate appraiser is brought in. If there is a disagreement on the fair market appraisal, then the City and developer each hire a third-party appraiser. These two appraisers then mutually hire another appraiser to determine the value by majority vote. If the two parties cannot agree to a third appraiser, then the State steps in (Minneapolis, 1983).

Finally, the last approach is tied to the income generated by the ARD project. Some ARD developers choose to share a portion of their revenues with the public entity landowner. For example, the ARD above the Bethesda Metrorail station in the Washington Metro Area receives a minimum revenue of $1.6 million, and receives 7.5% of annual gross revenues in excess of $31 million (Mathur & Smith, 2012). The Miami-Dade Transit's ARD agreement over the Dadeland South Station involves the agency receiving the higher of $300,000 (consumer price index adjusted) or 4% of the gross revenue (Mathur & Smith, 2012). This appraisal approach is subject to market volatility; however, it may be more attractive to developers as payments are adjusted on the basis of the project's economic performance.

A final note about the air space appraisal is that it is not the sole deciding factor as to whether an ARD project is implemented. ARD can be feasible when there is a scarcity of available sites but there is a pressing need for a public good (Pine, 1970). For example, affordable housing may

be a prominent need within a particular area, and the land constraints make ARD opportunities the most feasible option.

Whatever approach is used, the valuation process needs to be transparent, and the public entity landowner needs to effectively communicate this process to the public and the developer so that these stakeholders understand the nuances of the appraisal (Campbell, 2004; Hauser, 1989). The valuation of air space should also be predictable, providing the developer as much information about the appraisal process and ARD site as possible so that it can make informed decisions. For the Columbus Centre ARD project in Boston, the Turnpike Authority did not negotiate the air space value until after the design was finalized and permitted by the City of Boston. The value of the air space ended up being three to four times higher than what the developer initially anticipated, thereby decimating the developer's feasibility analysis (Campbell, 2004). Overall, the developer should understand the appraisal process and be able to estimate the air space value before the proposal is finalized.

5.3 Tax Assessment

The property tax revenue generated from ARD is another benefit for local governments. Like local zoning regulations, some ARD projects have been exempt from property taxes, as seen with Boston's Gateway Centre ARD (Clancy, 1998). Today, Massachusetts' General Laws state that ARD projects may be exempt from property taxes, but the developer must still make payments in lieu of taxes to the local government (Massachusetts, 2016). The majority of the jurisdictions studied had property taxes applying to ARD.

In the case where the ground and air space parcels have different owners, taxes are typically assessed separately (British Columbia, 2016; Zoning, 1974). Taxation of ARD projects are similar to terra firma projects, where the taxes are applied to the site and improvements as if the developer were the landowner (Campbell, 2004; Clancy, 1998). This also applies to leasing arrangements, as seen in Massachusetts, where lessees have a taxable possessory interest and are treated as if they own the land (Clancy, 1998; Massachusetts, 2016). However, taxation ultimately depends on which method the jurisdiction uses to assess property taxes. Some jurisdictions choose to tax only the value of land, or may tax land and buildings separately. The

taxation of buildings in air space parcels is fairly straightforward as they are comparable to terra firma buildings. However, air space parcels are not located on land, and some jurisdictions such as Massachusetts prohibit the value of land to be included in the tax assessment of leased air rights (Massachusetts, 2016). Instead of using the 'terra firma' value, the value of the air space is substituted as the 'land' value (Conveyance, 1964). The value of air space is determined by various methods as detailed in Section 5.2, and is often less than terra firma land values due to the associated costs of ARD. Once determined, the value of the air rights lease or sale is then used in the property tax assessment.

There are additional considerations and options around the taxation of air space. ARD property taxes may be further divided by different tax classifications since the ARD has different uses, as practiced in Minneapolis. Some municipalities choose to assign a proportion of the complete fee tax value. For example, New York has a history of using 80% of the complete fee rights of the land for its tax assessment value of ARD, including the total value of land, buildings, and structural supports (Lillie, 1964). Furthermore, the timing of taxation is another consideration, where most municipalities tax ARD in its post-development phase (Lillie, 1964). This is further supported by the fact that undeveloped air space is generally not classified as real property and therefore is not taxable (Conveyance, 1964). Lastly, these property tax complexities must be understood within the jurisdictional context before corresponding policies and agreements are created for ARD.

5.4 Incentives

There are several incentives that public entities can use to further encourage ARD, including both financial and non-financial incentives. First, public entity landowners can reduce lease payments or charge below market value to incentivize target areas. Property tax assessment values can also be lowered to reduce the costs for developers (Campbell, 2004; Lillie, 1964). For example, the Hudson Yards developer received a $328 million real estate tax exemption from the City for an 80-story tower and shopping center (Levitt, 2013). The tax exemption involves the developer receiving a 40% tax break for the first four years, with decreasing reductions until the tax breaks end after 25 years. Public entities can provide financing at lower rates to reduce

construction costs (Savvides, 2002). Local governments can allow density bonuses to increase developer revenues, as seen in the Boston, New York, and Washington D.C. ARD zonings. Public entities can also provide a number of public investments within the ARD project. For example, the Hudson Yards project saw the City of New York invest in new public spaces and extend the Line 7 subway, which was particularly critical to the area's redevelopment. Public entities can agree to rent space in the new development as a way of securing revenue for the developer, and to attract other tenants (Savvides, 2002). Finally, local governments can streamline approval processes to expedite ARD timelines, thereby saving time and money for developers. When determining whether ARD projects should receive incentives, public entities should always ensure that there is a net benefit for the public good.

