



B U S I N E S S C O N C E P T

The Property-Powered Rail Open Market Development Model

Le ferroviaire propulsé par le secteur immobilier : un modèle de développement du marché ouvert

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Abstract: Real Property Value Optimization Through Open Private-Sector Metropolitan Railway Development and Operation

The Property-Powered Rail (PPR) Open Development Model is designed to optimize return on investment in real property by delivering attractive, safe, efficient and affordable metropolitan-scale passenger railway systems and services on a commercial open market basis to a limited number of “linked localities, without dependence upon government subsidies, public debt, or taxes.

In this approach, the organizing consortium creates an open competitive market for linked localities with the goal of augmenting real property income and realized asset values through the development and operation of a metropolitan passenger railway system, integrated with other modes of transportation. The consortium publishes generic technical specification and architectural guidelines for stations and surrounding sites and core business requirements, otherwise leaving the organizational and architectural design to site developers.

Transit “option value” in property is expected to provide a stable and predictable operating revenue, unperturbed by fluctuations in actual ridership, and to some degree protected from economic downturns because of the consequent increased preference for affordable transit.

Improvement and maintenance to railway infrastructure would be financed entirely by the consortium in negotiation with owners of existing railway assets.

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About the Company: The Opman Company is a member of Moose Consortium. Opman helps large and small sets of clients to advance, operationalize and sustain tangible outcomes to their mutual advantage. Engagements have been completed or are ongoing with global corporations, multilateral institutions, NGOs and boutique services firms, national commercial, public and civil society organizations, and diverse entities at local or regional levels. The company works to advance socio-economic well-being based upon long-term availability of resources, restoration and maintenance of ecosystem integrity, and the comprehensiveness of a diverse social and cultural fabric.

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Résumé: Le ferroviaire propulsé par le secteur immobilier v1.4

Le ferroviaire propulsé par le secteur immobilier : Un modèle de développement des marchés ouverts (FPSI) prédit l'augmentation des revenus et de la plus-value des biens immobiliers grâce à la création d'un marché ouvert, concurrentiel et bien commercialisé celui-ci a comme but le développement et le fonctionnement d'un système métropolitain de transport de passagers intégré avec les autres modes de transport. (Consultez le livre blanc— en anglais.)

Le FPSI permet d'appliquer au secteur du transport la combinaison des éléments clés de la formule free/libre/ouverte et concurrentielle du développement et du déploiement du système d'exploitation Android, avec la logique financière du développement des chemins de fer à leur apogée dans les années 1800 et au début des années 1900. Les premiers chemins de fer d'origine ont été financés grâce à l'augmentation des revenus et de la valeur des biens immobiliers situés à distance de marche des gares ou stations ferroviaires.

Le modèle d'entreprise des premiers chemins de fer était très centralisé et monopoliste, c'était tout-à-fait le contraire dans le cas des voies qui elles étaient free/libre/open source et plus concurrentielles. En vertu du FPSI une équipe de gestion de projet publie l'équivalent d'un logiciel « API » (application programming interface), en utilisant des spécifications techniques génériques et des exigences d'affaires minimum pour « une gare ». Ainsi les chemins de fer deviennent l'équivalent du réseau telecom, un consortium FPSI l'équivalent du système d'exploitation Android, et la station de chemin de fer l'équivalent d'une application de logicielle.

Outre les exigences de base, le modèle FPSI laisse à chaque développeur de station le soin de s'occuper de la conception de son organisation et son architecture, des consultations avec la communauté et de l'obtention des approbations municipales. Avec l'accord de consortium, les revenus d'exploitation pour l'ensemble du système sont alors établis sur une base de « paiement à l'acte d'arrêt du train » que chaque station participante s'engage à payer — comme frais d'accès au réseau qu'inclut n'importe quel forfait téléphonique. Pour les chemins de fer,

cela ne représentera qu'une partie de l'augmentation marginale des revenus et de la valeur des biens immobiliers, qui pourrait s'élever à 25 pourcent et même beaucoup plus.

Le consortium des propriétaires de stations déterminera quelle proportion de l'augmentation devrait être versée pour assurer un service de chemins de fer métropolitain sûr et attrayant. On décidera des nouveaux développeurs de stations sur la base du « premier arrivé, premier servi », à condition de respecter les distances exigées entre les stations.

Selon ce modèle, le prix des billets des passagers est calibré pour optimiser la régularité des augmentations marginales des revenus et de la valeur des biens immobiliers des propriétaires participants. On maximise la valeur des propriétés à distance de marche des stations de train en gardant les tarifs des usagers des chemins de fer les plus bas possibles et en optimisant la qualité de l'expérience des passagers. Il en résulte un cercle vertueux.

Comment financerait-on le réseau de chemins de fer si dispendieux? Le consortium des propriétaires de stations louerait les voies et les ponts ferroviaires. Le consortium financerait lui-même l'entretien et les travaux de mise à niveau des chemins de fer et en retour les propriétaires de voies n'exigeront pas de redevances pour leur utilisation. En vertu des contrats entre propriétaires de stations et propriétaires de voies, il n'y aurait aucun paiement à faire pour l'utilisation des voies jusqu'à ce que la valeur cumulée des frais annulés qui auront été négociés soit égale à la valeur cumulée et documentée des dépenses d'entretien et de mise à niveau des voies que le consortium a encourues, en y ajoutant les coûts de financement. Les membres du consortium n'ont rien à payer, et ils vont financer la dette plutôt que payer des frais de location pour pouvoir utiliser les voies. Quant aux propriétaires de voies ferroviaires leur infrastructure est mise à niveau sans qu'il ne leur en coûte rien, et à la fin de la période d'amortissement, ils peuvent facturer au consortium des frais de location plus élevés pour l'utilisation de voies en meilleure condition qu'elle ne l'auraient été sans les mises à niveau.

1. Introduction

Empirical studies in many countries have long reported the tendency for real property income and asset values to increase within walking distance of metropolitan railway stations, relative to the background property market. Planners, academics, and investors have explored how this effect can be harnessed to optimize property development potential in relation to transit infrastructure and operations (Bertolini, 1996) (GVA Grimley, 2004) (Smith & Gihring, 2006) (Debrezion, Pels, & Rietveld, 2007) (van der Krabben, 2010) (Guerra, Cervero, & Tischler, 2011) (Zhao, Das, & Larson, 2012) (Hale & Miller, 2013) (Hazel, 2013). This value effect played a role in the development and operation of the original steam, electric and then diesel railway systems for metropolitan transit operating between the mid-1800s and mid-1900s, through private sector entrepreneurship and finance.¹ However during the economic interventionist period of the 1950s and 60s most such private transit operations were taken over or shut down by governments. Since that time, the public sector has developed and operated metropolitan transit systems, funding them through a combination of passenger fares, general tax revenues, and in some jurisdictions, special land value capture provisions in property tax legislation that take a portion of the marginal increment in commercial and residential land or property value which is directly attributable to availability of the public transit service (Transport Canada, 2009).

However recent macroeconomic upheavals have partially undermined the fiscal revenues upon which public sector budgets depend. This has brought governments to pursue so-called “public-private partnerships” (P3) in which they outsource some of their core transit infrastructure and services. The most common P3 development model in the transportation domain involves government personnel conceptualizing and specifying business opportunities that it chooses to privatize in alignment with jurisdiction-based policy objectives. It then runs bidding processes in which large private consortia compete for long-term monopoly management rights and service contracts. The revenue models differ amongst jurisdictions in the proportions of transit funding to be supplied through the general tax system, versus through specialized fiscal instruments that capture a portion of property value uplift near stations. Those that do capture property value effects differ in terms of the proportions retained by the property owners and by the government.

