Implementing the United Nations 2030 Agenda for Sustainable Development through effective “People-First Public-Private Partnerships”
Contents

I. Introduction ........................................................................................................................................ 6

II. Objectives of the Standard ............................................................................................................. 6

III. Scope of the Standard ................................................................................................................... 7

A. Standard type ............................................................................................................................... 7

B. Sector focuses of the standard .................................................................................................... 7

C. Geographic coverage of cases in the standard ............................................................................ 8

IV. Central Question .......................................................................................................................... 8

A. Project Types and Examples of Urban Rail Transit PPPs .......................................................... 9

   A1. Criteria of project sample selection ....................................................................................... 9

   A2. Project types ......................................................................................................................... 9

B. Pros and cons of PPPs in the Urban Rail Transit Sector ............................................................. 12

   B1. Core elements of successful Urban Rail Transit PPPs ........................................................ 12

   B2. Lessons learnt from unsuccessful Urban Rail Transit PPPs ................................................. 14

C. PPPs Meeting People First Objectives ...................................................................................... 15

   C1. Demonstrate Replicability, Scalability, Equity, Efficiency, and Sustainability ................ 15

   C2. An Urban Rail Transit PPP model to best achieve SDGs of UN ....................................... 16

V. Delivering the Model ..................................................................................................................... 17

A. Project Selection and Baseline Requirements for Private Interest ........................................... 17

   A1. Identify objectives to adopt PPP model in Urban Rail Transit projects ............................... 17

   A2. Financial and legal readiness of the project ....................................................................... 17

   A3. Technical appropriateness of the project .......................................................................... 18

   A4. Rationalize the project preparation and implementation procedure ................................ 18

   A5. Evaluate project performance ............................................................................................ 20

   A5.1. Ensure the security of Urban Rail Transit construction and operation ............................ 20

B. Financing for Urban Rail Transit PPPs ....................................................................................... 21

   B1. Financial cash flow analysis ................................................................................................. 21

   B1.2. Financial viability gap analysis ....................................................................................... 21

   B2. Design project financing structure ..................................................................................... 21

   B3. Financial Acceptance .......................................................................................................... 22

   B4. Mitigation measures of financing risks ................................................................................ 22

C. Key consideration to implementing Urban Rail Transit construction, operation and transfer.. 23

   C1. Construction ....................................................................................................................... 23

   C2. Operation and Maintenance ............................................................................................... 24

   C3. Transfer ............................................................................................................................. 25

D. Legal Requirements for Urban Rail Transit PPPs ...................................................................... 26

   D1. Establishment of PPP Particular Standards ....................................................................... 26

   D2. Operation of the project ...................................................................................................... 26

   D3. Management of the Contract ............................................................................................ 26

   D4. Promote Zero Tolerance to Corruption ............................................................................. 26

E. Feasibility for Low and Middle Income Countries ..................................................................... 27
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1. Main Challenges and Opportunities of Low and Middle Income Countries in Urban Rail Transit PPPs</td>
<td>27</td>
</tr>
<tr>
<td>E2. Advice on how to achieve SDGs through urban rail transit PPP in low and middle income countries</td>
<td>27</td>
</tr>
<tr>
<td>F. Other Issues Related to Urban Rail Transit PPPs</td>
<td>28</td>
</tr>
<tr>
<td>F1. Contract management</td>
<td>28</td>
</tr>
<tr>
<td>F2. Project asset management</td>
<td>29</td>
</tr>
<tr>
<td>F3. Transferring project asset</td>
<td>30</td>
</tr>
<tr>
<td>VI. Indicators of Compliance</td>
<td>30</td>
</tr>
<tr>
<td>VII. Credits and References</td>
<td>31</td>
</tr>
<tr>
<td>Annex 1. Case Studies</td>
<td>32</td>
</tr>
<tr>
<td>1. Case of Zhengzhou-Gongyi-Luoyang (Gongyi Section) Suburban Line PPP Project</td>
<td>32</td>
</tr>
<tr>
<td>2. Case Study: São Paulo Metro Line 4, Brazil</td>
<td>33</td>
</tr>
<tr>
<td>3. Case of Canada Line</td>
<td>34</td>
</tr>
<tr>
<td>4. Case of Eagle PPP project</td>
<td>36</td>
</tr>
<tr>
<td>Annex 2. List of projects of urban rail transit PPPs</td>
<td>38</td>
</tr>
<tr>
<td>Annex 3. Sector-specific knowledge, terms and terminology</td>
<td>39</td>
</tr>
<tr>
<td>A. Urban rail transit</td>
<td>39</td>
</tr>
<tr>
<td>A1. Rapid transit</td>
<td>39</td>
</tr>
<tr>
<td>A2. Light rail</td>
<td>39</td>
</tr>
<tr>
<td>A3. Commuter rail</td>
<td>39</td>
</tr>
<tr>
<td>A4. Tram</td>
<td>39</td>
</tr>
<tr>
<td>A5. Monorail</td>
<td>39</td>
</tr>
<tr>
<td>B. Urban Rail Transit Project Cycle</td>
<td>39</td>
</tr>
<tr>
<td>B1. Feasibility</td>
<td>39</td>
</tr>
<tr>
<td>B2. Plan and Design</td>
<td>40</td>
</tr>
<tr>
<td>B3. Investment and financing</td>
<td>40</td>
</tr>
<tr>
<td>B4. Construction</td>
<td>40</td>
</tr>
<tr>
<td>B5. Operation &amp; Maintenance</td>
<td>40</td>
</tr>
<tr>
<td>C. Application of the TOD Model in Urban Rail Transit PPP Projects</td>
<td>41</td>
</tr>
<tr>
<td>C1. Key roles</td>
<td>41</td>
</tr>
<tr>
<td>C2. Core principles</td>
<td>41</td>
</tr>
<tr>
<td>C3. Keys to implementation</td>
<td>42</td>
</tr>
<tr>
<td>C4. Approach to advancement</td>
<td>43</td>
</tr>
<tr>
<td>D. Financial Subsidy Models Applied in Urban Rail Transit PPP Projects</td>
<td>44</td>
</tr>
<tr>
<td>D1. Main Reasons for Financial Subsidy for Urban Rail Transit Projects</td>
<td>44</td>
</tr>
<tr>
<td>D2. Common subsidy estimation models used in urban rail transit PPP projects</td>
<td>45</td>
</tr>
<tr>
<td>D3. Recommendations on the Selection of Subsidy Model</td>
<td>49</td>
</tr>
<tr>
<td>Abbreviations and Terms</td>
<td>Meaning</td>
</tr>
<tr>
<td>-------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations</td>
</tr>
<tr>
<td>PPP</td>
<td>Public Private Partnership</td>
</tr>
<tr>
<td>SDG</td>
<td>Sustainable Development Goal</td>
</tr>
<tr>
<td>DBOT</td>
<td>Design-Build-Operate-Transfer</td>
</tr>
<tr>
<td>BOT</td>
<td>Build-Operate-Transfer</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>Operate &amp; Maintenance</td>
</tr>
<tr>
<td>TOT</td>
<td>Transfer-Operate-Transfer</td>
</tr>
<tr>
<td>ICO</td>
<td>Investment &amp; Construction-oriented</td>
</tr>
<tr>
<td>SOE</td>
<td>State-Owned Enterprise</td>
</tr>
<tr>
<td>IOO</td>
<td>Investment &amp; Operation-oriented</td>
</tr>
<tr>
<td>EMO</td>
<td>Equipment &amp; Maintenance-oriented</td>
</tr>
<tr>
<td>SPV</td>
<td>Special Purpose Vehicle</td>
</tr>
<tr>
<td>VFM</td>
<td>Value for Money</td>
</tr>
<tr>
<td>EAM</td>
<td>Enterprise Asset Management</td>
</tr>
<tr>
<td>MTR</td>
<td>Mass Transit Railway</td>
</tr>
<tr>
<td>UNECE</td>
<td>United Nations Economic Commission for Europe</td>
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<td>ECE</td>
<td>Economic Commission for Europe</td>
</tr>
<tr>
<td>BOOT</td>
<td>Build-Own-Operate-Transfer</td>
</tr>
<tr>
<td>DBFOT</td>
<td>Design-Build-Financing-Operate-Transfer</td>
</tr>
<tr>
<td>TOD</td>
<td>Transit-Oriented Development</td>
</tr>
<tr>
<td>UNESC</td>
<td>UN Economic and Social Council</td>
</tr>
<tr>
<td>VGF</td>
<td>Viability Gap Funding</td>
</tr>
<tr>
<td>PFS</td>
<td>Project Feasibility Study</td>
</tr>
<tr>
<td>NPV</td>
<td>Net Present Value</td>
</tr>
<tr>
<td>IRR</td>
<td>Internal Rate of Return</td>
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<tr>
<td>FNPV</td>
<td>Financial Net Present Value</td>
</tr>
<tr>
<td>FIRR</td>
<td>Financial Internal Rate of Return</td>
</tr>
<tr>
<td>ENPV</td>
<td>Economic Net Present Value</td>
</tr>
<tr>
<td>EIRR</td>
<td>Economic Internal Rate of Return</td>
</tr>
<tr>
<td>SA</td>
<td>Social Assessment</td>
</tr>
<tr>
<td>PID</td>
<td>Public Participatory Development</td>
</tr>
<tr>
<td>CIECC</td>
<td>China International Engineering Consulting Corporation</td>
</tr>
<tr>
<td>PfPPP</td>
<td>People-first Public-Private-Partnership</td>
</tr>
<tr>
<td>WP</td>
<td>Working Party</td>
</tr>
</tbody>
</table>
I. Introduction

The United Nations (UN) has identified Public-Private-Partnership (PPPs) in infrastructure and public services as a means to achieve the Sustainable Development Goals (SDGs)\(^1\). The UN has further introduced the concept of “People-first” PPPs (PfPPPs) which means the primary objective of a PPP project should be to maximize the utility of the project to people and facilitate governments achieving the SDGs, including poverty reduction and overall promotion of shared prosperity.