6.0 Recommended Steps

This report provides an overview of how the literature and jurisdictions address the political, regulatory, facilitation, and economic issues associated with ARD. There are often many ways to address these issues, and the proper response will depend on the local context. This handbook is meant to act as a resource for public entities to use in order to build an effective implementation structure for ARD. While there are multiple options available, this research has identified steps that public entities should take to build an implementation structure that facilitates and encourages ARD, and ultimately maximizes the public benefits.

1. **Ensure the possession of powers to implement ARD.** Before a public entity begins to explore ARD opportunities, it needs to make sure that it has the legislative authority to create air space parcels. A general overview of the legal context is encouraged to understand what the public entity is allowed to do, and to identify any legislation that needs to be created or amended.
2. **Designate an office or committee to oversee ARD applications.** Both the municipality and government agency should designate one committee to be responsible for liaising with other departments and government bodies, which will help the private market to interact more effectively. It also makes it easier for the public and the developer to identify who is responsible for overseeing ARD if they are looking for more information. Typically, the office responsible for the public entity's real estate initiatives would oversee ARD.
3. **Establish roles and responsibilities amongst stakeholders.** Providing clarity as to who does what and when they are involved in the approval process facilitates a smoother implementation of ARD projects. In general, the province/state grants legislative authority and plays a conflict resolution role, the local government approves the development, the landowner negotiates the transaction and development agreement, the public provides input in the pre-RFP and final review stages, and the developer is involved throughout the process. The roles and responsibilities within the development agreement should also be established, such as maintenance and operation considerations.

4. **Create partnerships amongst public entities.** The municipality, government agency, and higher orders of government need to be on the same page when ARD opportunities arise. Strong working relationships need to be established to facilitate agreement among the public entities. These partnerships can be created by aligning the priorities of the public entities involved, such as having affordable housing or job linkage policies in development above transit infrastructure. The benefits of air rights revenues should also be clearly and fairly distributed so that each stakeholder participates in the ARD process.
5. **Establish procedural clarity.** The developer should understand what regulations apply, the RFP process, how air space is valuated, what the development agreement involves, and the municipal approval process before the ARD project is bid on. This helps the developer to make informed decisions on its proposal and will prevent obstacles later in the development process.
6. **Build flexible yet guiding regulations.** Local government regulations should apply to ARD projects. These local regulations need to balance between accommodating the unique needs of an ARD site but also providing enough direction to ensure development is sensitive to the local context**.** Certain regulations should be applied generally or on a case-by-case basis. Standardized regulations for ARD include construction guidelines, building codes, building permits, and subdivision applications. Meanwhile, master plans, zoning, and covenant agreements should be adapted to site-specific needs. Within zoning, parking and loading requirements are typically relaxed while added height and density may be necessary to make the project economically feasible. Overall, established regulations and approval processes provide direction for ARD, which helps to manage expectations among the public and developers.
7. **Locate ARD opportunities.** The government agency, local government, and higher orders of government (i.e. state/province) can initiate corridor-specific or city-wide studies of ARD opportunities. These studies increase awareness within the private market of ARD opportunities. Additionally, it allows the public entities to prepare for ARD, in such ways as rezoning, incorporating ARD into policy documents, and setting aside funds for public investments.

8. **Consider ARD opportunities with new public investments.** Public entities should use a long-range perspective when planning future investments, including considering ARD as a land value capture tool. ARD opportunities become more financially feasible when integrated into the initial design or construction phase. This could include setting aside land within the medians or on either side for new transportation routes, or integrating the construction of new public buildings with ARD construction. ARD opportunities over new public buildings, such as libraries and transit stations, are the 'low-hanging fruit' of ARD opportunities, as they are economically feasible and do not involve the complexities of building over a transportation route. Having ARD opportunities in mind at the initial stages of development increases the likelihood of ARD becoming a reality.
9. **Incorporate ARD opportunities into master plans.** Including ARD within master plans can help the municipality determine the appropriate built form of an ARD project and to understand how the site connects with the surrounding areas. It can also bring awareness to the private market and prepare the community for an ARD application. Official plans or over-arching master plans should include policies around ARD opportunities and may indicate general locations. Community or secondary plans should specify locations for ARD and detail more site-specific policies.
10. **Provide public amenities and incentives for ARD projects.** Public entities can invest in public amenities such as parks or transit improvements that improve the public realm and make ARD opportunities more attractive to the private market. Public entities can also provide incentives to encourage ARD, however these should be weighed against the net public benefits resulting from ARD. These incentives include density bonuses, property tax breaks, public financing, and a streamlined approval process.
11. **Treat the platform as a piece of public infrastructure.** The platform needed for ARD serves more than just private buildings. It can complete the local road network, provide open spaces, clean the air from the transportation corridor below, increase local amenities, and can provide local housing and jobs. Ultimately, the platform should be seen as a piece of public infrastructure that unlocks development opportunities. With this perspective, the platform costs should be deducted from the rent or sale of the air space, which reduces

costs and make ARD competitive with terra firma development. Public financing options such as TIEGs or TIFs should also be explored for the platform construction.

12. **Make ARD information readily available for the developers and the public.** Creating various policy documents and guidelines for ARD, and having these available online and through other means, is beneficial for the community and the private market. These documents can include construction guidelines, the approval process, the solicitation process, and TOD or joint development criteria. This also helps to facilitate a smoother implementation process.
13. **Educate the public on ARD issues.** ARD tends to be controversial since it involves selling a public good and is typically located in central areas. Efforts should be made to increase community understanding of ARD issues. The public should recognize the benefits, the economic costs, and the trade-off between public amenities and increased density surrounding the implementation of ARD.
14. **Pursue ARD during favourable market conditions.** Surrounding land values need to be high enough in order to justify the costs of ARD, which are dependent on the real estate cycle. ARD should be pursued when the market returns are above this economic threshold. This helps to mitigate the amount of public financial incentives needed to make the ARD project financially feasible.
15. **Test implementation structure through a demonstration project.** When a public entity has created or significantly modified their implementation structure for ARD, it is advisable to choose a development as a test-pilot project in order to evaluate the implementation structure. Additionally, this demonstration project should be small in scale to limit the impacts and complexities involved. Public entities may also use a consulting firm to oversee the pilot project, which helps to save municipal staff and resources. Using a demonstration project helps to identify areas of improvement within the implementation structure. It also helps to build administrative capacity and increase awareness among the general public and the developers, highlighting the challenges and benefits of ARD. Overall, a demonstration project can improve the current implementation structure and boost support for this type of development.