Two prominent property-based railways today are Hong Kong's mainly government-owned Mass Transit Railway Corporation (MTR), and the commercially-operated Japan Railways Group (JR).

- In Hong Kong's “Rail+Property” model the metropolitan government grants special land development rights to MTR, itself owned 77 per cent by the government (Chiou, 2013). MTR finances and builds railway infrastructure, and develops property adjacent to stations as a developer in its own right, and in arrangements with other developers. Marginal increases in property value directly attributable to railway service adjacent to the stations can then be leveraged to finance new railway developments (Enoch, 2002) (Cervero & Murakami, 2009) (Hang-Kwong, 2011) (GovHK, 2012) (Padukone, 2013) (MTR Corporation, 2013). MTR's annual profits are approximately 15 per cent, within which profit from property development, rental and management is generally about twice that which it obtains from rail operations. Hong Kong provides a public sector enterprise example of a property-centric approach.

¹ This may be illustrated with a prominent example from the author's own region. The Ottawa Electric Railway was created and operated from 1891 to 1959 by Ottawa industrialist entrepreneurs Thomas Ahearn and Warren Soper. It was quickly followed in 1894 by the Hull Electric Railway created by Québec entrepreneur Théophile Viau, banker Jacques-P. de Martigny, and millwright Stanislas Aubry. By 1901 these two Ottawa and Hull companies integrated their services across the Alexandra Bridge which was financed and built by the Ottawa Northern and Western Railway Company. Their twin city service exchanged passengers with CP's regional service to the rural villages of the National Capital Region. At their peak, together the two urban electric railway companies were transporting 30 million passengers annually on 90 rail cars over 100 km of track. The train cars on the system were designed and built locally by Ahearn & Soper Electrical Engineers in collaboration with Westinghouse (McKeown, 2006).

- The Japan Railway (JR) Group is a consortium of nine private commercial firms, formed originally in the 1980s through the privatization of Japan National Railways. In recent years JR has transitioned from a transportation-centric business strategy in which railway stations were perceived as “transit points”, to a “life-style business” in which stations are now “bases for living” (Sayama, 2014). Today the consortium's non-transportation businesses adjacent to stations account for more than a third of the consortium's operating revenues.

The Hong Kong and Japan examples have developed from simpler public sector governance scenarios than many other metropolitan areas face. Furthermore they are based upon vertically-integrated business monopolies that may not be suited to other cultures. Metropolitan railway development in other venues typically depend upon sustained multi-jurisdictional coordination, and an open competitive market model (Bertolini, 1996) (Lehlbach, 2009) (Faiola, 2013). This is a very tall order. A recent report by the consulting firm A.D. Little observes that in most areas, “the management of urban mobility operates in an environment that is too fragmented and hostile to innovation. Our urban management systems do not allow market players to compete and establish business models that bring demand and supply into a natural balance” (Van Audenhove, Kornichuk, Dauby, & Pourbaix, 2014, p. 26). There is an urgent need for innovation in rail finance (Miller & Hale, 2011) through an open competitive property-based model that is also resilient to multi-jurisdictional complications.

This paper introduces the “Property-Powered Rail Open Market Development Model” (PPR), with the caveat that its relative utility remains hypothetical until its logic is peer reviewed, until financial modeling demonstrates its coherence, and ultimately, until market interest is validated through real projects. None of these is yet in place. It is hoped that this paper will launch the required critical assessment, experimentation and consideration.

PPR describes how *an open consortium of private sector real property investors* may optimize real property value in a competitive market through autonomous privately-financed metropolitan passenger railway development and operation. Its premise is that property investors in an open competitive market can self-organize into a rules-based consortium to achieve the critical mass required to initiate, finance, own and operate their own metropolitan passenger railway systems and services, operationally integrated with other existing municipal and intercity systems. This approach has no dependence upon government funds, although it does require that governments: (a) engage in open discussion; and (b) assert and protect the public interest by respecting and enforcing existing laws and regulations. In some markets this model can be used to restore passenger rail service to an existing metropolitan network of un-utilized or under-utilized railway corridors. In other markets it provides a way to extend the reach of an existing transit network.

2. Purpose

2.1 Entrepreneurial Interest in Property as the Driving Force

The Property-Powered Rail Open Market Development Model (PPR) has a dual purpose, with a directional feedback loop in operation between the two. The micro-economic entrepreneurial incentive structure is designed to increase target property income and realized asset values by generating emergent effects (Goldstein, 1999) in the form of public transit services as “external economies” (Marshall, 1890, p. 221).

- (a) *Return on Investment Optimization in Real Property*: For investors in strategically located commercial and residential property, PPR describes a way to increase net income and realized asset value, with controlled financial risk, through the create of a network of “linked localities”. This is accomplished through private sector open market development and operation of attractive, safe, efficient and affordable metropolitan passenger railway systems and enterprises. The limited business objective of a PPR project is to optimize real property values (assets and incomes) amongst all of the linked localities, within walking distance of stations. Property value increases are independently verifiable through routine real property market data.
- (b) *Metropolitan Transit Systems and Services*: For transit stakeholders, PPR describes a self- financing development strategy for metropolitan-scale passenger railway systems and extensions, with zero dependence upon public debt or taxes. Public interest benefits, including low fares, excellent service, and environmental advantages are positive externalities relative to the business of optimizing real property value. In this context, PPR describes a functional incentive structure for private-sector financing of metropolitan rail systems under one or more of the following circumstances:
 - Persistent fiscal constraints impeding public-sector development of essential services;
 - Economic culture favouring open competitive commercial development of essential services;
 - Fragmentation of a metropolitan region into numerous jurisdictions and layers of authority.

The PPR is tailored to the scale of a metropolitan region (Debrezion et al., 2007) of a few thousand square kilometers including urban, town and rural areas, and may not be relevant at smaller or larger scales. The regional railway must be extensive enough to generate sufficient cumulative financial effects to cover core system costs and investor returns, and yet able to concentrate its property value effects around a very limited number of stations. The financial model is based upon the synergistic relationship between relatively unconstrained *demand* for safe, efficient and affordable metropolitan-scale mobility, and the market value of naturally constrained *supply* of property within walking distance of stations. With suitable business arrangements, these natural constraints can generate a controlled revenue stream to pay for the service and to reward investors. The effect is unlike road-based transportation modes that diffuse their benefits so widely that the only means of revenue-capture is indirectly through the tax system. Accordingly, the property value effects of bus rapid transit systems (BRT) are not as significant, in spite of the increased volume of land development near major stations, resulting in improved access to shopping, employment, and services (Stokenberga, 2014).

Potentially eligible sets of properties are those within an easy walk of the region's existing railroads (i.e. defined as 800 meters, about a 5-to-7 minutes walk). The PPR prioritizes locations with the greatest potential to experience a net value-added increase in both income and asset value directly attributable to the availability of the planned metropolitan-scale passenger rail service. Sites are be autonomously nominated by investors, then prioritized by the coordinating consortium to optimize the aggregate value increment from a whole-system perspective.

Whole-system revenue optimization requires a critical mass of linked localities widely distributed throughout the regional network of railways. It will therefore include real property investment of very diverse types: retail, office, condos, rentals, owner-occupied, recreational, rural and industrial zones. The minimum required average marginal increase in property value of any type expected within the 2 square kilometers around a platform is 25 per cent. (The 2 km² results from the area of a circle of radius 0.8 km.)