Many countries have implemented PPPs through their domestic institutions and frameworks resulting in many varieties depending on the context of the country, sector, and project. The purpose of this standard in Urban Rail Transit is therefore not to unify the various urban rail transit PPP forms, but rather to identify successful approaches and key concerns that will assist governments in orienting their urban rail transit PPP projects towards the interest of people. Precisely, this and other UNECE PPP standards are designed to provide public and private partners with guidance on how to implement a PPP project that would achieve the SDGs.

This standard was developed through the analysis of Urban Rail Transit PPP cases around the world, and compares various PPP models, summarizes key factors needed to implement a People-first PPP, and identifies common requirements across a number of steps in PPP project implementation.

II. Objectives of the Standard

The objective of this standard is to provide guidance to stakeholders of Urban Rail Transit PPP projects on how to achieve SDGs by applying a “people-first” PPP model. It will assist governments in their decision making and help design appropriate PPPs that meet People’s interests. Use of the standard will also create incentives for private partners to positively correlate their commercial interest with the enhancement of public good. The standard not only fosters an effective enabling environment by aligning policy with practice, but also identifies important implementation steps of a people-first Urban Rail Transit PPP project.

By applying the standard, Urban Rail Transit PPPs can:

a) Goal 3: ensure healthy lives and promote well-being for all at all ages

b) Goal 8: promote inclusive and sustainable economic growth, employment and decent work for all

c) Goal 9: build resilient infrastructure, promote sustainable industrialization and foster innovation

d) Goal 11: make cities inclusive, safe, resilient and sustainable

\(^1\) SDG 16 and 17
III. Scope of the Standard

The recommendations of the standard are based on a global review and distillation of recent and near recent Urban Rail Transit PPP projects and derived from both developed and developing countries.

Urban Rail Transit projects are often highly capital and technology intensive and hence require long-term financing as well as strong design, construction, operation and maintenance capacity if they are to be successful. Public authorities often adopt PPPs for Urban Rail Transit projects in order to leverage funds, improve efficiency, and supplement capacity where they may have difficulties in achieving the project solely by themselves. Urban Rail Transit PPPs have different models according to the specific project requirements; however, the standard looks into the most prevalent types such as DBOT, BOT, O&M, and LBOT.

The standard is also project-centric in that it acknowledges certain important sectoral policy issues but focuses more on specific project elements that need to be achieved in order to realize the SDGs through Urban Rail Transit. To this end, it combines some general rules of PPP with distinct factors of the transport sector and Urban Rail Transit projects.

A. Standard type

The standard is also project-centric in that it acknowledges certain important sectoral policy issues but focuses more on specific project elements that need to be achieved in order to realize the SDGs through Urban Rail Transit. To this end, it combines some general rules of PPP with distinct factors of the transport sector and Urban Rail Transit projects.

B. Sector focuses of the standard

Urban Rail Transit projects vary in size and complexity but most present a high degree of complexity and require significant experience and skill in planning, design, financing, construction, operation, maintenance and management. Several key issues that impact PPPs in Urban Rail Transit include:

1) Project complexity
2) Project readiness and suitability for PPP
3) Route selection
4) Natural resources along proposed routes
5) Level of private activity in investment, construction, operation and maintenance
6) Tariff flexibility
7) Selection of capital-intensive equipment such as rolling stock
8) Public sector capacity, experience, and reliability
In addition, the complex and massive nature of Urban Rail Transit investments has a direct effect on the type and form of private sector involvement, and ensuring adequate public and private sector funding requires a major investment by the grantor in commitment, time, and resources. Developing Urban Rail Transit projects through PPP arrangements therefore requires rigor and a structured approach that will satisfy both public and private sector objectives.

C. Geographic coverage of cases in the standard

The standard is based upon review and analysis of Urban Rail Transit cases from both developing and developed countries including China, Philippines, France, Canada, Brazil and others. The full list of projects and programs is available in annex 3 and accessible on the project team webpage at https://wiki.unece.org/display/pppp/Urban+Rail+Transit.

IV. Central Question

‘People first’, SDG compliant Urban Rail Transit PPP projects should achieve the following goals and address these core issues:

Goal 3: ensure healthy lives and promote well-being for all at all ages
1.1 Focus on the influence of urban rail transit project implementation on the spread of disease.
1.2 The project should improve people’s ability to obtain medical services and other basic public services for related communities;
1.3 provide convenient public transit services for urban residents and promote healthy lifestyles by reducing air pollution and protecting the environment;

Goal 8: promote inclusive and sustainable economic growth, employment and decent work for all
2.1 The implementation of urban rail transit project should consider the goal of full employment;
2.2 provide a decent working environment and labour safety protection measures for workers;
2.3 Emphasize the training of labour skills and legally employ the workers, with equal remuneration for work of equal value;

Goal 9: build resilient infrastructure, promote sustainable industrialization and foster innovation
3.1 Optimize the urban rail transit construction scheme, and adopt clean and environmentally sensitive technologies that improve resource utilization efficiency and ensure the project construction scheme is resilient;
3.2 Promote the development of inclusive and sustainable urban rail transit industry;
3.3 Promote technological development, research and innovation in investment and construction of urban infrastructure;
Goal 11: make cities inclusive, safe, resilient and sustainable

4.1 Promote inclusive, safe, resilient and sustainable urban rail transit construction;
4.2 Provide safe, barrier-free, affordable and sustainable urban rail transit service;
4.3 Pay special attention on the needs of vulnerable groups, women, children, the disabled and the aged and their ability to use urban rail transit facilities;
4.4 Focus on the protection of urban cultural heritage;

Goal 17: reinforce the means of implementation and revitalize the global partnership for sustainable development

5.1 Optimize any subsidy or scheme of governmental fiscal support for the urban rail transit project through PPP model;
5.2 Optimize the financing approach to promote project viability;
5.3 Relieve governmental debt associated with projects and promote debt financing, debt relief and debt restructuring to realize sustainability of long-term debt;
5.4 Promote technical cooperation and promote knowledge sharing through the PPP model;
5.5 Promote international cooperation and capacity building in construction and management of projects;
5.6 Promote international cooperation in equipment trade and service provision;
5.7 Promote innovation in management systems and local government governance mechanisms, including strengthening policy coordination and building sustainable development policies;
5.8 Establish multi-stakeholder partnerships, and encourage effective public, public-private and civil society partnerships in Urban Rail Transit.

A. Project Types and Examples of Urban Rail Transit PPPs

A1. Criteria of project sample selection

The standard relied upon project samples that were:
1) From solid and reliable sources.
2) Representing a distinct type of PPP model.
3) Successfully applied in a developing or developed country.
4) Able to provide transferable experience and lessons learnt.
5) Impactful in the development of the Urban Rail Transit sector.

A2. Project types

Urban Rail Transit PPP projects can generally be divided into four types that represent the typical contractual arrangements:
(1) Design-Build-Operate-Transfer (DBOT). DBOT is a full project-cycle PPP which starts with designing Urban Rail Transit lines and continues until project completion, operation, and eventual transfer back to the public partner.

(2) Build-Operate-Transfer (BOT). BOT is the most common type of PPP in Urban Rail Transit projects where design remains primarily with the public partner but construction and operational risk is transferred to the private partner.

(3) Operate-Maintenance (O&M). O&M focuses on the later phase of Urban Rail Transit project and aims at improving the level of public service provision.

(4) Transfer-Operate-Transfer (TOT). TOT is an approach often used to enhance Urban Rail Transit asset management and transfers the ownership of an existing Urban Rail Transit project during its operational period to a private partner who in turn operates and maintains the system for a period of time.

As a public service, Urban Rail Transit is most often implemented by governmental institutions and/or public utilities. However, a well-functioned Urban Rail Transit line requires large investment, high-quality construction and equipment, professional operation and maintenance and in order for it to remain effective and efficient. This range of responsibilities is difficult for a single governmental body or a public utility to fulfill, and government entities often take on significant risks during the full project cycle of an Urban Rail Transit line. Therefore, cities that plan to have an Urban Rail Transit project often need to leverage support from the private sector to supplement their capacity and mitigate the risk that the project presents. Governments that apply PPP therefore aim to solve a number of different problems. Hence, another way to categorize Urban Rail Transit PPPs is to divide them based on the public sector entity’s objectives and what risks they hope to mitigate, share, and/or transfer.