ARD certainly has several complexities. It often takes multiple years to be approved and can encounter several obstacles along the way. However, when ARD is implemented, it can have positive impacts on the transportation corridor, the surrounding area, and the entire city. By building an implementation structure and addressing the various issues outlined in this report, public entities take tremendous steps towards making ARD a reality. Even though ARD may not be feasible for a municipality at the moment, an implementation structure should be in place so that the public entities and private market are able to capitalize when the opportunity comes. Public entities will continue to learn what works as they implement ARD projects. Hopefully this report helps public entities to develop their own best practices for ARD.

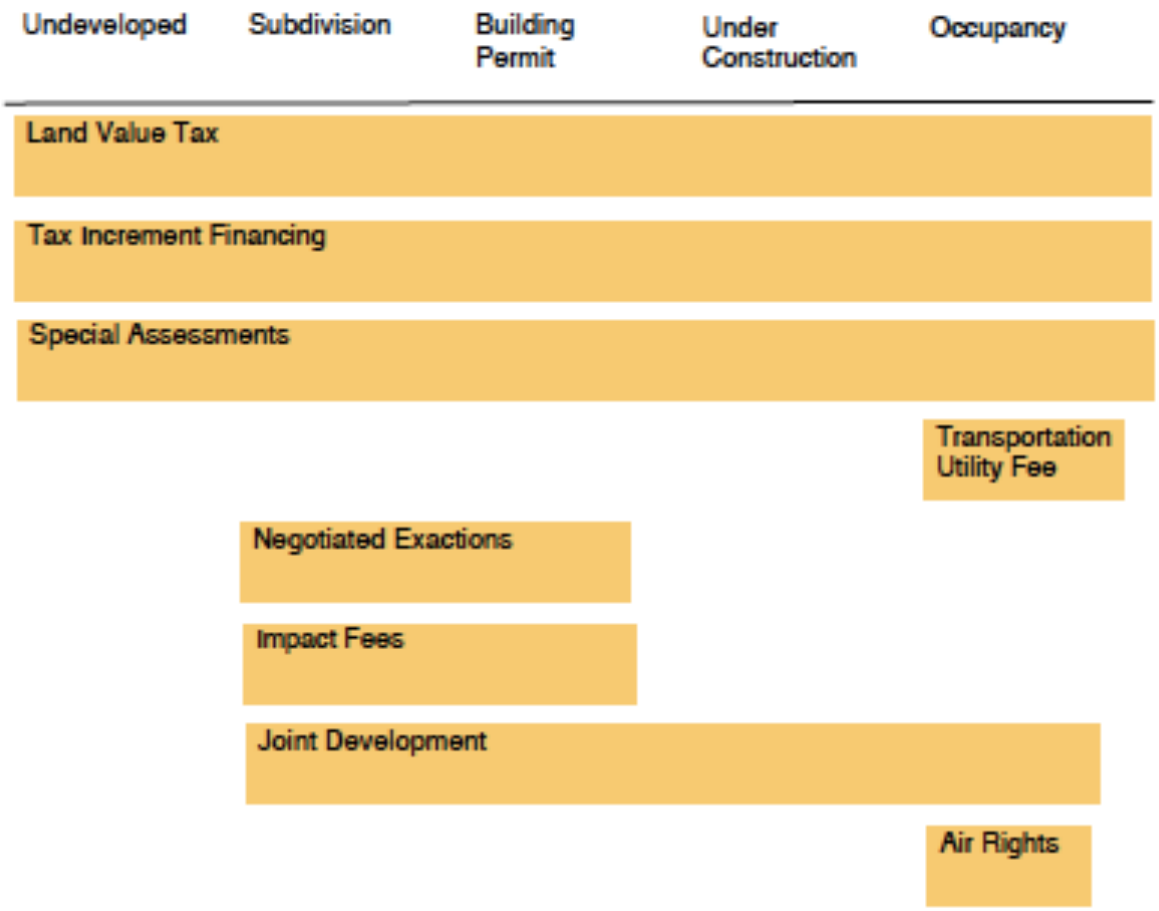
7.0 Appendices

Appendix A – Comparison of Land Value Capture Tools (Lari et al., 2009)