Each site development group is responsible to obtain its own approvals, and the organizing consortium will assemble site development financing packages.

Trains will service each participating autonomous locality in exchange for a monthly fee, to be based upon a simple formula for increments attributable to the utility of added mobility that shows up in independently verifiable empirical data on property market effects. This “train stopping fee” is calculated as a proportion of the measured uplift in realized property revenues (marginal increase in leases, rents) and capital gains (marginal increase in sales closed in the period). In this model it is not necessary to assume the 100% of property owners within the defined locality choose to participate in the arrangement. If a critical mass of property owners in a locality want to participate in the arrangement to split the increment in property value by a negotiated proportion. Those who do not sign onto the increment-sharing arrangement would nevertheless experience an increase in the market value of their properties as windfall gains. But if they have no plans to sell, their municipality property tax liability will also rise. For owners who do not want to participate in a Linked Locality agreement, and yet also not want to sell, the consortium can offer to cover 100% of their property tax increment for as long as the owner holds their property, in exchange for assigning 100% of the increment to their property asset value which is statistically attributable to the value added from train service, once they eventually sell that property.

Several smaller sources of revenue can be added within the PPR, but they are not core to the model. The incentive structure drives effective demand for properties, adding high quality mobility through the provision of railway services to turn disparate properties into a network of linked localities while cultivating that property value by passenger experience.

There is nothing original in noticing that regional passenger railway stations tend to raise the values of nearby properties. Most of the original railway transit systems created between the mid-1800s and mid-1900s were financed by monopolies or oligopolies on the basis of this property value uplift, part of which was cycled back by the owners to finance the operation and further development of the railways. However in the 1950s and 60s practically all commercial passenger railway companies were taken over by governments, and most were shut down. Since then development and operation of metropolitan transit has been perceived as necessarily a government monopoly funded through general tax revenues, specialized taxes (property, fuel, tolls), and high passenger fares. Some municipalities outsource track maintenance and train operations to private monopolies. But drawing upon the work of authors and solution developers from various disciplines, the PPR breaks new ground in transit project financing. The 150-year-old real property value optimization model for financing railway systems through land appreciation around stations within a public or private-sector monopoly context, can be adapted to modern principles of an open competitive market economy.

PPR may appear similar in some ways to the common “Public Private Partnership” (PPP or P3) model “operated on the principle that a grantor, usually but not always a government body, would offer an operating license to a concessionaire for a long term contract to develop and operate a transportation company with exclusive rights” (Brown & Schmidt, 1999). In particular, PPR can be mistaken for the conventional *Build-Own-Operate* model for transit projects in which: “the concessionaire is essentially buying the basic facility in installments from the owner, with the facility and its upgrades provided as security over the repayment period. On completion of the contract, ownership reverts to the concessionaire” (Brown & Schmidt, 1999).

But any similarities in terminology and some elements of form are superficial. There are fundamental differences that PPR brings to the entire business incentive structure and to the relationships that characterize the business. The purpose of this paper is to outline these differences. This approach shares some of the business drivers found behind commercial metropolitan railway development of the 1850-1950 period, and contrasts with post-1960s government-determined approaches to generally. On the other hand, PPR draws upon the business drivers of the post-1990s open-systems and open-markets, in contrast to the relatively closed-systems and restricted-market approaches that have gone before.

2.2 Public Interest as External Emergent Effects

2.2.1 Private Interest and Public Interest

“Property-Powered Rail Open Market Development Model” is the first in the global railway industry to adapt a “platform business model” whereupon each station would be an autonomous enterprise. (Kogut & Kulatilaka, 1994) (Choudary, 2015) However any plan for private commercial development of essential services brings forward to public discussion the inevitable tension between private interest optimization and public interest optimization. Many stakeholders take a principled stance against “important transportation assets being operated primarily to boost private profit rather than best advance public needs”. And also on strategic grounds, many parties prioritizing the general public interest will understandably take steps to prevent “the ability of private-sector actors to hold projects hostage and demand increased subsidies or other concessions from government” (Dutzik, Schneider, & Baxandall, 2011, p. 2).

Such concerns with private sector transit are reflected, for example, in the following description of results with the Taiwan High Speed Rail Corporation (THSRC) in a US-based study:

“In Taiwan, the government’s efforts to pursue a fully private-sector built and financed high-speed rail line fell apart—despite rising ridership—as the private company responsible for building the line faced a financial crisis caused by its reliance on high-cost debt. The Taiwan government ultimately stepped forward to bail out the company and refinance its debt... with little choice but to prop up the failed business plan of a private operator with public funds.” (Dutzik et al., 2011, p. 2, 24)

However these analysts neglect to distinguish government outsourcing to private companies on government-defined terms, versus genuine entrepreneurial business models. A brief study was undertaken at the Wharton School to assess the THSRC's business architecture. This was published in 2007 when Taiwan's 400 km system first opened for service. It shows that the THSRC approach is more accurately described as a partial and temporary outsourcing of project components by government. THSRC has never been a private sector commercial initiative, even if the business form of the legal entity is structured as a private corporation:

“The new rail is owned and operated by the THSRC, a private company with strong links to the Taiwan government. ... Although it is a private company, the THSRC operates the rail under a BOT [build-operate-transfer] contract: It built the rail and will own and operate it until 2033, when ownership will be transferred to the Taiwan government. ... Funding for the rail came from two main sources: Shareholder equity accounted for 20% while the rest was borrowed, mostly from local banking groups ... and mostly they are government owned” (Wharton, 2007)

Interestingly, even though THSRC was granted rights to construct and operate commercial developments on the land near the stations for 50 years, it never leveraged this obvious entrepreneurial opportunity. Unlike the financially successful MTR in Hong Kong and (recently) the publicly-owned JR in Japan, THSRC in Taiwan has never pursued uplift in property income and asset values generated near its stations. Instead it appears to have implemented nothing more than a post-1960s bus-oriented funding model that has depended upon passenger fares for more than 95% of its revenue, and even those passenger fares are government-controlled (Wharton, 2007). Taking all of these business characteristics into consideration, it is misleading for Dutzik et.al. to refer to THSRC as “a fully private-sector built and financed” railway plan that failed, and which “government ultimately stepped forward to bail out” (Dutzik et al., 2011, p. 2).

Unfounded characterizations of private enterprise failure notwithstanding, there are certainly legitimate and critical public interests that require protection when structuring a major transportation service under private or public sector models. In either scenario, the most resilient approach is to ensure that public interest protection is inherent within the business systems architecture itself, and is not merely dependent upon brittle contractual and political promises.

The PPR approach to metropolitan railway finance, development and operation has several characteristics at the level of business architecture which ensure that its competitive private sector incentive structure remains complementary to broader societal interests, namely:

- First and most generally, the broad public interest is served by having access to a sustainable self-financing metropolitan passenger rail system that does not depend on public debt, changes to the tax base, or the variable municipal cash flow situation;
- A PPR consortium structure has no barrier to entry for small and medium enterprise, and fully respects the letter and intent of competition laws and policies, thereby distributing financial benefits;
- A PPR approach is premised upon whole region integration, providing equivalent attention to dense core and suburban as well as sparsely-populated semi-rural and rural areas. Such support for rural-urban linkage is beneficial to both urban and agricultural ways of life;
- A PPR has an incentive structure favouring the lowest possible passenger fares, because lower fares increase the option value of properties adjacent to stations;
- Even though each station is an autonomous enterprise, its developers and operators of course need to follow municipal master plans, zoning bylaws and environmental and safety regulations, and they must obtain all appropriate permits from their municipalites to create stations.
- Beyond specific business architectural considerations, a PPR carries further the Japanese and Hong Kong perceptions of metropolitan railway stations as life-style centres, mentioned earlier. This concept is developed in section 2.2.2 below.