(1) Investment & Construction-oriented (ICO) PPP. ICO PPP procures a construction firm who is to provide not only high quality construction but also shares in the risk of cost overruns during construction. The need for a high capacity to deliver on complex construction elements while attracting investment are the primary motivations under this PPP model. City governments often adopt this type of PPP to address fiscal stress during the construction period and as an approach to controlling the risk of construction cost. The construction firm is therefore responsible for providing investment as well as construction to the project. The construction cost is often paid by the government through government subsidies. In this model, the operation and maintenance will still be conducted by the government institution or public utilities.

For example, the Barcelona urban rail line 9 &10 adopted this type of PPP to procure construction firms with the capacity to invest in metro stations and provide advanced technology for station construction. The private party was awarded the concession right to
construct the stations, and perform the maintenance work of the stations, for 30 years, in
return for a fixed sum paid early

For those countries where domestic construction firms do not have adequate capacity or
experience to construct urban rail lines, this type of PPP can also help bring international
experience and capacity to construction.

(2) Investment & Operation-oriented (IOO) PPP. IOO PPPs aim at improving investment
efficiency and operational service to Urban Rail Transit systems. Under this model, governments select private companies with proven capacity to invest and operate an Urban Rail Transit line. The private company and, typically, a city government establish a SPV which undertakes the investment and operations, while outsourcing the construction through competitive bidding process. The SPV gets a return usually from user fees and often some degree of government subsidy that can be tied to the private partner’s satisfactory performance.

For example, in China the Zhengzhou-Gongyi-Luoyang Urban Rail Transit PPP project adopted the IOO PPP model and selected a private company with the capacity to invest in its system and assume operations. It was the first Urban Rail Transit project in China with such a private investor and operator approach. The project otherwise was a DBOT and had a subsidy scheme that featured the provision of land development rights along the rail line.

(3) Equipment& Maintenance – oriented (EMO) PPP. EMO PPPs target the producers of high-tech equipment, which for Urban Rail Transit systems are often train or rolling stock producers. This equipment accounts for a large percentage of the total equipment investment needed for an Urban Rail Transit project, and in fact are the core parts of an Urban Rail Transit line. Similar to construction-oriented PPP, this type of arrangement also helps government to control the risk of equipment cost and ensure sufficient maintenance of core assets of the system.

For example in Brazil, the São Paulo Metro Line 4. During phase 1, the Companhia do Metropolitano de São Paulo—the public authority that owns the underground network—was responsible for constructing the tunnelling, track, and metro stations. The private sector contractor, under a 30-year concession agreement, was responsible for the supply, operation, and maintenance of the rolling stock (14 metro trains with six cars each) and operating the systems (a train signalling and control system and a mobile voice and data communications system). During phase 1, according to the state’s time frame, six stations were to be built by the first quarter of 2010. The second phase, which was subject to further studies and market demand, would require the private sector contractor to open additional stations on the existing line and add between five and 15 more trains, at the discretion of the State of São Paulo, at any time after the second year of commercial operations.
B. Pros and cons of PPPs in the Urban Rail Transit Sector

Based upon the empirical evidence of the project cases reviewed for this standard, in particular an analysis of their and project design, transaction structure, financial arrangement, risk allocation scheme and contract management, the following lessons may be learnt from both successful and failed cases.

B1. Core elements of successful Urban Rail Transit PPPs

An examination of recent PPP projects from both developed and developing countries provides useful insights on why some PPP projects appear to be more successfully than others. The core elements enable a successful Urban Rail Transit PPP include:

1) **Clearly and firmly put forward the primary objective of applying PPP in Urban Rail Transit projects.** The primary objective is significant to PPP project design, as it determines the selection of the PPP model, and is closely linked to the choice of implementation solutions offered through PPP.

2) **Align projects with national economic development and urban sector development strategy.** Urban Rail Transit PPPs that serve the national development strategy help achieve and accelerate national development, in addition to sector development goals, and thereby bring increased benefits to people’s livelihood.

3) **Early and continued consultation with stakeholders-particularly the private parties during the feasibility and design stages is critical to achieving an optimal outcome.**

4) **Conduct effective value for money evaluation in the design and implementation of the PPP.** Value for money analysis provides public decision makers with information on whether PPP is a better option than traditional governmental delivery of an Urban Rail Transit projects. An effective value for money evaluation will take full consideration of and clearly link the project context, project demand, and the proposed solution instead of arbitrarily justifying the endeavour.

5) **Achieve full project cycle fiscal affordability.** Urban Rail Transit PPP projects may require fiscal subsidy to ensure asset availability and continuity of operations. If so, public authorities should set limits on the percentage of subsidy that would come from fiscal revenues. For example, if a subsidy demand exceeds a prescribed limit, public authorities could give the SPV other ‘in kind’ support such as other developable resources, adjusting tariff rates, or negotiated tax benefits that would mitigate the subsidy demand. These approaches can help mitigate fiscal risks and ensure the fiscal affordability of an Urban Rail Transit project.

6) **Strongly link investment with operations in the design of Urban Rail Transit**
projects. Urban Rail Transit involves large capital investment and recurrent financial input. The return for the private sector is mainly derived from operations. Therefore, governments should create a close link between the return on investment and successful operation. This will create strong incentives for the private party to maintain or improve public service level which results in a faster capital payoff, and vice-versa.

7) **Open and competitive bidding procedures.** Procurement of private parities of Urban Rail Transit PPPs needs to follow an open and competitive selection procedure such as tendering, competitive negotiation, etc. The evaluation should examine not only the historical achievement of bidding companies, but also their capacity and willingness to share and/or partner on project risks with the public partner.

8) **Carefully systematic management.** Abandoning a functioning Urban Rail Transit system is politically unacceptable in most cases, making the strong case for trying to get it right from the earliest stages. As a result, the complete process requires careful systematic management, with resources and focus adapted to suit the specific needs of each project stage and targeted to delivering a high quality long lasting project.

9) **A clear and fair method for dealing with demand risk.** Governments and partners must manage fares intelligently, including a clearly defined mechanism for any subsidy that may be afforded (taking into account incentives for the private sector).

10) **Subsidy scheme that reflects risk sharing and creates the right incentives of improving public service.** Many PPP schemes have mechanisms to provide for capital subsidies, because capital development costs are often far in excess of the capacity of the fare revenue to fund them. However, unconditional return of that capital is unrealistic and proper performance incentives need to be put in place to ensure operational success and a high level of public service provision is met.

11) **Allocate risks to the party that can afford best.** Risk allocation of urban rails projects should comprehensively look through the scope of government responsibilities and clarify which risks are allocable to the private parties, and which are not. This can be different from project to project and from country to country, but often risks regarding project approval, planning, land acquisition, policy and regulation change, and those things squarely within the power of the public sector to control should be retained by the public sector; whereas risks of investment, construction, operation, maintenance, and resource development and optimization should be taken by the private sectors.

12) **Good governance and enforcement of the contract under a healthy rule of law.** Both public and private parties are equal subjects of a PPP contract. In more successful urban PPPs, good governance and a healthy rule of law enables the effective implementation of the PPP contract, which furthermore pushes forward a sustainable project and good operations.
B2. Lessons learnt from unsuccessful Urban Rail Transit PPPs

Some Urban Rail Transit PPPs have completely failed or at least resulted in negative outcomes in the transport or financial objectives of the project. These elements are key challenges that can threaten the success of an Urban Rail Transit PPP:

1) **Delinking PPP objectives and selecting the wrong PPP model.** For example, in China, while the objectives of PPP are often to control local government debt and improve the public service level, some city governments chose financial institutions which did not have the capacity or experience in Urban Rail Transit projects. This resulted in huge implicit local government debt, which frustrated a key motivation of the project which was to control debt limits with respect to infrastructure.

2) **Inadequate consultation with stakeholders.** Urban Rail Transit projects involve many stakeholders, such as local government approvals and supervising bodies, financial institutions, impacted users, etc. Lack of consultation increases the danger of opposition, and if performed late in the process, can lead to delays or even cancellation.

3) **Overlook construction in favour of financing.** Some Urban Rail Transit projects took advantage of PPP by using the criteria of investment to select construction contractors without adequately examining their construction capacity and standards. This results in the risk of increased construction costs and lower construction quality. Countries with a highly competitive market of Urban Rail Transit construction should be mindful to carefully evaluate both financial and construction capacity bidders.

4) **Unclear obligations and rights in PPP contracts.** Urban Rail Transit PPP contracts without clear obligations and rights can result in ineffective allocation of risks and interests and a contract that does not achieve its intended purpose. It also increases the chance of default. Lack of clarity in a PPP contract can furthermore affect the overall likelihood of successful project implementation and negatively impact intended service levels.