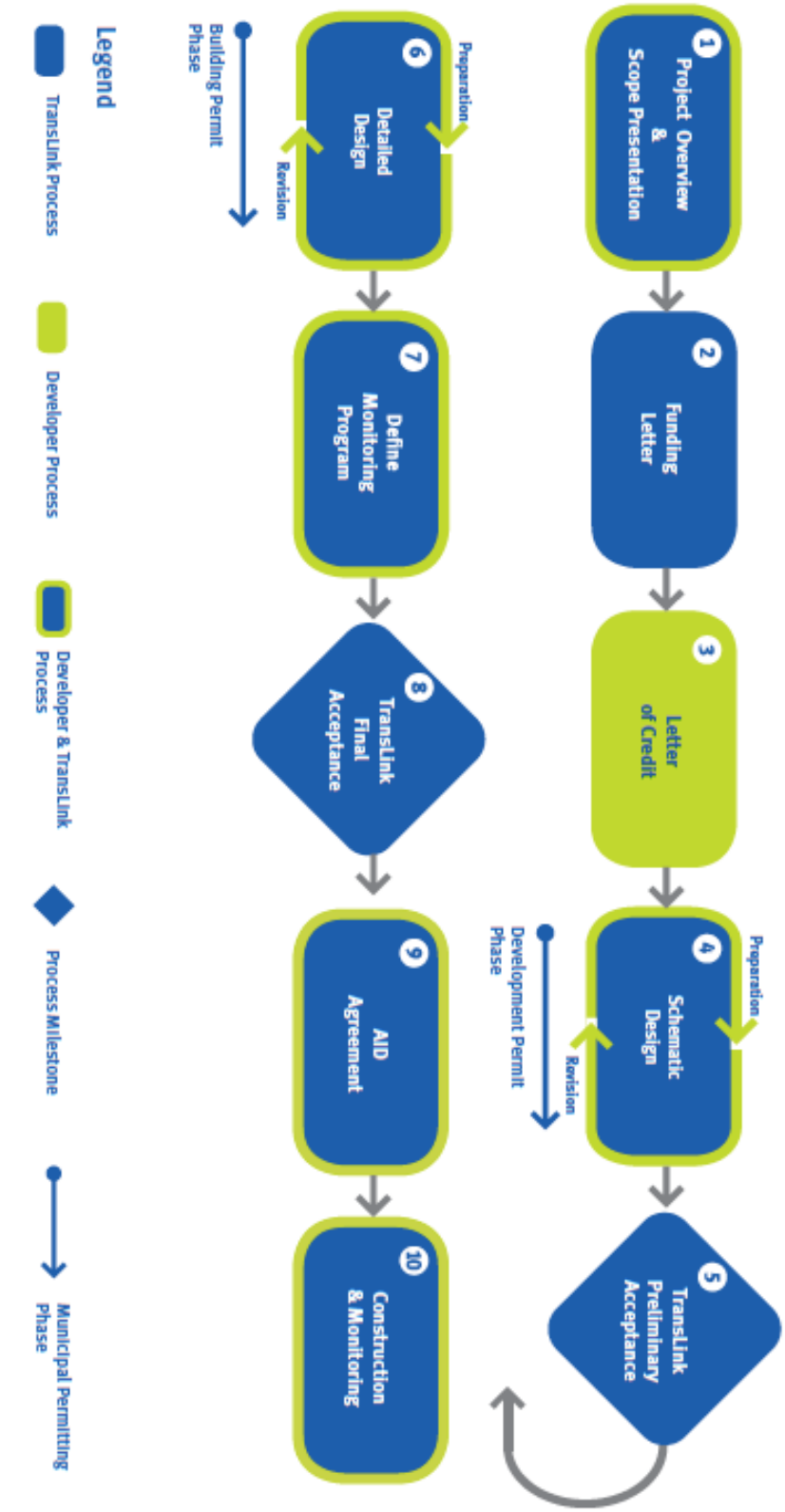
Features of Value Capture Policies

Value Capture Strategies	Contributor		Coordination			Timing		Space			Basis		Cost		Transport Owner-ship		Level of Govt.	
	Landowners	Developers	Taxing Authority	Negotiation	Partnership	Before Transp. Improvement	After Transp. Improvement	On-site	Restricted Off-site Areas	Entire Jurisdiction	New Development	Old Development	Upfront (Capital)	Ongoing (O&M)	Public	Private	State	Local
Land Value Tax	●		●			●	●			●	●	●	●	●	●			●
Tax Increment Financing	●		●			●			●		●	●	●		●			●
Special Assessments	●		●			●			●			●	●		●		●	●
Transp. Utility Fees	●		●			●	●		●	●	●	●	●	●	●			●
Development Impact Fees		●	●				●		●		●		●		●			●
Negotiated Exactions		●		●		●		●			●	●	●		●	●	●	●
Joint Development		●			●	●	●	●	●		●	●	●	●	●	●	●	●
Air Rights		●		●			●	●			●		●		●	●	●	●

Timing of Tax Imposition within Development Cycle Comparison



Appendix B – TransLink Review and Acceptance Process (TransLink, n.d.a)



Appendix C – Anticipated Permits and Approvals for ARD Parcel 7 in Boston
(Epsilon Associates, 2008)

Agency Name	Permit / Approval
FEDERAL	
United States Environmental Protection Agency	NPDES General Permit for Discharge
Federal Aviation Administration	FAA Height Restriction Notice, No Hazard to Air Navigation
Federal Highway Administration	Review and Approval of Non-Highway Use of Highway ROW Surplus approval – Confirmation of Action
STATE	
Executive Office of Environmental Affairs (MEPA Unit), to include a Chapter 91 Public Benefits Review.	MEPA Review
Executive Office of Transportation and Construction	Approvals Under MGL Ch 40 Section 54a
Department of Environmental Protection, Division of Water Pollution Control	Sewer Connection and Extension Permit Air Plan Approval Groundwater Discharge Permit (if required)
Massachusetts Water Resources Authority	Sewer Use Discharge Permit; Construction Dewatering Permit
Massachusetts Historical Commission	Determination of No Adverse Effect or Memorandum of Understanding
LOCAL	
Boston Air Pollution Control Commission	Parking Freeze Permit
Boston Civic Design Commission	Review and Approval
Boston Redevelopment Authority	80B Large Project Review Article 80 Project Agreement
Boston Transportation Department	Transportation Access Plan Agreement (TAPA); Construction Management Plan
Boston Water and Sewer Commission	Sewer Use Discharge Permit; Site Plan Approval; Construction Dewatering Permit; Sewer Extension/ Connection Permit
City of Boston Committee on Licenses	Parking Garage Permit / Flammable Storage Permit
City of Boston Inspectional Services Department	Building and Occupancy Permits

Agency Name	Permit / Approval
Boston Fire Department	Fuel Storage License Approval of Fire Safety Equipment
Boston Public Improvement Commission Department of Public Works	Street and Sidewalk Occupation Permits; Tieback/Earth Retention Permit; Specific Repair Plan
Boston Zoning Commission / Board of Appeal	Zoning Relief
Boston Groundwater Trust	Plan Review and Approval

8.0 References

Abramovitch, Y. (1961). The Maxim "Cujus Est Solum Ejus Usque Ad Coelum" as Applied in Aviation. *McGill Law Journal*, 8(4), 247-269.