2.2.2 Privately Owned Public Space

In PPR business architecture, the interior of a metropolitan train is perceived as a type of “privately owned public space” (Kayden, 2000) (Cosulich-Schwartz, 2009) (Rahi, Martynkiw, & Hein, 2012) (Mac Síthigh, 2012). That's to say, the train is given essentially the same status as the general access areas of the stations, with comfortable seating, elegant furnishings and an attractive atmosphere. The difference for the rolling stock is that these spaces change location in a predictable, reliable way, rather like an elevator in a shopping mall, albeit horizontally.

The PPR incentive structure is drawn towards maximizing demand by optimizing passenger experience, and train interiors are critical to this objective. To enhance the market value of fixed properties near stations, the moving spaces in which people wait between the target locations must be guided by the insights of interior architects. In an architectural design pattern entitled “Place to Wait”, Christopher Alexander and team explained:

“The fundamental problem is this. How can the people who are waiting spend their time wholeheartedly – live the hours or minutes while they wait as fully as the other hours of their day – and yet still be on hand, whenever [what] they are waiting for is ready? ... Therefore, in places where people end up waiting, ... create a situation which makes the waiting positive.” (Alexander et al., 1977, p. 710)

By taking an architectural approach to the train interior, one takes into account that different travellers at different times wait in a train for their stations in different ways. Some chat quietly with their friends, some engage noisily with their friends, some read from paper or devices, some listen to music or voice with earbuds or headphones, some nod off in a half-sleep, some gaze out the window. Typically all of these

people share same “room”, which is not ideal. But in a three-car bi-level train, for example, an architect sees six distinct rooms, each with a capacity of about 100 people. An architectural approach to train interiors may potentially promote different norms for each of three bilevel cars: one could be posted with a quiet rule like a public library (which we shall nickname here “*the train of thought*”), the second could include for recorded and/or live music with the atmosphere of a pub (“*the soul train*”), and the third could be dedicated to talking, laughing, loud-earbuds, etc. (“*the power train*”). Differentiating vertically, the second decks of one or more of the bi-level cars could be outfitted as compact cafés or pubs.

Such concepts arise from, and make sense in, a property-oriented perspective wherein the train interior is understood as a valid place for people to want to be. This is how train interiors were perceived between the 1850s and 1950s. It is the same strategy as appears amongst other privately-owned public spaces we are familiar with today: pleasant public corridors of certain commercial shopping centres, and the finely decorated lobbies and outward-facing gardens of some commercial office buildings and hotels. However this way of seeing is entirely foreign to the post 1960s mass transit perspective, in which train interiors exist as safe, relatively austere holding pens to transport passengers between places where they want to be.

In this framework, complex public interest outcomes that derive from the PPR are *emergent* (Goldstein, 1999) *positive externalities* (Mundt, 1993) relative to the simple business purpose of increasing property earnings through attractive privately-owned public space. In the whole-region scenario of a PPR development, the cumulative set of narrow purposes directed to enhancing the income and asset values of the properties adjacent to each autonomous station resolve into a bottom-up approach to applied regional transportation economics (similar to Delli Gatti, Desiderio, Gaffeo, Cirillo, & Gallegati, 2011, but at a different scale).

2.2.3 Private and Public Interest in Minimizing Barriers to Entry, to Cultivate a Popular Movement

In principle, passenger fares in PPR business strategy would be calibrated to whatever level optimizes sustained marginal increases in real property income and realized asset values for participating owners of property around stations. The incentive structure is drawn towards maximizing property demand and market price by minimizing fares and optimizing passenger experience.

The capital and management burden of fare collection and enforcement is significant. For example, the capital cost alone of the “Compass Card & Fare Gate Project” undertaken by Vancouver’s Translink system has cost almost \$200M and has taken more than 8 years to develop and implement (Translink, 2013), with expected operating costs of \$12M annually. However the PPR puts in place an incentive structure that tends to reduce passenger fares to insignificant amounts.² An optimal fare for PPR remains to be modeled formally. However it is useful to consider how systems planners should respond if results indicate that the optimal passenger fare would be so low that it approaches the cost of collection and enforcement operations. Once these two factors approach each other, one could shift to a free or “*pay what you want*” relationship with passengers (Kim, Natter, & Spann, 2009) (Schons et al., 2014) (Schmidt, Spann, & Zeithammer, 2014) (Gomez & Krishnamurthy, n.d.). Moreover, it must be asked whether any foregone fare revenue would be more than offset by property revenues increases due to the overall market attractiveness of pay-what-you-want mobility. The perception goal for propertied interests near stations is to have passenger fares so low that drivers feel ridiculous driving and parking a car to get around a

² On Hong Kong’s system Rail+Property system, the average train fare is about US\$1 (Chiou, 2013) (granted that, even this low fare is the more expensive option amongst the various available transit modes in this region).

metropolitan region. Such a radical approach would not only get routine drivers out of their cars, but the business model itself would turn heads and gain a following. Property income and asset value near stations is optimized when the common refrain is: “My next car’s a train.”

In the PPR application of *pay-what-you-want*, payment can be oriented to the new generation of widely-deployed devices (smartphones, tablets, laptops) equipped with a “near field communication antenna” and “host card emulation” technology to enable easy and secure contactless payment (Google Inc., 2015) (Apple Inc., 2015) to enable the collection of revenues with low or no collection costs (W3C, 2014a) (W3C, 2014b). While it can be expected that gross revenues will be lower, the minimization of payments collection infrastructure and staffing actually means that the net retention of every \$ £ € or ¥ received from passengers is proportionately greater. Far from neglecting the value of money, this model forces the business to treat clients with such respect and that it attracts voluntary payments. To cultivate a loyal movement in support of voluntary payment in scenarios where PPR *pay-what-you-want* appears feasible, in the PPR model 100% of revenue received from passengers is earmarked for passenger experience enhancement. This can include a wide variety of on-board and in-station services for greater passenger comfort and convenience, with pro-active and responsive communication channel in place for listening to client interests, preferences and creative ideas. These earmarked funds could also be used to partially cross-subsidize complementary off-site services for passengers. Some examples include railway-subsidized daycare at stations and railway-subsidized walk-in medical clinics at major stations. (Having trained medical staff at stations also enhances the railway’s emergency-response capabilities.) Proceeds from the passengers’ experience fund can also be used for a “guaranteed-ride-home” service that the PPR consortium would pre-arrange with a variety of participating ride companies, to look after passengers who have missed the last train on any evening. The passengers’ experience fund also pays for clean-up/repair of vandalism and graffiti (i.e. beyond routine maintenance and cleaning) in order to establish an incentive structure with passengers for station upkeep and enhancement. All riders have a clear and direct stake in keeping the trains and stations clean.

The PPR approach to *pay what you want* circumvents the “tragedy of the commons” problem (Hardin, 1968) in which potential user are locked into an incentive structure that compels each individual user of a limited common asset to increase their use of the commons without limit. Trains and railway corridor infrastructure are scalable to demand (more train cars, more passing tracks, etc.). It is the property and infrastructure within walking distance of stations which is naturally limited. But the PPR financial model is based upon this synergistic relationship between relatively unconstrained demand for metropolitan-scale mobility, and the value of naturally constrained property to access it.