5) **Lack of effective control on fiscal and financial risks.** Public authorities may underestimate fiscal and financial risks in Urban Rail Transit PPPs by committing excessive fiscal subsidies to make the Urban Rail Transit PPP more attractive to the private sector, or overestimating projected fiscal revenue increases. Consequently, if the promised subsidy is established but then not available at that excessive level, the project will most often be suspended or the private party may choose to lower the quality or service level to overcome the shortfall. A similar negative outcome can occur with excessive, or simply unanticipated, contingent liabilities become payable.
6) **Use PPP as method of government borrowing.** Urban Rail Transit projects contain large investment, and some city governments are constrained to issue sufficient debt to finance Urban Rail Transit projects, thus PPP becomes an ‘attractive’ option because it makes the project happen, but disguises the government borrowing. When a government promises a fixed return to financial institutions or provide certain guarantees for private parties’ borrowing, it not only increases the government implicit debt, but also expands the systematic financial risks among the government, private party and financial institutions.

7) **Unreasonable risk allocation between public and private parties.** Both public and private parties have impulse to transfer the risks to the other party. However, if one party has to take the risks beyond its management capacity, for example the private party taking on the risk of land acquisition, or the public authority taking on the risk of project finance, it can result in project failure.

8) **Large deviation between actual traffic and forecast traffic.** Urban Rail Transit is most often a user-charge public service. Future traffic is therefore a foundation to justifying the feasibility of an urban rail line project and typically is a basis for project approval. As a result, there is a tendency to exaggerate future traffic volumes in order to get the project approved or attract more private investors. However, an unrealistic traffic forecast will fundamentally set a project on a course to fail, since either the city government or the private company will have to pay for the real traffic risk buried under unrealistic projections.

9) **Lack of effective constraints on default of public or private party.** In those countries with relatively immature legal systems, it might not be easy to enforce the legal terms of PPP contracts. Hence, public and private parties will tend to default when the actual project implementation is not as expected, or when political change or financial crisis takes place. This lack of adequate remedy increases the risk of a party exercising the absolute remedy of defaulting.

C. **PPPs Meeting People First Objectives**

C1. **Demonstrate Replicability, Scalability, Equity, Efficiency, and Sustainability**

A ‘People first’ Urban Rail Transit project should meet one or more of the following criteria:

(1) Accessibility & equality. A people focused Urban Rail Transit PPP project should enhance people’s accessibility to job opportunities, public services and business markets, and hence promote more equal development between urban and rural area, or between big cities and small towns.
(2) Economic efficiency & sustainability. The Urban Rail Transit PPP project should increase economic efficiency by reducing travel time and/or transport cost. Urban Rail Transit as a public transport service reduces the pollution from motorized transport, which improves the sustainability of a city. Performance-based evaluation and payment system also provide better incentives to enhance a project’s economic efficiency and sustainability.

(3) Replicability & building capacity. People first Urban Rail Transit projects should result in successes elsewhere and improve project outcomes for similar projects. Projects should not be ‘one off’ projects attempted once in 50 years, they should inspire and inform decision makers and stakeholders in undertaking similar projects and accelerating overall development.

(4) Sustainability and climate adaptability. Private investors are more sensitive to project costs throughout the full project life-cycle, and yet are more susceptible to the risk of natural disasters, therefore because of the long term nature of PPPs, there is an incentive and priority to build more resilient, efficient, and sustainable infrastructure that will mitigate long term costs and withstand force majeure risks.

(5) Stakeholder engagement. Urban Rail Transit projects contain diverse stakeholders such as the government, users, designers, construction contractors, financial institutions and more. PPPs have the effect of establishing a platform where all types of stakeholders can be engaged, provide project input, and participate in project management.

C2. An Urban Rail Transit PPP model to best achieve SDGs of UN

Considering all aspects, including typical investment requirements and operation-oriented issues, the DBOT PPP rail project model is best suited for Urban Rail Transit projects that aim to achieve applicable SDG outcomes (SDGs 3, 8, 9, 11, and 17) and put people first.

Key attributes of investment and operation-oriented DBOT PPP:

1) Investor as operator. Only investor and operator’s interest lies in the full life cycle quality and efficiency of the project, ensuring the investor as operator safeguards the full life cycle quality and efficiency of the project.

2) Common interest for public and private sector. The investor and operator’s interest is mostly in line with the public sector, i.e. full life cycle quality and efficiency of project, which builds a solid foundation for the public and private sector to form partnership, share risks and reach sound agreement so as to ensure the overall quality of the project.

3) Early stage involvement of private sector improves quality and efficiency of project. Entering at the design stage enables the private sector to truly utilize its advantage in
market-oriented operation, resource integration and innovation, optimizing the project from the very beginning, realizing the potential of adopting PPP model in Urban Rail Transit projects to reach best quality and efficiency of the operation and services of the project.

V. Delivering the Model

A. Project Selection and Baseline Requirements for Private Interest

Governments interested in potential Urban Rail Transit PPP projects need to undertake an appraisal process to ensure the rationale for developing and implementing them. For any proposed PPP project, there are five key criteria that governments should consider when deciding whether or not to pursue a project as a PPP:

1) Feasibility and economic viability: Developing and assessing the feasibility of the project concept; Appraising whether the project is a good public investment decision based on an economic viability analysis;

2) Commercial viability: whether the project is likely to attract quality investors by providing robust and reasonable financial returns.

3) Value for money of the PPP: whether developing the proposed project as a PPP can be expected to best achieve value for money as compared to other delivery options.

4) Fiscal responsibility: whether the projected project cost is within fiscal affordability limits during the entire project cycle.

5) Project management: whether the contracting agency has the authority, capacity, and fiscal resources to prepare and tender the project effectively, and to manage the contract during its term.

A1. Identify objectives to adopt PPP model in Urban Rail Transit projects

It is significant for governments to be clear and insistent on achieving their objectives. Different PPP models serve different purposes, but the overall objectives of a PPP in Urban Rail Transit should include decreasing fiscal stress, enhancing public service levels, improving investment efficiency, and promoting competition.

Governments should conduct preparatory research, as well as consult widely with practitioners and experts, to understand significant dependencies, priorities, incentives and other drivers of the proposed Urban Rail Transit PPP project. Governments should also consider the full range of issues likely to affect their objectives, and identify the policy instruments or project elements that can be used to address those issues and/or meet their objectives.

A2. Financial and legal readiness of the project
Once a project is established as viable, the next step is to determine whether it would be attractive to the market if structured as a PPP. Governments often assess the appetite of potential partners for a proposed PPP before taking it to market.

Generally speaking, potential rail partners will find a project commercially attractive if it offers good financial returns and requires the private party to bear reasonable levels of risk.

Assessing returns typically involves financial analysis—that is, building a project financial model and checking project cash flows, returns, and financial robustness.

Where revenue from user charges exceeds costs and yields sufficient returns to remunerate the anticipated application of capital, the project will generally be commercially attractive provided other project risks are reasonable.

In terms of legal readiness, governments should also assess and perform due diligence to identify any legal or regulatory constraints that could prevent the government from entering into the anticipated PPP contract or impair the purposes or likely structure of the contract. Governments should also examine the existing Urban Rail Transit sector, financial sector, and public policy environment, to make sure the proposed PPP model aligns with all the relevant policies.

Needless to say, institutionally, each government institution that conducts a tender for an Urban Rail Transit project should also be capable of meeting the legal requirements and following robust tender procedures and bidder selection to ensure a fair and transparent process and attract the highest quality partners. Governments should also use competitive tender procedures, avoiding single source awards, and otherwise obey applicable procurement law and regulations. This should include ensuring the jurisdiction has a competent, independent juridical institution that will supervise or oversee the entire process.

**A3. Technical appropriateness of the project**

Governments should analyse whether the project can be implemented as planned, using proven technologies, and not present unreasonable technical risks. This analysis needs to take into account system connectivity, links, and interdependencies of various infrastructure and transit elements, and employ a holistic view of the system in light of the technical environment.

**A4. Rationalize the project preparation and implementation procedure**

**A4.1. Consultation with all types of stakeholders**
The stakeholders are critical to the sustainability of an Urban Rail Transit PPP. Even if the contract is awarded despite opposition, the difficulty and risk of the project increases drastically if public support is not present.

Stakeholder engagement helps governments identify critical issues and prepare effective strategies. In particular, it can frame discussions with beneficiaries, clarify project impacts and objectives, and ultimately increase public support for a given project.

Stakeholders provide valuable input to the design and practicality of a project approach as well. In fact, allowing stakeholders to comment on PPP strategies allows for a sense of buy-in and can lead to innovative new ideas and approaches.

Consultation is a less formal process through which themes and points of interest are discussed within or across stakeholder groups. It is intended to gather information and build an understanding among the participants as to current perceptions and understanding of projects and the basis of various opinions. A key part of stakeholder consultation is to manage expectations with respect to the Urban Rail Transit project and identify how these ideas may be incorporated into the project.