Alberta Land Surveyors Association (ALSA) (2016). *Easements and Right-of-Ways.* Accessed from http://www.alsa.ab.ca/publicinformation/easementsandrightsofway.aspx.

Arlington County (2015). *Rosslyn Sector Plan Update: Highway Air Rights Development Feasibility Study.* Accessed from http://arlingtonva.s3.amazonaws.com/wp-content/uploads/sites/31/2016/01/Rosslyn-Air-Rights-Memo-150113_clean_w_memo_appendix.pdf.

Baker, A. (2015). *What a Strata Corporation Needs to Know About: Air Space Parcel Agreements.* Condominium Home Owners' Association of British Columbia. Accessed from http://www.choa.bc.ca/_resources/600-005%20Understanding%20ASP%20agreements%20May%2020%202015_2%20columns%20with%20graphic.pdf.

Bell, L. (1928). Air Rights. *Illinois Law Review, 23,* 250-264. Accessed from HeinOnline database.

Berg, N. (2012). *It's Official: Downtowns are Booming.* Accessed from http://www.citylab.com/work/2012/09/its-official-downtowns-are-booming/3429/.

Beyer, S. (2014). *Why Don't More Cities Sell Air Rights?* Accessed from http://www.governing.com/columns/urban-notebook/gov-air-rights.html.

Boston Redevelopment Authority (BRA) (1998). *A Civic Vision for Turnpike Air Rights in Boston.* Accessed from http://www.cityofboston.gov/.

Boston Redevelopment Authority (BRA) (2015). *Article 80 – Development Review and Approval, Zoning Code.* Accessed from https://www.municode.com/library/ma/boston/codes/redevelopment_authority?nodeId=ART80DEREAP.

Bozung, L.J. (1985). Public Trust Doctrine and Transfer Development Rights. *Real Property, Probate and Trust Journal, 20(3),* 975-984. Accessed from HeinOnline database.

British Columbia, Province of. (2016). *Land Title Act – Part 9: Air Space Titles.* Accessed from http://www.bclaws.ca/civix/document/LOC/complete/statreg/--%20L%20--/Land%20Title%20Act%20%5BRSBC%201996%5D%20c.%20250/00_Act/96250_09.xml.

Bunio, N. (2015). *Air Rights Development: An Implementation Guide for Municipalities Detailing the Considerations involved with Developing Air Space.* Unpublished Paper.

Calgary Municipal Land Corporation (CMLC) (n.d.). *New Central Library: to Inspire All.* Accessed from http://www.calgarymlc.ca/new-central-library/.

Campbell, B.E. (2004). *Creating Sustainable Air Rights Development Over Highway Corridors: Lessons from the Massachusetts Turnpike in Boston* (Master's Thesis). Accessed from http://dspace.mit.edu/.

Capitol Crosssing (n.d.). *Capitol Crossing Fact Sheet.* Accessed from http://www.capitolcrossingdc.com/#press.

Cervero, R. (1994). Rail transit and joint development. *Journal of the American Planning Association*, 60(1): 83-94.

Chen, D.W. (2004, Jun 18). Life on the Road; Learning to Sleep as Trucks Roar Through Basement. *The New York Times.* Accessed from http://www.nytimes.com/2004/06/18/nyregion/life-on-the-road-learning-to-sleep-as-trucks-roar-through-basement.html?_r=0.

Chicago, City of (2015). *Title 17 Chicago Zoning Ordinance: Chapter 17-8 – Planned Developments.* Accessed from http://library.amlegal.com/nxt/gateway.dll/Illinois/chicagozoning/chicagozoningordinanceandlanduseordinanc?f=templates$fn=default.htm$3.0$vid=amlegal:chicagozoning_il.

Chu, M. (1985). *Development Plan for the Air Rights at South Station Transportation Center* (Master's Thesis). Retrieved from http://dspace.mit.edu/.

Clancy, S.P. (1998). *Air Rights Development: Is it Different From Traditional Land Development?* (Master's Thesis). Retrieved from http://dspace.mit.edu/.

Conveyance and Taxation of Air Rights. (1964). *Columbia Law Review*, *64*(2), 338–354.

Costonis, J.J. (1973). Development Rights Transfer: An Exploratory Essay. *The Yale Law Journal, 83(1),* 75-128.

District of Columbia, Office of the Deputy Mayor for Planning and Economic Development (DMPED) (n.d.). *Capital Crossing.* Accessed from http://dmped.dc.gov/page/capitol-crossing.

District of Columbia, Office of Planning (OP) (n.d.). *Zoning Commission Cases (ZC).* Accessed from http://planning.dc.gov/node/640852.

District of Columbia (2002). *Planned Unit Development (PUD).* Accessed from http://www.dcregs.dc.gov/Gateway/RuleHome.aspx?RuleNumber=11-2400.

District of Columbia, Zoning Commission (2011). *Zoning Commission Order No. 08-34).* Accessed from http://www.dcoz.dc.gov/orders/08-34.pdf.