3. Visualizing a PPR Competitive Market

A project based on the PPR establishes an open and disaggregated competitive market, the goal of which is to optimize the asset values and incomes of lands and buildings within walking distance of a limited number of stations that provide access to a regional railway system. A PPR consortium consists of a wide assembly of direct investor-stakeholders whose joint interests are served by regional railway infrastructure and operations that are resilient, cost-effective, timely, attractive and more ecologically sound than feasible alternatives.

The consortium is not itself the operator of rail services, and it need not own the corridors or tracks. Instead, apportionment conditions in the consortium agreement assemble the funds to pay one or more train operators, and to lease running rights on tracks. Track owners and train operators can of course hold regular consortium memberships, but this is not essential. They may simply sell their services to the consortium.

Figure 1 illustrates the value-for-money revenue stream for operations. Through a PPR project a consortium management authority is paid by investors to run the project's day-to-day business. The project manager negotiates lease fees with rail access owners and possibly other rights holders, contracts with the train operators, arranges bulk procurement of supplies such as fuel and on-board Internet access, and contracts for various professional services.

The PPR functions even when neither municipalities nor higher levels of government have funds to develop and operate metropolitan rail services, and they cannot afford to take on debt to subsidize such a system. However public-sector bodies are asked to take pro-active steps within their normal authorities to simplify, facilitate and expedite development pre-requisites or components in acknowledgement of:

- The very high risk to private sector investors prior to government development approvals, pending the completion of research, modeling, planning and communications.
- The significant and quantifiable public interest benefits from the success a regional transit system;
- The public interests that are served by research results and data generated through PPR operations being publicly documented and made easily accessible under “open data” terms.

Fig 1: PPR Value-for-Money

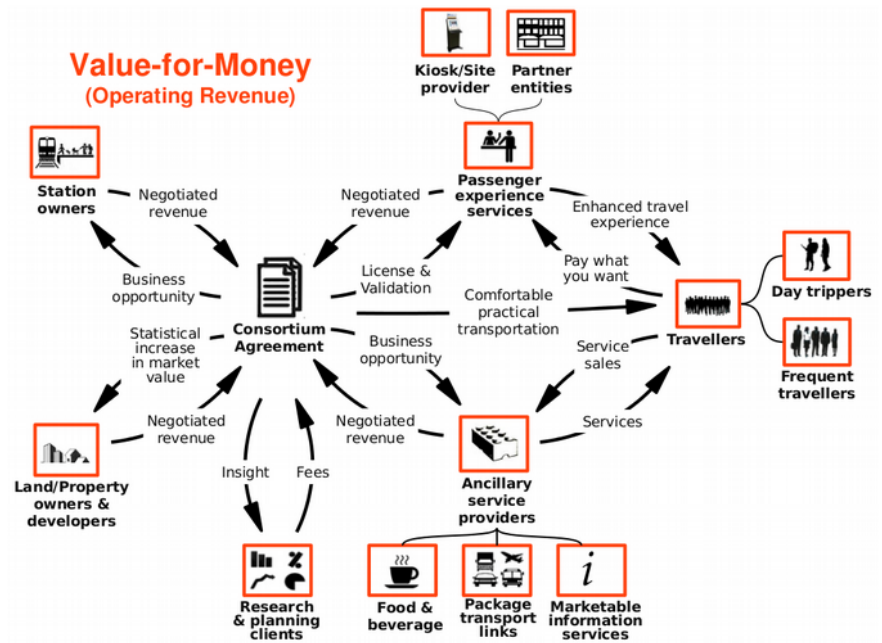


Fig 2: PPR Cost-Effectiveness

Cost-Effectiveness (Operational Expenses)

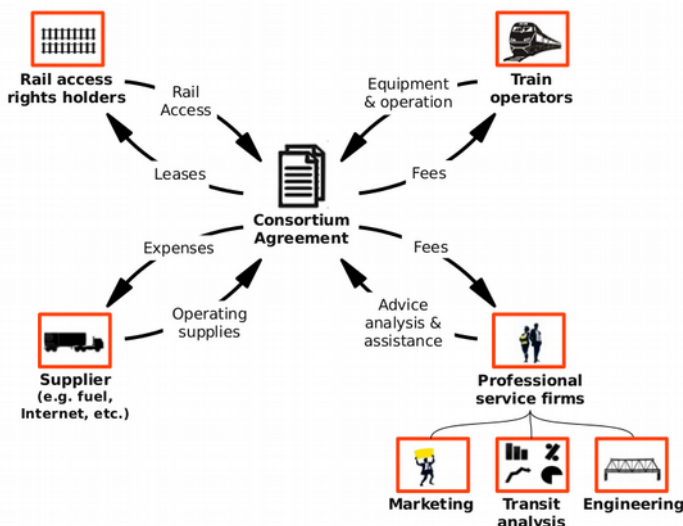


Figure 2 shows the four general directions of operational expenses within a PPR consortium. In this sense it is a conventional enterprise, although it is modular, and it incorporates strong incentives for cost-effectiveness. The distributed approach to both revenues and expenditures creates an open competitive market around the metropolitan transit system, rather than a monopoly. This would even enable competition amongst appropriately qualified operators of trains, so long as the equipment meets all technical specifications for the system, and there is useable capacity on the infrastructure. Increased and improved service enhances property values. Generally, each line in the system can be competed separately. With unified dispatch and regulations throughout a PPR network, there is no practical, safety or legal reason to restrict metropolitan passenger train ownership to a single company.

Figure 3 outlines capital investment relationships with private-sector, public-sector and civil society participants in a PPR initiative. Most capital resourcing is premised upon private investment.

Significant elements of a metropolitan railway project will normally qualify for grants under existing national and provincial/state programs. These would be sought, however public-sector funds are only accepted in a PPR initiative as grants, or in the form of facilitative instruments such as loan guarantees where the primary financing is commercial.

This model forgoes project dependence upon operating subsidies from any level of government, because such a relationship is considered to present an unacceptable risk to level-of-service continuity, which would harm property value. Operating subsidies could also interfere with competitive bidding eligibility.

While rejecting operational funding, the PPR model does rely upon municipal and regional governments for “aligned decisions” within the parameters of master plans and democratic process, which can very significantly offset project costs.

A corporate affinity club open to the general public can provide only a very small source of funds, which would be earmarked for a defined set of activities. Its primary purpose is to engage the general public, and to maintain a strong channel of communication for the expression of tangible demand preferences regarding all aspects of the metropolitan rail service. These funds could be used to support professionally designed independent annual service quality evaluations.