In Urban Rail Transit projects, key stakeholders can include:

1) Political decision makers such as local government departments that approve, supervise, and/or manage Urban Rail Transit projects, as well as institutions relevant to the construction management, land acquisition, planning, coordination of underground pipelines or conduits that will be necessary for the system.

2) Potential private partners and suppliers such as construction firms, operation firms, and equipment providers.

3) Existing and future users and those impacted by the proposed Urban Rail Transit line.

4) Financiers, investors and lenders such as banks, funds, and/or guarantors.

5) Strategic consultants such as transaction consultants, legal advisors, and financial accountants.

A4.2. Allocate risks between public and private parties

Governments should identify macro-economic risks, sector risks, and project risks associated with the proposed Urban Rail Transit project, and create a detailed risk matrix that is shared with the private party. In most Urban Rail Transit PPP projects, risk allocation follows three main principles:

1) Risks should be allocated to the party that has best manage them

2) Risks correspond with returns. The party taking higher risks should get higher return.

3) The risks should be controllable. For those risks caused by only one party, the party should take responsibility of the risk.

Based on these premises, the main risks that should be taken by government include:
1) Feasibility risks such as planning risk, land acquisition risk, the risk of approving the feasibility study, technical design, and the like.

2) Legal, policy and regulatory risks. Urban Rail Transit PPP contracts often commonly have terms as long as 30-40 years, it is therefore possible that changes in law, regulation and policy could seriously affect the project and impair (or enhance) its implementation and long term performance. Project risks resulting from those changes should be taken by the government.

The primary risks that the private party should bear include:

1) Investment and financing risks. Many Urban Rail Transit PPPs adopt a project finance scheme under which the SPV is responsible for the debt financing. Within the SPV, the private party is commonly the controlling shareholder and thus the private party should be responsible for and afford the risk of attracting the investment and placing the appropriate financing.

2) Construction, operation, rehabilitation and maintenance risks.

Both public and private parties should take responsibility for the following risks in an Urban Rail Transit project.

1) Traffic demand risk. There are many factors impacting the actual traffic demand of an Urban Rail Transit line, such as the alignment, the public service level, and the comprehensiveness of city planning and integration of the system into other modes of transit. Some of these factors belong to the government, and some are the private parties, therefore, the traffic demand risk should be shared by both parties.

2) Force majeure risks such as nature disasters, wars and those events that are beyond the influential scope of both parties should be borne by both parties and fair and reasonable provisions that address the potential impact of force majeure events should be used.

A5. Evaluate project performance

A5.1. Ensure the security of Urban Rail Transit construction and operation

It is important for the government to establish a systematic performance evaluation mechanism that occurs periodically and correlates to the contractual subsidy afforded within the project. For example, if the SPV performs well, the government should reward it, and if not, the government should punish the SPV by reducing the subsidy and encouraging improved performance.

Key performance indicators of Urban Rail Transit PPP projects include:

1) Reliability and punctuality
2) Customer satisfaction
3) Cleanliness and general upkeep
4) Safety, access, and security
5) Ride quality and noise emission

B. Financing for Urban Rail Transit PPPs

B1. Financial cash flow analysis

B1.1. Financial cash flow identification
In Urban Rail Transit sector, revenue growth is often affected by challenges related to the overall levels of ridership and the effectiveness of collection of fees. These issues can be particularly difficult if the traditional under-pricing of user fees by governments is maintained in order to gain political capital instead. Realistic cost recovery through fees needs to be established and if necessary governmental support will be needed if a revenue gap is to be accommodated, that is until tariffs would allow cost recovery.

B1.2. Financial viability gap analysis
In most Urban Rail Transit projects, the user tariff is often established by policy. While politically effective, this is often insufficient to generate a level of revenue to repay the project, and is further insufficient to reward the debt and equity that may have been applied to cover the capital cost of the project.

If full tariff rates are not permitted, the public authority may have to entertain other approaches to ensure viability. For example, pay for part of the capital cost itself at implementation, thus reducing the amount of debt and equity funding required. This is sometimes known as a capital contribution from the public party and makes sense in such cases so long as a substantial part of the remaining capital costs still involve private capital at risk (the private party continues to be properly motivated to perform well).

Another type of governmental capital contribution is to make payments during the operating phase, depending on the availability and performance of the project, which, alongside some level of payment from users, make up the overall revenue stream. This still requires the full capital costs to be financed, but it reduces the dependence of the project on tariff revenue, while strongly incentivizing operating performance.

B2. Design project financing structure

B2.1. Asset-based financing model
As Urban Rail Transit generates stable revenue from its operation tariff and government subsidy, it is possible to refinance the project based on its cash flow during the operation period. Financial institutions can issue project bonds for the SPV based on its assets and cash
flow. Shareholders of SPV can also increase the bond credit rating by provide guarantee to the bond return. Governments should therefore anticipate refinancing of debt in Urban Rail Transit PPP projects and the opportunities it may afford to the overall viability of the project or realizing a return on investment for both the public and private partners.

B2.2. TOD model
(To be updated)

B3. Financial Acceptance

B3.1. Financial Affordability
Private parties should conduct financial affordability of the Urban Rail Transit project. Although the PPP project finance is a non-recourse financing instrument, it still includes the project debt on the private party’s balance sheet, in particular if the private party holds more than 50% the equity in a SPV. The financial affordability analysis should look into aspects such as capital cost, traffic demand, project cash flow, operation revenue and cost, government subsidy, developable resources and other such projections that would impact financial affordability. A matrix of parameters can be set up depending on the individual context of the project. To the private party, the project debt burden should be controlled within their affordability. In addition, the private party should carefully manage the capital and operational costs which also include rehabilitation and maintenance cost which is generally high in an Urban Rail Transit context, to make sure to collect returns sooner than later.

B3.2. Fiscal affordability evaluation
Many governments provide a subsidy in Urban Rail Transit PPPs. The subsidy, paid to the SPV, is usually composed of an availability payment and/or viability gap funding. An availability payment subsidizes the private partner for making the project ‘available’ and a number of projects choose to pay a fixed availability subsidy every year through the contract period. A viability fund payment subsidizes the rail’s operations, and the subsidy can fluctuate with the revenue-cost gap that actually occurs.

While making the project viable, the fiscal affordability of such subsidy must also be evaluated and the stress of such yearly subsidy accounted for within the public fiscal tolerances. Prudent governments should therefore check the available fiscal revenues for transport infrastructure, or specific revenue space for PPP projects, and carefully forecast future fiscal revenue growth in light of the ongoing obligation of the PPP.

B4. Mitigation measures of financing risks
Both public and private parties need to take measures to mitigate the financing risks, as Urban Rail Transit projects inject significant amounts of funding to achieve just one project.
Some primary risk mitigation measures include:
1) Conducting careful fiscal and financial affordability analysis before making financial
decisions.

2) Applying a relatively flexible subsidy mechanism to respond to the uncertainty of financial situation from both parties.

3) Adopt guarantee/insurance products to reduce the risks of financial loss.

4) Use refinancing tools to reduce financial stress in the operation period.

5) Separate project financial risks from the financial risks of shareholders of the SPV.

C. Key consideration to implementing Urban Rail Transit construction, operation and transfer

C1. Construction

1. Meet the construction needs of local urban rail transit and provide good, safe and reliable rail transport infrastructure in accordance with the local technical standards for construction. To ensure the safety, quality, progress, technology and humanities of urban rail transit projects to meet the requirements of construction standards. To achieve the overall goal of overall coordination, perfect system, safe and orderly, and quality project.

2. Optimize the construction schemes of urban rail transit, promote the intelligent and technological use of urban rail transit equipment, enhance rail transit technological development and promote rail transit technological innovation and industrial development. With a strong investment and financing capacity to ensure the project funds supply can match the investment needs, also to meet the project according to the duration and the quality. Strengthening the training of urban rail transit construction technicians.

3. Set up safety objectives during the construction period to meet the local related regulations and requirements, combined with the actual situation of the project, establish and improve the safety assurance system, formulate safety management program according to the safety objectives, and organize the development and revision of all safety management systems. Prepare safety plan by different sub-sections, and the implementation is ensured through the project safety measures and periodic inspections. Establish emergency handling mechanism and prevention of accidents.

4. Implement conscientiously with the relevant laws, regulations and compulsory standards of local related quality control. According to the contract, design documents, project quality management program documents and technical quality support documents, organize quality inspectors to supervise the quality of the construction, and timely rectify the problems.

5. To establish a technology management system to clarify the responsibilities of various posts, to supervise and implement the effective operation of the technology management system. For practical work, to collect codes and standards related to the project. Before the construction, carefully review the construction drawings, technical data, complete check the drawings, and timely communication with the design institute. During the construction, double check the various technical reviews to ensure the efficiency of the technology management, timely summarize the project technical progress to ensure that the
implementation of the various tasks can effectively guide the continuing project. Standardize the local technological achievements, formulate unified technical standards for construction management, and formulate technical communication mechanism with other regions, and gradually improve the international standard of urban rail transit technology.

6. To determine the schedule of project progress scientifically and reasonably, ensure the overall goal of progress control throughout the full project construction period, clear implementation of the project overall plan. The key point and the difficulty links are highlighted, and monitoring and correction mechanism is established.