Dumfries, C. (1995). Appraisal of Air Rights: An Introduction. *The Canadian Appraiser,* 28-34. Accessed from https://professional.sauder.ubc.ca/.

Dunlap, D. W. (2015, Jul 22). A Hudson Yards Garden Will Grow with Concrete, Coolant and High-Power Fans. *New York Times.* Accessed from http://www.nytimes.com/2015/07/23/nyregion/a-garden-will-grow-with-fans-concrete-coolant-and-28000-plants.html?_r=0.

Edmonton, City of. (2015). *Opportunities for Commercial Development in Future LRT/Transit Infrastructures LRT Stations and Lines - Options for Sale or Lease of Air Rights.* Accessed from http://sirepub.edmonton.ca/sirepub/home.aspx.

Epsilon Associates (2008). *Draft Project Impact Report/Draft Project Environmental Report: Massachusetts Turnpike Parcel 7 Air Rights Kenmore/Fenway Area.* Accessed from http://www.bostonredevelopmentauthority.org/getattachment/03fd3e77-bed8-4349-84d9-89c2c9880253.

Federal Highway Administration (FHWA), Office of Planning, Environment and Realty (2014). *Airspace Guidelines to 23 CFR 710.405 - 710.407.* Accessed from http://www.fhwa.dot.gov/real_estate/right-of-way/corridor_management/airspace_guidelines.cfm.

Federal Highway Administration (FHWA) (2016). *Planning, Environment, & Realty.* Accessed from https://www.fhwa.dot.gov/hep/index.cfm.

Florida, R. (2005). *Cities and the Creative Class.* New York: Routledge.

Goelman, A. (1999). *Transferable Development Rights: A Policy Analysis of a Planning Instrument and its Application in Vancouver* (Master's Thesis). Accessed from https://open.library.ubc.ca/cIRcle/collections/ubctheses/831/items/1.0089027.

Goldschmidt, L.A. (1964). *Air Rights – Information Report No. 186.* American Society of Planning Officials. Accessed from https://scholar.google.ca/.

Gray, C. (1998, Oct 11). Streetscapes / Grand Central Terminal; The 23-Story, Beaux-Arts 1913 Tower That Wasn't. *New York Times.* Accessed from http://www.nytimes.com/1998/10/11/realestate/streetscapes-grand-central-terminal-23-story-beaux-arts-1913-tower-that-wasn-t.html.

Frug, G.E., & Barron, D.J. (2008). *City Bound: How States Stifle Urban Innovation.* Ithaca: Cornell University Press.

Hall, J. (2002, Mar 20). TTC Explores Selling Station 'Air Rights'. *The Toronto Star.* Accessed from http://transit.toronto.on.ca/archives/data/200203200100.shtml.

Hauser, S.L. (1989). *A Conceptual Analysis of Air Rights Development Over the Urban Transit Corridors of Boston* (Master's Thesis). Retrieved from http://dspace.mit.edu/.

Hudson Yards (2016). *The Story.* Accessed from http://www.hudsonyardsnewyork.com/the-story.

Hudson Yards Development Corporation (HYDC) (n.d.). *Hudson Yards Development Information.* Accessed from http://www.hydc.org/downloads/pdf/hy_development_information.pdf.

Hudson Yards Development Corporation (HYDC) (2015). *The HYDC.* Accessed from http://www.hydc.org/html/about/about.shtml.

Hudson Yards Infrastructure Corporation (2004). *Hudson Yards: Presentation of Hudson Yards Infrastructure Corporation Financing Plan to City Planning Commission.* Accessed from http://www.nyc.gov/html/dcp/pdf/hyards/financing_for_cpc.pdf.

Hudson Yards Infrastructure Corporation (HIYC) (2014). *Mission Statement and Performance Measurements.* Accessed from http://www.nyc.gov/html/hyic/html/about/hyic.shtml.

Jacobs, J. (1961). *The Death and Life of Great American Cities.* New York: Vintage.

Jones, S. (2007). *Mixed Use Developments: Air Space vs. Strata.* Accessed from http://www.bcrelinks.com/articles/swj1.htm.

Kelly, H.F. (2015). *Emerging Trends in Real Estate.* PricewaterhouseCoopers and Urban Land Institute. Accessed from https://www.pwc.com/ca/en/real-estate/publications/pwc-emerging-trends-in-real-estate-2016-en.pdf.

Kirkpatrick, K. (2012). *RFO Process – Lease and Sale of Air Rights at Lansdowne Park.* Finance and Economic Development Committee. Accessed from http://ottawa.ca.

Kwasniak, A.J. (2005). The Potential for Municipal Transfer of Development Credits Programs in Canada. *Journal of Environmental Law and Practice, 15,* 48-70.

Lachman, M.L., Brett, D.L., & Becker, L. (2015). *Gen Y and Housing: What They Want and Where They Want It.* Urban Land Institute. Accessed from http://uli.org/wp-content/uploads/ULI-Documents/Gen-Y-and-Housing.pdf.

Lari, A., Levinson, D., Zhao, Z., Iacono, M., Aultman, S., Vardhan Das, K., Junge, J, Larson, K., & Scharenbroich, M. (2009). *Value Capture for Transportation Finance: Technical Research Report.* Center for Transportation Studies, University of Minnesota. Accessed from http://www.cts.umn.edu/research/featured/value-capture.

Levitt, D.M. (2011, Sept 2). Brookfield Saves in 'Big Megillah' Plan for New York's West Side. *Bloomberg Business*. Accessed from http://www.bloomberg.com/news/articles/2011-09-02/brookfield-saves-in-big-megillah-plan-for-new-york-s-west-side.