4. Option Value of Access to Metropolitan Railway, Reflected in Property Prices

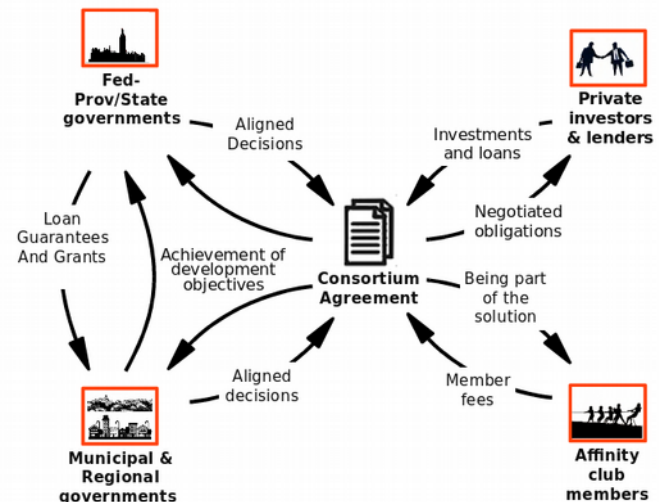
Burton Weisbrod introduced the concept of “option value” to economics in 1964 (Weisbrod, 1964) and it has been widely developed for tangible projects under the phrase “real option” theory (Driouchi & Bennett, 2012). Real option value concerns effective demand for something that may or may not be used, however the purchaser wants to be able to use it at least occasionally, or wants it to be available for others to use:

[Such an asset or service] is utilized infrequently by most persons and not at all, by some; yet... it provides a valuable stand-by service, so that its value cannot be measured by the number of its users or the fees collectable from them alone. This stand-by or option value may be sizable enough to justify the existence of the [asset or service] ... on efficiency grounds... Urban transit firms have come to recognize that persons who normally walk or use private automobiles will occasionally use public transportation e.g., when weather is bad, or when the auto breaks down. These and other occasional users may patronize the transit system once or twice a year, or even less often. Yet an option demand will exist for the stand-by facilities. (Weisbrod, 1964, p. 474)

Many studies delineate the several ways that option value can be considered in the analysis of transit projects, ranging from the availability of opportunity (e.g. travel where and when desired) to the avoidance of nuisance, cost or uncertainty (e.g. future traffic congestion, gas prices) (Geurs, Haaijer, & Van Wee, 2006) (Gao & Driouchi, 2013). The concept has wide application, however the PPR is narrowly concerned with

Fig 3: PPR Return-on-Investment

Return on Investment (Public/Private/Community Capital)



the marginal localized effects of regional railway service upon sets of properties within walking distance of stations, measured in terms of influence on *effective demand* for real property. Effective demand refers to what market participants are able and willing to purchase. Actual property value increases are independently verifiable through real property market data maintained by industry and government bodies.

Ghebre Debrezion et.al. have reviewed diverse studies on the actual measured value impacts of metropolitan railway stations upon the market values of commercial and residential properties. (Debrezion et al., 2007) Results across numerous studies, using different methodologies, have found that every 250 metres of proximity to a station affects property value (rent) from between –12.84% and +38.70%. This wide range indicates attractive investment opportunities as well as risks which need to be mitigated via thoughtful research. The studies demonstrated that “commuter railway stations have had a significantly higher impact on property values compared to light or heavy railway/Metro stations”, which Debrezion et.al. explain by the observing that “commuter railways usually have wider service coverage (i.e. a larger catchment area)” and also that “the number of commuter railway stations is comparatively low”. They report some propensity for commercial properties to exhibit a higher positive value impact due to proximity to railway stations than is typical of residential properties. But this does not imply that return-on-investment would not be sufficiently attractive for stations to arise in primarily residential areas. Some businesses near stations would find it useful to attract employees who would not need to commute by car.

When considering the financial impacts of station placement in the context of a proposed project, the potential investor needs to estimate the option value of access to metropolitan railway service that can be reasonably expected to show up in property prices through time. Then they can weigh the option value from access to the metropolitan rail service, against the cost of funds required for their direct participation. Once the regional railway service is operational, their ongoing participation can be determined though a predictable formula based upon actual property income and asset values.

In a PPR context, both passenger fare and station placement/type are determined by the over-riding objective of real property value optimization within walking distance around stations (assets and incomes). For this type of project to succeed, the straightforward criterion that must be met at both the station and whole-system levels is:

$Z > W+X+Y$ wherein:

Z = the total marginal increase in station-related property values

W = cost of infrastructure upgrades and maintenance

X = cost of railway technical and business operations

Y = returns to investors

Across the whole network, aggregate increases to property value attributable to the metropolitan railway needs to be enough to provides all the operational and maintenance funding. It is understood that increased asset value is only realized as a percentage upon property sales, which occur occasionally, while increased rent/lease value provides an ongoing monthly revenue stream. A structured model can be used to assess the amount of money that can be reliably generated on both ways from a given set of stations. The blend of asset-based and income-based property value will be unique to each station investment group.

5. Creating an Open Competitive Market for Railway Access Points

A PPR network provides autonomous business opportunities for development of stations and platforms by any private or public sector entity wishing to self-organize and invest in the required infrastructure and services, and willing to commit to the land value uplift clauses in the Consortium Agreement, which is itself managed by members of the consortium.

Under a PPR, the Consortium could accommodate stations or platforms according to a rules-based process, which could be “first come, first served”, auctioning, or tendering. In any of these approaches, the consortium establishes the parameters of an open competitive market for railway access points by publishing generic *specifications* and *financial requirements* for stations and platforms, much like the manager of an open modular software platform would publish the API (application programming interface):

- Published specifications include technical parameters such as platform height and length; accessibility and safety; essential passengers services; minimum distances between stops; and other essentials of the System Technical Architecture. The PPR consortium does not, however, fully specify all characteristics of a station. This competitive open market environment will help to ensure station development that integrates effectively with local community preferences. The specifications would include a consultation and accommodation protocol. Each neighbourhood may develop its own unique station or platform placement, look and character, business model (profit-seeking; non-profit; single-owner, cooperative, joint-venture, consortium) and adjunct services appropriate to their situation and needs. Competitive creativity is expected to lead to a diversity of attractive solutions. Each station will have its own story.
- Published financial requirements of the Consortium Agreement require payment of a "train stopping fee", whereby the station will receive train service in exchange for a formula-based fixed percentage of the marginal increase in property asset and income values through time. Stated the other way around, if fees are not paid in accordance with the formula as it applies to a given station, the trains will not provide service to that station.

The distribution of accountability for financial contributions amongst property owners in the area of a station is not a direct concern of the consortium, and there are many types of possible arrangements. Furthermore, central, suburban and rural sites may require different assumptions.

The PPR consortium offers a set of agreement templates, so that each station owner would choose the mix of fee formula that best corresponds to their chosen site development model (e.g. components of condo fees, commercial leasing fees, covenants upon properties upon sale, etc.).³ In each case, however, service fees from each station will be a proportion of the marginal increase in the value of real property transactions within a walking distance of the stations, understanding that increased asset values are only realized as a percentage upon each sale (which has a predictable turnover rate in most markets), while increased rent/lease values provide an ongoing revenue stream. Where municipalities have fiscal instruments to apply tax premiums that can be earmarked in exchange for train service, a PPR initiative can include public-sector stations.

A PPR creates an incentive structure for ongoing performance at the level of each station. Persistent shortcomings by a station in meeting the specifications and requirements will have a detrimental effect on the whole system, and according to established governance principles and processes, lead other consortium members to re-open that section of track to other offers. Stations that occur at essential transfer points with other transportation systems will operate on a different principle: where their existence and exact location are not negotiable, a variety of mutual business opportunities are negotiable. But in most cases the competitive position of each station must be maintained through compliance with the generic *specifications* and *financial requirements*, without incumbent advantage or lock-in. No party shall gain or be provided a monopoly, monopsony or choke-point role over metropolitan railway services.

3 The are several potential methods to negotiate. The autonomous property owners and investors of a Linked Locality could jointly create a 'freehold condominium' corporation to develop and maintain their train station and related common facilities. They remain full owners of their properties, but pay a monthly fee. Alternatively, autonomous property owners and investors could agree to affirmative (positive) covenants. These do not “run with the land, and

6. Financing Core System Infrastructure Upgrades and Maintenance

A PPR consortium need not own any railway tracks or corridors, and does not necessary need to have railway corridor owners amongst its members. It is sufficient that on behalf of the consortium, the train operators negotiate lease agreements in-cash or in-kind for running rights with the owners of railway infrastructure, along with any incumbent rights holders.