7. The conditions permitted projects can be considered to establish management institutions such as construction management, EPC management, etc., to professionally manage the project, plan and control the progress of project construction, leverage the project resources, and undertake the response to project risks.

8. During the construction period, all the activities must comply with the local environmental protection, cultural relics protection and other laws and regulations. We should also comply with water saving, land saving, material saving, energy saving, minimize the negative impact which harmful to the surrounding environment, and create a harmonious, stable, green and sustainable development environment. The construction of the project should pay attention to the protection of urban resources, historical relics and cultural heritage. We also should pay attention to the participation of different races and women in urban rail transit project construction, ensure the physical and mental health of workers, and strictly control the incidence of occupational diseases.

C2. Operation and Maintenance

1. In accordance with the relevant laws and regulations of local rail transit operational service and equipment renewal maintenance requirements, fully consider local operational requirements, pay attention to the interests of passengers and humane care, taking into account economic benefit and social benefit, realize the overall operation the target of "people-oriented, demand oriented, dynamic improvement, quality service".

2. In the operation stage, we should carry out the advanced technology and management concepts, adopt the information management systems of human resource management and financial management etc. to achieve the goals of save costs and improve efficiency. The concept of life cycle management of equipment and facilities is introduced, and EAM management system, vehicle intelligent maintenance management system and other information to achieve the link and modern management of all aspects of operation management. With sufficient financial support capability and intelligent maintenance and repair technology, we can ensure that the operating lines renewal, maintenance and repair can match operation needs in time sequence and standard.
3. Through the concept of safety management, safety culture, science and technology and the emergency rescue and other aspects, to establish safety management mechanism, and to improve emergency rescue system, safety education and training should be provided, strengthening security management basis, improve the level of safety management. Improve the safety awareness of staff and passengers. Base on the Internet and the big data analysis to establish operational security risk management data platform, to create a safe, efficient and good imaged railway.

4. According to the local laws and regulations of operation and the urban operation needs, formulate operation management system, technical management system and comprehensive management system, to establish emergency rescue organization, information reporting process and emergency response mechanism, improve the efficiency of fault disposal, And to improve the level of emergency management.

5. The use of advanced information technology, to achieve the automation of the operation equipment, to reduce personnel operation of the vehicle, equipment status to be monitored, forecasting and early warning, real-time display the status of vehicle equipment operation, and to monitor the personnel operation to ensure the safe operation.

6. Choose the right way to operate management organization can reduce the cost of operation management, improve the efficiency and benefit of the project, and to provide better service for the passengers. According to the actual situation of the project and the local management habits, to set up the management and control mode of the project. Banding set the management layer and executive layer, ensure the project can be centralized, unified, under commanded, meticulous and specialized. Management layer is responsible for the operation and management, financing, maintenance, safety supervision and other matters, the execution layer is responsible for the depot management, vehicle management, line control and other matters, and strengthen the horizontal linkages between institutions and the integration of management to meet the requirements of emergency management and daily management.

7. We should pay close attention to the vulnerable groups for their needs of urban rail transit, and provide safe and barrier free urban rail transit services. Considering the full employment of rail transit operation industry, we can improve the employment rate and employment level for local people, provide decent working environment and labour safety protections for employees, especially the equal employment opportunities for different races, women and different societies.

C3. Transfer

Urban rail transit projects, like all PPPs, require a stable transferring procedure. This includes a well thought out plan for transferring of project assets such as civil works, equipment, and intellectual property assets, as well as the transfer or reversion of the rights of concession which include considering the needs of operation, rehabilitation, development and maintenance of the rail system The public and private parties should agree on the pre-transfer
criteria in the PPP contract, and create a joint working team that includes a third party evaluation to verify operational and infrastructure conditions. Ultimately it is critically important to not affect the rail service and try to maintain continuity of operations during and after the transfer.

D. Legal Requirements for Urban Rail Transit PPPs

D1. Establishment of PPP Particular Standards.

On the other hand, in consideration of the special features of PPP projects, such as the involvement of private sector, the balance between the private sector’s pursuit for profit and public interests, particular industry standards and specifications shall be introduced in order to safeguard the qualified provision of public infrastructure and service. These standards and specifications shall be illustrated in each stage of a PPP project. For an urban rail transit PPP project, how the objectives like VFM, People First and SDGs could be achieved shall be taken into consideration during the design and construction stage. While performance evaluation (to be linked with the payment mechanism) shall be emphasized during the operation stage to avoid the detriment of public interests by excessive pursuit of profit by the private sector.

D2. Operation of the project

As a newly-incorporated company, the SPV lacks record of construction and operation. For an urban rail transit project, the long-term stable operation is particularly important. The public sector shall pay sufficient attention to the operation of the rail as well as the construction. Such could be achieved by detailing the relevant legislative requirements and industry standards in the contract.

D3. Management of the Contract

PPP project involves a full set of contract agreements, namely the PPP Contract, shareholders agreement, construction contract, operation contract, etc., with different priority and function. All the contract agreements work together to ensure the due implementation and risk allocation among the parties. Among various PPP projects, an urban rail transit project is comparatively more open and more comprehensive, and imposes higher demand to the parties involved. Accordingly, the terms and conditions of an urban rail transit PPP project is more complicated, training is necessary to both the public sector and the private sector.

D4. Promote Zero Tolerance to Corruption
Urban rail transit projects involve large interests and last for a long period, zero toleration to corruption need to be noted at each stage, including the project identification and preparation, preparation of the implementation plan, selection of private sector, negotiation and implementation of the PPP contract, management of the SPV and the transfer of the project. Robust anti-corruption measures also can curb the cost of the project, improve the efficiency and quality of the project, and help achieve the goals of People First and VFM.

E. Feasibility for Low and Middle Income Countries

E1. Main Challenges and Opportunities of Low and Middle Income Countries in Urban Rail Transit PPPs

Urban rail transit projects are only feasible with adequate demand of fast public transport, which means low and middle income countries with enough population, in particular in urban settings, are likely candidates for employee the recommendations contained within this standard.

Urban rail transit is relatively capital-intensive, labour-intensive and technology-intensive so low and middle income countries will encounter a few challenges and difficulties in a particularly acute way.

These may include:

1) Lack of a comprehensive urban rail transit network plan.
2) Lack of enabling institutional and legal environment
3) Incomplete or insufficient project finance capacity.
4) Limited fiscal and financial capacity.
5) Insufficient governmental institutional support.
6) Incomplete tendering procedure.
7) Under-developed private sector.
8) Lack of domestic construction, operation and maintenance experience and teams.

While most experience and lessons learnt in urban rail transit come from developed countries, low and middle income countries can benefit from this experience and comparatively start ‘further ahead’, with more thorough approaches to structuring transactions, more advanced technology, and more mature system design. Low and middle income countries also present comparatively faster urbanization processes, with a lot of potential for increases in demand growth capacity.

E2. Advice on how to achieve SDGs through urban rail transit PPP in low and middle income countries

The cases from low and middle income countries, in terms of applying PPP model in urban rail transit sector, summarized the main lessons include:

1) Identify the main objectives at both national level, local level and project level of urban
rail transit PPPs and keep them consistent to each other.

2) Establish a strict legal and regulatory system for urban rail transit PPP to enforce rule of law and spirit of contract.

3) Start with bringing in experience from the international service provider, but keep cultivating the domestic capacity.

4) Design project financing scheme, fiscal subsidy scheme and risk allocation scheme according to the country’s development stage and context.

5) Manage risks of default by effective administrating measures and set up compensation and re-negotiation mechanism.

6) Engage private sector stakeholders at the project feasibility phase, to make sure the economical and commercial feasibility of urban rail transit PPPs.

7) Provide affordable urban rail public service but at the same time to ensure the fiscal subsidy within the fiscal capacity.

8) Strengthen Inter-ministry and inter-department collaboration in terms of policy making, standard drafting and project supervision on urban rail transit PPP projects.

F. Other Issues Related to Urban Rail Transit PPPs

F1. Contract management

Since the PPP contract is the fundamental legal documents that specifies the essence and details of the PPP project, and is basis for dispute resolution, contract management is essential for successful implementation of urban rail transit PPP project. The following issues are of vital importance should one intend to conduct quality contract management:

1) Enforceable contract. An enforceable contract arrangement is the prerequisite for contract management. “Enforceable” does not suggest that one party shall have coercive power to make the other party conform to the contract, but rather, the contract shall be fair, reasonable and have taken into consideration of all stages of the full life cycle of the project.