Levitt, D.M. (2013, Oct 15). Related Hudson Yards Approved for $328 Million Tax Break. *Bloomberg Business*. Accessed from http://www.bloomberg.com/news/articles/2013-10-15/related-hudson-yards-gets-approval-for-328-million-tax-subsidy.

Lillie, R.R. (1964). Facilitating air rights development (Master's Thesis). Accessed from https://smartech.gatech.edu/.

Lopez, E., & Hampton, J.M. (2014). *Memorandum: Planned Development Area Policy Guidance for Developers.* Prepared for the Boston Redevelopment Authority. Accessed from http://www.bostonredevelopmentauthority.org/getattachment/e6644505-ce9c-4e42-b591-40e6c6049d63.

Los Angeles County, Department of Public Works (2014). *Guidelines for Overbuilding and Air Rights.* Accessed from https://dpw.lacounty.gov/spats/public/spatsfaq/forms/GUIDELINES-OVERBUILD.pdf.

Lorinc, J. (2006). *The New City: How the Crisis in Canada's Urban Centres is Reshaping the Nation.* Toronto: Penguin Group.

Manhattan West (2016). *Deck Engineering and Technology.* Accessed from http://manhattanwestnyc.com/content/innovation/deck_engineering_and_technology-29602.html.

Massachusetts Department of Transportation (MassDOT) (2014). *Request for Proposals: Air Rights Parcel 13 & Hynes Convention Center Station.* Accessed from https://www.massdot.state.ma.us/Portals/0/docs/infoCenter/realEstate_assetDev/airRights/rfp_airRights_parcel13_hynes.pdf.

Massachusetts, Government of. (2016). *General Laws: Chapter 6C Massachusetts Department of Transportation, Section 46.* Accessed from https://malegislature.gov/Laws/GeneralLaws/PartI/TitleII/Chapter6C/Section46.

Mathur, S. & Smith, A. (2012). *A Decision-support Framework for Using Value Capture to Fund Public Transit: Lessons from Project-specific Analyses*. Mineta Transportation Institute.

Accessed from http://transweb.sjsu.edu/project/1004.html.

McMorrow, P. (2012, Oct 23). Finally, a Building Above the Mass Pike. *Boston Globe.* Accessed from https://www.bostonglobe.com/opinion/2012/10/23/finally-building-above-mass-pike/f2vOtfhwwlNekkjsYHeIqL/story.html.

Metro Atlanta Rapid Transit Authority (2010). *Transit-Oriented Development Guidelines.* Accessed from http://www.reconnectingamerica.org/assets/Uploads/MARTATODGuidelines11-2010-Final.pdf.

Metro Atlanta Rapid Transit Authority (MARTA), Office of Transit Oriented Development. (2014). *Request for Expressions of Interest I34254: MARTA's Station Air Rights.* Accessed from http://www.georgiaresourcecenter.com/MARTA/docs/RFI%2034254%20Request%20for%20Expression%20of%20Interest%20MARTA's%20Station%20Air%20Rights.pdf.

Metropolitan Transit Authority (MTA) (n.d.). *Chapter 1: Project Description.* Accessed from http://web.mta.info/mta/planning/wry/pdf/01_deis.pdf.

Metropolitan Washington Airport Authority (MWAA), Office of Engineering (2011). *Report to the Dulles Corridor Committee Workshop: Analysis and Recommendation Phase 2 Dulles Corridor Metrorail Foundation Structure for Air Rights Development over the Dulles Airport Access Highway and Dulles Toll Road at Reston Parkway Station.* Accessed from http://tollroadsnews.com/sites/default/files/DullesAirRights.pdf.

Minneapolis, City of (1983). *Property Agreements Summary: Centre Village Air Rights Lease – Minnesota Hometel Associates.* Accessed from http://www.ci.minneapolis.mn.us/www/groups/public/@cped/documents/webcontent/convert_274251.pdf.

Minneapolis, City of, Community Planning and Economic Development (2014). *Request for Proposals for Purchase and Development of Real Property: Block 1 Liner Parcel and Air Rights Plane 728 South 4th Street.* Accessed from http://www.minneapolismn.gov/www/groups/public/@cped/documents/webcontent/wcms1p-118845.pdf.

Neibauer, M. (2015, Jun 17). Union Station Overhaul Doesn't Happen Until H Street Bridge is Rebuilt. Here's When That Might Happen. *Washington Business Journal.* Accessed from http://www.bizjournals.com/washington/breaking_ground/2015/06/union-station-overhaul-doesnt-happen-until-h.html.

New York, City of (2005). *Special Hudson Yards District: Zoning Text Amendment as Adopted by*

City Council N040500(A) ZRM. Accessed from http://www.nyc.gov/html/dcp/pdf/hyards/zoning_text_011905.pdf.

New York, City of, Department of City Planning (2008). *Inventory of Decking Opportunities over Transportation Properties.* Accessed from http://www.nyc.gov/html/dcp/pdf/transportation/deck01.pdf.

New York, City of (2016). *The Zoning Resolution.* Accessed from http://www1.nyc.gov/site/planning/zoning/access-text.page.

New Westminster, City of (2001). *Zoning Bylaw No. 6880, 2001.* Accessed from http://www.newwestcity.ca/database/files/library/100_Introduction(3).pdf.

Nursall, K. (2014, Apr 2). Big Ideas: Use air rights to build a better city. *The Toronto Star.* Accessed from http://www.thestar.com/news/gta/2014/04/02/big_idea_use_air_rights_to_build_a_better_city.html.

Pim, L. & Ornoy, J. (2003). Smart Growth Principles. *Alternatives Journal, 29*(3), 11. Excerpt from *A Smart Future for Ontario*, (2002), Don Mills: Federation of Ontario Naturalists.