The railway corridors of interest to the consortium may have numerous owners, including general purpose railway companies, municipalities, and single-purpose manufacturing firms or tourism organizations running trains under contract. A PPR initiative can re-use or rehabilitate existing railway corridors to generate renewed opportunities for residential and commercial development in areas where development has historically been.

A simple lease fee can be paid for running rights on track that is already maintained to the required minimum Class 3 safety standards (Transport Canada, 2012) and that has all the required elements (including passing tracks), or in cases where the owner or another rights-holder commits to carry out the required upgrades. In many cases, however, tracks and corridors will require significant upgrades which the infrastructure owners cannot be expected to finance. In such circumstances, the consortium members would negotiate permission from the corridor owners and other railway companies using the track make modifications, and then plan, finance and carry out the upgrades. All such costs would be accounted for as a loan from the consortium to the asset owner, to be paid back with interest *in-kind* through the waiving of lease fees for running rights. From the consortium's perspective, approximately the same amounts as would have been paid for running rights are directed instead to repay the loan principal and interest assumed under the arrangements to finance the infrastructure upgrades. The consortium will therefore obtain running rights on the improved infrastructure until the total costs for its improvement are matched. The asset owner ends up with improved, fully-operational assets and, given that a new railway undertaking is in operation, an additional sustainable revenue stream.

The financial arrangements for different assets are case-specific, and may need to include reasonable compensation for disruption or additional costs to other existing railway services. For example, should there be any other users of the track that are not members of the consortium, they would pay full lease fees to the owner of the upgraded track. However any marginal increase in their payments due to track improvements should flow through the corridor owner to the consortium to service its debt on the upgrade to shortening the amortization period. The sooner than happens, the sooner the consortium pays the corridor owner for full running rights.

This scenario creates a logical financial vehicle that can generate attractive returns to lenders or investors from upgrades to railway assets that the investors do not own, while also respecting normal running rights legally available to other users, and replying upon normal market rates. All infrastructural and operational financing of the system is undertaken by the private sector, or by other types of organizations that accept and comply with the consortium agreement.

7. A Generic PPR Implementation Process Template

This PPR outlines a generic five-phase implementation process. This process is not a requirement, rather it is offered as a working draft to be adapted to circumstances. In any case, the process of developing a PPR system with involve incremental steps through structured research, planning and implementation, more or less as summarized in Box 1.

This template process begins with a business intelligence study to identify real property within walking distance from existing railroads, or other potential corridors, with greatest potential to increase by at least 25

per cent as a result of obtaining direct access to metropolitan passenger rail service. Real property of all types is considered: retail, office, housing, industry, brownfield, recreational, agricultural, and others. The initial working assumption is that valuation increases would not depend upon zoning changes: the valuation increases being targetted are those which arise from access to metropolitan rail services.

Phase 1(a) preliminary work would establish whether it is worthwhile to proceed with a full Phase 1(b) research and planning initiative. As a self-contained commercial research initiative, the completed Phase 1 would provide:

- All key information needed to back a comprehensive investor prospectus is prepared towards development of a private sector metropolitan railway system in a manner that will lead to real property value increases where access to the metropolitan railway service is provided;
- Exclusive advance access to statistical and analytical results is provided to identify real property market opportunities created by the railway project. Results will be restricted technologically and under a strict non-disclosure agreement amongst the participating companies during one or two full years after the completion of Phase 1.
- A set of template business arrangements are adapted to the geographical and jurisdictional circumstances through which a managed proportion of actual property value increments, directly attributable to railway service access, can be sustainably harnessed to finance railway operations.

Investors in the preliminary research of Phase 1(a) will determine whether or not to proceed with the full research effort under Phase 1(b). If so, they may choose to finance its continuation themselves to fully retain the exclusivity of its investment value, or they may prefer to distribute cost and risk by including additional funders, also widening access to the results.

The objective of Phase 1 is to assess the potential for sustainable financing of railway operations, and for a suitable return on investments, in the context of underlying considerations relating to trends in regional, national and global economics and society. It provides quantitative scenarios relating to real property markets, demographics, and mobility behaviours. Current railways and potential corridors for the desired network are inspected, and upgrade/development costs are estimated. This initial phase includes the actual negotiation of conditional agreements with stakeholders, and the comparative evaluation of financing methods for Phases 2-5. All of this is supported with methodological documentation, adaptable computerized models, concise analytical reports and supporting communications and assistance.

Box 1: Working Draft of a A Generic 5-Phase PPR Implementation Process

Development of the system is scheduled in five Phases involving research, planning and implementation work.

Real Property Investors

- **Phase 1(a):** (1 year) Funded through convertible debentures or tax-deductible research grants to participating universities. Preliminary business intelligence research, feasibility and planning, with Class D cost estimates. (Huxley, 2002) Decisions on Phase 1(b).
- **Phase 1(b):** (6 months) Funded through convertible debentures or tax-deductible research grants to participating universities. Expanded business intelligence research, feasibility and planning. Class C estimates. Investor prospectus to fund Phase 2.

Railway Project Investors

- **Phase 2:** (6-12 months) Funded through shares. Stakeholder and time commitments and permissions. Complete plans, insurance agreements, certificate(s) of fitness, marketing. Class B then class A cost estimates. Investor prospectus and detailed Phase 3-4-5 plans.
- **Phase 3:** (1-2 years) Funded through shares and fixed-term credit. Core Railway Infrastructure Upgrades, Terminus and Transfer Stations. Detailed plans for Phases 4-5.
- **Phase 4:** (1-2 years) Funded through shares and fixed-term credit. Core Equipment and Maintenance Facilities, plus Additional Stations . Detailed plans for Phase 5.

Operating Revenues, Expenses, Capital Maintenance

- **Phase 5:** (Ongoing) Funded through terms of Consortium Agreement. Regular operations expenses and revenues.

Some elements of the work can be peer reviewed during this time with industry association professionals academics and public-sector officials, but potential station placement is restricted commercial information

at the beginning. The non-disclosure agreement on that information expires upon start of Phase 3, at which time all elements of Phase 1 of the study, including primary source data, customizable business intelligence software, are publicly shared under free/libre licenses, as a means of cultivating natural demand-driven increments to real property market value. This proposal shares the open source principles for financial risk analysis expressed in 2008 by Pershing Square Capital Management (Ackerman, 2008) and more generally the ethical stance and methods behind free/libre/open works (Open Source Initiative, 2014) (Open Source Initiative, 1998) (Free Software Foundation, 1996) and data (Open Knowledge Foundation, 2012) (International Council for Science (ICSU), 2009).

8. PPR Software Extensions

Free/libre/open source transportation simulation and validation software such as TRANSIMS, MatSIM, TravelR and Polarsys⁴ can be extended with PPR modules to include real property valuation effects, and calibrated from empirical and conceptual research and monitoring. The modules would be designed to embody PPR business concepts, objectives, assumptions and rules structure. These generic free/libre/open source extensions would be fully-functional to support analysis, but would also serve as reference implementations for independent peer review of Phase 1. These modules would also be licensed for autonomous adaptation to additional software solutions such as the EMME and ArcGIS which are under restrictive software licenses.