The parties arranging a PPP contract for an urban rail transit project shall pay special attention to “all stages of the full life cycle of the project”. When planning an urban rail transit PPP project, some governments tend to pay disproportionate attention to the construction stage (especially in developing countries whose local government’s urge to develop is strong), neglecting key items in the later phases, however, urban rail transit PPP projects usually last for decades, and are prone to disputes over contract in the middle of the operation stage due to unrealistic demand forecast, volatility of financial market, etc. Failure to carefully consider all aspects in the operation and transfer stage undermines the prospect of sound contract management.
Some key items to consider when arranging an urban rail transit PPP contract:

a) Force majeure. Clear definition, course of actions when took place, conditions for immunity, etc.;

b) Political force majeure. Clear definition, conditions when such incidents are caused or controllable by the contracting public party, and thus who should bear the risks, not enjoy immunity and take actions or compensate to mitigate negative impact on the private sector, conditions for immunity, etc.;

c) Step-in right/early termination. On what conditions and to what extent can the public sector or the creditors could step-in the management of the project or control of the project asset, etc. what triggers an early termination of contract;

d) Renegotiation. Mechanisms and conditions for renegotiation of contract, etc.

e) Equipment overhaul and renewal. Specific plan, careful calculation of investment needed, sound financial arrangements, etc.

2) Supportive legal system and political environment legal system and political environment that commits to rule of law, embraces fair, just and open market economy and protects property rights are foundations for the sound management of the contract of an urban rail transit PPP project. It is not possible to manage contracts if one is not protected and rewarded for conforming to the contract and breaching of contract is not properly punished.

3) Sufficient management capacity. Urban rail transit PPP contract management requires high level of professional and technical capacity, which the public sector usually lacks. However, the public sector should specify personnel with responsibilities of contract management, and depending on the resources available, provide professional and technical trainings to ensure the competency of such personnel. The public sector could seek professional service from third party institutions like accounting and legal firms, but relying entirely on third party institutions for manage contract is not recommended.

F2. Project asset management

Urban rail transit asset is not only large in scale, but also with complicated structure. Proper project asset management not only contributes to the quality of asset from a financial point of view, but also helps improving the quality of operation and service. To properly and efficiently manage urban rail transit PPP project asset, one should pay attention to the following items:

1) Ownership of asset and allocation of asset management responsibility. While it’s reasonable to explore all types of ownership structure to be economically most viable, it
is advisable, due to its high operation complexity, the quality of asset has significant direct impact on the quality and efficiency of operation and service level in projects, thus it is ideal to have the operator to own and be responsible for managing all asset related to the project, so that it could manage the asset from both financial and operational point of view to reach optimized full life cycle outcome.

In cases when the project operator does not own all project assets, it is important for the operator to have certain authority over the decision-making of the asset management entity so as to ensure that the quality of operation and service level would not face negative impact due to asset transactions.

2) Market-oriented asset management. Urban rail transit is one of the most important public service for cities, thus the public sector tends to impose strict rules over urban rail transit asset management in order to ensure quality and security of service. However, managing large scale asset of urban rail transit requires high professional capacity as well as flexibility to cope with fast-changing environment like financial market volatility, equipment market upgrade so as to reach best financial and service outcome. Therefore, on the basis of quality and security of service, the public sector should leave room for the asset management entity to use market-oriented approach to manage urban rail transit asset.

F3. Transferring project asset

Transferring of project asset is the last stage of an urban rail transit PPP project, to safeguards smooth transferring of asset and responsibilities, the following items need careful examination:

1) Start preparation for transfer early. It is advisable to form an asset transfer committee at least 24 months before the actual transfer date and start preparatory work for the transfer. The asset transfer committee should comprise of all parties related to the transfer, including the public and private sector, the successor for operation and management of asset (if the asset is not transferred to the public sector), etc.

2) Specify conditions for transfer. The list of asset, status of equipment, arrangement for non-tangible asset etc. should be carefully discussed and agreed upon by the PPP contracting parties.

3) Transfer due to early termination of contract. The PPP contract should consider the possibilities of transfer due to early termination of contract and design mechanisms to best protect the operation of the project and the interest of innocent contracting party.

VI. Indicators of Compliance

The indicators of compliance for an urban rail transit PPP project relate directly to the SDGs.
These recommendations are based on a few urban rail transit PPP projects. The geographic regions include China, Spain, Canada, Brazil, Philippines and etc. These projects represent various types of PPP model in both developed and developing countries and have relatively sufficient information disclosure.

We appreciate the positive engagement and knowledge contribution from team members, relevant organizations and companies.

The complete list of projects from which the standard team draw lessons and experience is presented on annex 2. The Standard will be maintained by UNECE and the Urban Rail Transit PPP Standard Development Team conducted by UEECE International Centre of Excellence.
### Annex 1. Case Studies

#### 1. Case of Zhengzhou-Gongyi-Luoyang (Gongyi Section) Suburban Line PPP Project

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<tr>
<th>Project context</th>
<th>Zhengzhou-Gongyi-Luoyang (Gongyi Section) Suburban Line PPP Project is going to be a 50 km long suburban metro line. Upon completion, the project will be able to connect Zhengzhou on the east and Luoyang on the west through Gongyi (a county level city located at the centre point of the shortest route between Zhengzhou and Luoyang). The Gongyi section is the first phase of the Zhengzhou-Gongyi-Luoyang Suburban Line, which is the 50km of metro line within the jurisdiction of the city of Gongyi. After competition through public bidding process, China Metro Investment Corporation, a private enterprise dedicated to the investment and operation of metro/rail line, has won the bid, and has signed PPP contract with the government of Gongyi.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of PPP</td>
<td>DFBOM: Design-Finance-Build-Operation-Maintenance Investment-Operation-Oriented PPP: the project emphasizes that the private party has the capacity to invest and operate.</td>
</tr>
<tr>
<td>Financial arrangement</td>
<td>Estimated investment: 18 billion RMB. 35 years of contract (including 5 years of construction and 30 years of operation). Capital investment constitute 20% of the total investment, the remaining 80% will be covered by project financing. The project recovers investment over 30 years of operation through: 1) user payment (ticket fare); 2) non-ticket income: commercial development, advertising, information services, etc.; 3) government subsidy. The subsidy scheme consists of three parts: (1) equity subsidy: the project company will transfer assets of the project line to the government after the contract expires, the government pays equity subsidy over 30 years of operation in return); (2) operation gap subsidy: The subsidy is a flexible subsidy with a cap. The public and private party will agree on an operation cost cap before the operation date. When the project company’s operation cost is below the cap, and its income doesn’t cover the operation cost, the project company faces negative cash flow on an operation year, the government pays the negative cash flow amount to ensure the basic operation of the line. When the operation cost exceeds the cap, the government pays the gap subsidy up to the cap, the private party covers the remaining negative cash flow; (3) reasonable revenue subsidy: When the project company does not receive operation gap subsidy, the government pays a reasonable revenue subsidy to reward the company’s service. The public private party will agree on a reasonable revenue rate, and the government pays reasonable revenue subsidy up to the rate. When the project company could satisfy the reasonable revenue rate by its own, the government no longer pays reasonable revenue subsidy.</td>
</tr>
<tr>
<td>Risk-sharing scheme</td>
<td>The government mainly bears the following risk: 1) legal and policy risk; 2) regional collaboration and coordination risk; 3) government examination and approval risk; 4) fiscal risk The private party mainly bears the following risk:</td>
</tr>
</tbody>
</table>
1) preliminary stage (feasibility) risk;  
2) financing risk;  
3) construction risk;  
4) operation risk.

**Lessons to learn**

**Significance:**
The line is a ground-breaking metro PPP project in China in that:
1) It is China’s first metro PPP project that has awarded the contract to a private enterprise;  
2) It is China’s first Investment-Operation-Oriented PPP project (as opposed to the typical Chinese PPP projects that mainly focuses on construction of financing);  
3) It is China’s first large scale infrastructure project that has allowed a private enterprise to enter at the preliminary stage and last till the transfer stage after 35 years;  
4) It is China’s first metro PPP project with a sound risk-sharing scheme and a clear project boundary.

**Purpose:**
The line is designed to serves the following purpose:
1) Connecting line. It will connect the two largest cities in one of the most populous and fast-growing province in China;  
2) Guiding line. Absent of a metro line, the construction and operation of the line alone will have significant impact on Gongyi’s development in the coming decades. Gongyi’s long term development strategy will adjust in accordance with the design of the line. The general planning, transport planning, land planning and many other social-economic planning is subject to revise to best utilize the benefits brought by the line, which will help to best realize the line’s potential to improve the social-economic development of Gongyi in return;  
3) Demonstrating line. The line will demonstrate to both central and local governments that PPP in China does not have to be PPP with Chinese characteristics, private enterprise can do a good job in implementing a full-life-cycle large scale infrastructure project; also, it has the potential to finally realize many of the familiar concept like TOD in metro rail development because the private partner enters into the project at the preliminary stage;  

**Sound subsidy scheme:**
1) the government pays a subsidy with a gap set to ensure basic public service, so as to ensure the government doesn’t over subsidize and that using PPP model doesn’t add extra fiscal burden on government;  
2) the private partner can only profit when the project company could manage to break even by itself, which provides incentive for the private party to cut cost and improve efficiency;  
3) the reasonable revenue subsidy will be a fraction of the amount the private partner saved for the government, so that the private partner does not make profit through subsidy, but rather profit through saving money for the government.