Persiko, L. (2011). *Joint Venture Redevelopment of Toronto Parking Lots* (Presentation). World Parking Symposium. Accessed from http://www.worldparkingsymposium.ca/index.php/2015-04-12-04-19-27/policy-administration/joint-venture-redevelopment-of-municipal-parking-lots-case-studies.

Parsons Brickenhoff Quade & Duglas (2001). *Inventory of Comparative Decking Projects: Summary Report*. City of Sacremento. Accessed from http://reconnectaustin.com/inventory-of-comparative-decking-projects/.

Park 101 (2015). *Friends of Park 101.* Accessed from http://park101.org/.

Pedowitz, J.M. (1974). Transfers of Air Rights and Development Rights. *Real Property, Probate and Trust Journal, 9,* 183-201. Accessed from HeinOnline database.

Pine, M. (1970). *The Development of Air Rights and the Search for Building Space* (Master's Thesis). Accessed from http://digitool.library.mcgill.ca/.

Reconnect Austin (n.d.). *About this Project.* Accessed from http://reconnectaustin.com/.

Richmond, City of (2015). *Air Space Subdivision Application.* Accessed from http://www.richmond.ca/__shared/assets/da3340833.pdf.

Rider, D. (2012, Oct 15). Oxford Properties' Casino Proposal Promises a Park Built on Air it Doesn't Own. *The Toronto Star.* Accessed from

http://www.thestar.com/news/city_hall/2012/10/15/oxford_properties_casino_proposal_promises_a_park_built_on_air_it_doesnt_own.html.

Ross, C. (2014, Dec 5). Fenway Center developer in new talks. *The Boston Globe.* Accessed from https://www.bostonglobe.com/business/2014/12/05/fenway-center-developer-new-partnership-talks/0tCbV8xM1AQbZ15wTGvnkO/story.html.

Savvides, A. (2002). *Reclaiming Ground: Joint Development of Urban Highway* Corridors (PhD Thesis). Accessed from ProQuest Dissertations & Theses Database (305533064).

Schulte, A. (2009). The Development of Roadway Air Rights: Boston's Future, A Slave to its Past. *Boston College Environmental Affairs Law Review, 36(2),* 607-636.

Slack, N.E. (2009). *Guide to Municipal Finance.* UN Habitat. Accessed from http://unhabitat.org/books/guide-to-municipal-finance/.

Steingasser, J., District of Columbia Office of Planning (2010). *Final Report - ZC #08-34- I-395 Air Rights (Return to L'Enfant): Consolidated PUD, First Stage PUD, and Related Map Amendment.* Accessed from http://planning.dc.gov/sites/default/files/dc/sites/op/publication/attachments/ZC%2008-34%20Final%20Report%2011.26.10%20%281%29_0.pdf.

Steingasser, J., District of Columbia Office of Planning (2009). *Setdown Report and Pre-hearing Statement for a Text Amendment to 11 DCMR and a Map Amendment to Square 717, Lots 7001 and 7002 and Square 720, Lots 7000 and 7001 to Guide Development of the Union Station Air Rights.* Accessed from http://ich.dc.gov/sites/default/files/dc/sites/op/publication/attachments/WARD6%20ZC%20Case%2009-21.pdf.

Thurler, K. (2015, June 16). Cummings Foundation Supports New Academic Building for Tufts. *Tufts Now.* Accessed from http://now.tufts.edu/news-releases/cummings-foundation-supports-new-academic-building-tufts.

Toronto Star (2014, Mar 13). Live chat recap: Should Toronto build affordable housing over public facilities? *The Toronto Star.* Accessed from http://www.thestar.com/bigideas/2014/03/13/live_chat_should_toronto_build_affordable_housing_over_public_facilities.html.

TransLink (n.d.a). *TransLink Review & Acceptance Process Adjacent & Integrated Development (AID).* Accessed from http://www.translink.ca/en/About-Us/Doing-Business-with-TransLink/Real-Estate/~/media/4F9CEA1C14AC46D594F87CB2701C8AE0.ashx.

TransLink (n.d.b). *Working Safely Around the Canada Line.* Accessed from http://www.translink.ca/.

TransLink (2015). *Adjacent and Integrated Developments (AID) Project Review Process: Guide for Developers.* Accessed from http://www.translink.ca/.

TranSystems Corporation (2012). *Chicago Union Station Master Plan Study: Final Report.* Prepared for the Chicago Department of Transportation. Accessed from http://www.cityofchicago.org/dam/city/depts/cdot/CDOTProjects/Chicago-Union-Station-Master-Plan-Study.pdf.

Vancouver, City of. (2011). *Rezoning and Community Amenity Contributions: Negotiating for a More Livable City.* Accessed from http://vancouver.ca/files/cov/cacbrochure.pdf.

Vancouver, City of. (2014). *By-Law No. 10908.* Accessed from http://former.vancouver.ca/blStorage/10908.PDF.

Vancouver, City of. (2016). *Air Space Subdivisions.* Accessed from http://vancouver.ca/home-property-development/air-space-subdivision.aspx.

Warren, A., Kramer, A., Blank, S., & Shari, M. (2013). *Emerging Trends in Real Estate.* PricewaterhouseCoopers and Urban Land Institute. https://www.pwc.com/ca/en/real-estate/publications/pwc-emerging-trends-in-real-estate-2014-en.pdf.

Washington Metro Area Transportation Authority (WMATA) (2013). *WMATA Joint Development Policies and Guidelines.* Accessed from https://www.wmata.com/about_metro/docs/Joint%20Development%20Policies%202013-07-25.pdf.

Williams, L.E., & McNichol, D.J. (1973). Valuation of Airspace. *The Appraisal Journal, 41(2)*, 234-253.

Zoning and Land Use—Tax Liability of an Air Rights Conveyance (1974). *Urban Law Annual, 7*, 285-295.