The marginal uplift to property income and asset value must be sustainably harnessed to finance railway operations. A set of template business arrangements which attribute a proportion of actual property value increments to railway service access will be available in source code, together with documentation of the algorithms and data model. These must be negotiated periodically amongst consortium members.

9. Demystifying PPR Business Logic: An Analogy

This *Property-Powered Rail Open Market Development Model* is an adaptation to the transportation sector of elements of strategic economic logic from the highly competitive commercial business model typical of free/libre/open source systems (Open Source Initiative, 2014). We may explain this by analogy with reference to management arrangements around the Android Operating System for mobile devices, a variant of the free/libre/open source GNU-Linux Operating System.

Since a computer program is a type of literary work (WTO, 1994, Article 10), the role of the authors (applied economists etc.) of PPR documentation may be considered analogous to the role of the four original authors (developers) of Android in 2007. Android is a written set of instructions for devices used by people for a range of practical purposes (use cases). PPR is a written set of instructions for organizations used by people for a range of practical purposes (mandates).

The original developers of Android did not themselves need to own or control the distributed systems or networks, so long as these were open-access and rules-based, albeit constrained by bandwidth and mobile service providers. But between 2007 and 2014 the Android instruction set advanced from 0% to 60% of the global smart phone market, and 50% of the tablet market. Similarly, in many metropolitan areas, an existing network of railway corridors also constitute an open-access rules-based network, constrained by logistical limits such as running-rights (akin to “bandwidth”) and numbers of access points (akin to mobile service providers).

4 • TRANSIMS (TRansportation ANalysis SIMulation System) <http://code.google.com/p/transims/>
 • MatSIM (Agent-Based Transport Simulation) <http://www.matsim.org/>
 • TravelR <https://r-forge.r-project.org/projects/travelr/> <http://user2010.org/slides/Raw.pdf>
 • Polarsys <https://polarsys.org/about-us>

A PPR Consortium Agreement in its market context would play a role analogous to that of Google Android's Compatibility Definition Document (CDD), setting out the terms of engagement. A PPR consortium itself would be like the Open Handset Alliance (OHA, 2014) which ensures conformance testing of devices to the CDD.

The small team of authors of this PPR does not purport to have the ability to underwrite and undertake projects of this scale in a metropolitan area. Rather its purpose is to provide a business concept of use to autonomous regional consortia that could convene such projects in various locations. In each case, these consortia would require the participation of diverse stakeholders to proceed with actual implementation.

It would be helpful if at least one major systems engineering management firm were to engage PPR as part of its portfolio of development models. For similar reasons, the original Android developers made arrangements with Google in 2009. To move forward on major projects requires significant business scale, market presence and competence. PPR is a generic concept that must be adapted, marketed and applied by a comprehensive transportation solutions company and/or property developer to the circumstances of each location.

It is important to realize in this analogy that *investment* returns in the Android business model reside with the suppliers of tangible devices, not with Google and not with the original small design team. Instead, Google is simply paid fees by device manufacturers to further advance and test Android. In a PPR consortium, investment returns would be optimized towards the developers of tangible stations, and the real property interests withing walking distance around those stations. The fee-for-service role of an engineering firm would be structured to match their usual net earnings expectations in comparison with other projects they undertake. The original developer of the PPR concept would compete in the open market for continued concept refinement, analysis, market development, client engagement and stakeholder partnering.

Most important in this analogy is to understand that when the suppliers of Android smartphones and tablets sell those devices wholesale to retail distributors, the equipment manufacturer's revenue model does not require that retail consumers use the devices frequently or to their full capacity. And even amongst companies that sell telecom network bandwidth, most sell access packages unrelated to individual customer usage. The analogy for investors in a PPR initiative is that to obtain *increased asset and income values*, it is sufficient that people pay a premium for the option of having metropolitan rail service delivered to the paying properties within walking distance of each station. This frees PPR project investors from the demographic and cultural concerns that determine whether or not people actually do use the stations and trains to their full capacity. This approach instead harnesses *option value*. This makes the PPR strategy for metropolitan transit development and operation fundamentally different from other transit development business models that have dominated throughout the post-war era.

10. Conclusion

This Property-Powered Rail Open Market Development Model may offer a way to augment real property income and realized asset values through creation of an open and disaggregated competitive market for the development and operation of metropolitan passenger railway systems, integrated with other modes of transportation. This PPR concept introduces to the real property and transportation sectors some elements of the highly competitive free/libre/open source strategic commercial business model (e.g. Android, Apache).

In the field of integrated metropolitan transit development, the PPR is unique in several ways. A PPR is based upon open competitive entrepreneurial initiative, organized and financed by the property investors without municipal investment (except possibly indirectly in complementary projects), although within the terms and conditions of municipal plans and regulations. It readily accommodates multiple jurisdictions and diverse patters of infrastructure ownership. Its method of revenue collection is innovative but relatively

straightforward: marginal increases to property value are captured through an algorithm in the voluntary consortium agreement managed by the station investors themselves. Public interest protection is inherent within the business systems architecture itself, and is not merely dependent upon brittle contractual and political promises. Therefore public interest benefits, including low fares, excellent service, and environmental advantages are positive externalities relative to the business of optimizing real property value.

This PPR remains to be validated in a tangible metropolitan railway project. However its essential logic is straightforward. A consortium management team creates an open competitive market for stations, publishing generic specifications and financial requirements, but otherwise leaving the organizational and architectural design to station developers. Under a Consortium Agreement, operating revenue is based on a "train stopping fee", whereby each station, qualified on a "first come, first served" principle, receives train service in exchange for payment of a formula-based percentage of the marginal increase in property income and realized asset appreciation values through time. Station placement is determined by the degree to which the option value of access to metropolitan railway service is expected to show up in the property lease rates and sales prices through time.

Actual property value increases are independently verifiable through routine market data. The price of passenger fares would be calibrated to whatever optimizes sustained marginal increases in real property income and realized asset appreciation values for station owners, which by design is drawn towards maximizing demand by minimizing fares and optimizing passenger experience. Transit "option value" in property should then provide a stable and predictable operating revenue, unperturbed by fluctuations in actual ridership, and to some degree protected from economic downturns because of the consequent increased preference for affordable transit. Empirical studies are required to determine the typical effects on the marginal increment in real property values with metropolitan rail service versus without, through periods of overall property value fluctuations. If the marginal increment is found to hold steady or even increase during periods of decline in overall property market prices, then PPR would provide a stabilizing effect on the metropolitan economy.

Improvement and maintenance to railway infrastructure would be financed entirely by the consortium in negotiation with owners of existing railway assets. In exchange, the right-of-way owners waive all lease fees that would otherwise apply to the consortium's land use and/or running rights. The waiver would remain until such a time as the cumulative value of the waived lease fees is equal to the documented cumulative cost of the improvements and/or maintenance work that the consortium has carried out, including all directly related project design, management, financing, construction, maintenance and administration costs. Operators that are not members of the consortium would not benefit from the waiver. Once the amounts for cumulative waived fees and cumulative improvement/maintenance costs are equal, the right-of-way owner would charge the consortium normal market rates for land use and/or running right on commercially fair and reasonable terms. This arrangement imposes no net cost to the consortium members, who in the arrangement will simply service debt instead of paying lease fees. For their part, right-of-way owners' infrastructure would be upgraded at no cost to themselves, and at the end of the amortization period they can charge the consortium higher lease fees for running rights than they would have otherwise.

The relative utility of this PPR remains hypothetical until this approach is further peer reviewed, until financial modeling is undertaken, and ultimately, until it is validated in real projects. None of these have yet been done.

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