**Source:**

2. **Case Study: São Paulo Metro Line 4, Brazil**

| Project context | Financial close: October 2008  
| Capital value: US$392.15 million (phase 1), of which US$309.2 million is debt (15-year A loan from the IDB for US$69.2 million accompanied by a syndicated 12-year B loan for approximately US$240 million) and US$82.95 million is equity |
**Consortium:** ViaQuatro—Concessionaria da Linha 4 do Metro de São Paulo—comprising Companhia de Concessões Rodoviárias of Brazil (68 percent), Montgomery Participações of Portugal (30 percent), RATP Development of France (1 percent), and Benito Roggio Transportes of Argentina (1 percent)

**Financiers:** Inter-American Development Bank

<table>
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<tr>
<th>Type of PPP</th>
<th>The project will be implemented in two phases. During phase 1, the Companhia do Metropolitano de São Paulo—the public authority that owns the underground network—will be responsible for constructing the tunnelling, track, and metro stations. The private sector contractor, ViaQuatro, under a 30-year concession agreement, will be responsible for the supply, operation, and maintenance of the rolling stock (14 metro trains with six cars each) and operating systems (a train signalling and control system and a mobile voice and data communications system). During phase 1, according to the state’s time frame, six stations will be built by the first quarter of 2010. The second phase, which is subject to further studies and market demand, will require the private sector contractor to open additional stations on the existing line and add between five and 15 more trains, at the discretion of the State of São Paulo, at any time after the second year of commercial operations.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial arrangement</td>
<td>As per the concession agreement, ViaQuatro will receive its revenues from the subway fare (set at US$1 for all trips), adjusted annually for inflation. It will receive 100 percent of the full fare for passengers using only Line 4 and 50 percent of the fare for passengers using Line 4 in connection with other metro and bus lines. In addition, ViaQuatro will receive yearly availability payments of US$44.1 million from the government and will be allowed to obtain alternative revenues by marketing spaces in the facilities and trains, as long as they do not affect the quality and standard of services. Finally, the concession benefits from a minimum revenue-guarantee and revenue-sharing threshold, protecting the concessionaire from low revenues, but providing the state with revenue sharing if use is higher than projections. ViaQuatro will be assessed periodically based on three types of performance indicators: (a) operating performance indicators, (b) users’ satisfaction indicators (which will be performed by an independent institution and will assess the level of satisfaction of users of the new line by means of specific direct surveys), and (c) maintenance quality indicators. If the values of these indicators fall below certain defined limits, Via-Quatro may be penalized through a reduction of its entitlement to income associated with the services provided.</td>
</tr>
<tr>
<td>Risk-sharing scheme</td>
<td>A key risk for the project is the interface between delivery of the publicly funded civil works and the rolling-stock PPP. A complex set of contractual obligations and financial arrangements was put in place to ensure that the private partner was compensated for any delays in provision of the public works. It is too soon to know how this will work in practice, but the project has demonstrated that investors are prepared to take key interface risks if they are structured properly.</td>
</tr>
</tbody>
</table>
| Lessons to learn | Performance-based  
Government takes the risk of construction |
| Source: | Emerging market report |

### 3. Case of Canada Line

**Project context**

Canada Line will be a 19 km automated light metro implemented through a 35-year design-finance-build-operate-maintain concession signed in July 2005 with the “In Transit BC” consortium (led by SNC Lavalin).  
At its northern terminus, Canada Line will integrate with Vancouver’s Skytrain
The Vancouver International Airport Authority has contributed towards the project’s upfront capital costs in order to make this connection possible. Canada Line is part of a larger public transport strategy developed by the South Coast British Columbia Transportation Authority (TransLink). This strategy aims at:

- Reducing greenhouse gas emissions
- Increasing the use of non-motorized transport
- Using the region’s transportation network as a tool for promoting economic development
- Promoting the densification of jobs and housing along frequently used transit routes

Planners estimate that Canada Line will begin revenue services in November 2009 – in time for the 2010 Winter Olympic games in Vancouver. Although the Canada Line was not part of Vancouver’s bid for the 2010 Games, the project’s construction schedule was partially driven by the Games.

<table>
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<tr>
<th>Type of PPP</th>
<th>DFBOM: Design-Finance-Build-Operation-Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial arrangement</td>
<td>2005 Full concession 35 years (including construction), private stakeholder In Transit BC (SNC-Lavalin) Preparing to open for revenue operations in late 2009</td>
</tr>
</tbody>
</table>

Canada Line’s contract ties 10% of the concessionaire’s payment to the system’s customer volume. Calculating this volume payment involves:

- A base forecasted credit ridership estimate (excluding ‘airport only’ ridership)
- An agreed base volume payment
- An agreed shadow fare per paying customer

During the system’s operating phase this information determines three possible payment scenarios as follows:

- If ridership equals forecasts, the concessionaire receives the base volume payment
- If ridership exceeds forecasts, the concessionaire receives the base volume payment plus the difference between actual and forecasted ridership multiplied by the agreed shadow fare
- If ridership falls below forecasts, the concessionaire receives the base volume payment minus the difference between forecasted and actual ridership multiplied by the agreed shadow fare

| Risk-sharing scheme | During Canada Line’s procurement, bidders assumed all risks associated with price fluctuations except for items included in the project’s early works contract, which allowed for construction progress between commercial close and financial close. Trans Link provided full protection and 100% reimbursement for early works in the event that financial close was not possible. Other noteworthy elements of Canada Line’s risk allocation structure include the following:

- Inflation during the construction period: Capital grant payments were specified as pre-agreed milestone payments during the construction period (based on nominal dollar values as negotiated at financial close). The concessionaire endures the risk of higher inflation during the construction period in addition to any effects related to delays in reaching agreed construction milestones. |

| Lessons to learn | Function of a transportation hub; Part of a large transport strategy Reasonable risk sharing mechanism The private stakeholder affords limited operation risks by only tying 10% }
### Project context

The Eagle PPP Project is being delivered and operated under a concession agreement that RTD has entered into with a "Concessionaire" that has been selected through a competitive proposal process. The selected Concessionaire is known as Denver Transit Partners (DTP), a special purpose company. The Eagle PPP Project concession agreement requires DTP to design-build-finance-operate-maintain (DBFOM) the East Rail Line, Gold Line, Northwest Electrified Segment (NWES) (segment 1 of the Northwest Rail Line) and the commuter rail maintenance facility, all under a single contract.

### Type of PPP

**DFBOM:** Design-Finance-Build-Operation-Maintenance

### Financial arrangement

- RTD will retain all assets while shifting much of the risk of designing and building the project to DTP. The Concessionaire has also arranged around $450 million of private financing for the project. This allows RTD to spread out large upfront costs over approximately 30 years, making it more affordable. In return, RTD will make annual service payments to DTP based on their performance of the operation and maintenance of the project through Dec. 31, 2044.

- First transit DBFOM (design, build, finance, operate, and maintain) PPP in the United States and the largest at a cost of $2.2 billion (USD):
  - $460 million in “local” funds (cash, revenue bonds)
  - $450 million from the Concessionaire
  - $280 million Transportation Infrastructure Finance and Innovation Act (TIFIA) loan from United States federal government
  - $1.1 billion United States Federal Government Grant

- **2011-2017**
  - DTP received lump sum payments from RTD during construction for the majority of costs but had the responsibility for raising capital (Private Activity Bonds (PAB) and Equity) for the remainder of costs. See next slide.

- **2017-2044**
  - DTP will receive annual payments (secured by sales and use tax collections) from RTD for PAB repayment. These annual payments are fixed (non-indexed to inflation) based on an amortization schedule. See next slide.

- **2016-2044**
  - DTP will receive monthly service payments from RTD for operations and maintenance (see next slide):
    - Base service payments by year are known and are adjusted each year for inflation (CPI, Labour and Materials indexes). Each of the three rail segments has its own service payment calculation.
    - Payments are adjusted according to performance criteria, such as on-time performance, fleet availability, and cleanliness. Could be a bonus or deduction.
    - RTD retains flexibility over the service payment when using the change order process to adjust service levels.

### Risk-sharing scheme

### Lessons to learn

RTD was able to expand its system to undeserved communities, including rail transport to Denver International Airport. Despite its challenges, RTD and the Concessionaire were able to deliver the first PTC system in the country thus delivering a safer mode of transport. The Project was built on time and on
budget, although it is not fully operational by deadlines set by the United States federal government and other agreements.

The Project has been recognized on a national level as an example of both successes and challenges associated with a PPP transportation project.

The relationship between RTD and the Concessionaire has been challenging at times as the Concessionaire’s design errors with regard to PTC has caused a breakdown in system performance and deliverability. These challenges have also impacted the public’s perception of RTD.

The dispute resolution results are unknown as of the date of this report however the end result could result in an operational structure that was unanticipated by RTD and could lead to a cancellation of the Concession Agreement. Ultimately, the design challenges have led the Concessionaire to attempt to push risk transfer back on to RTD, with risk transfer being an attractive and significant attribute of PPP’s.

| Source: | Heather Deckard, Regional Transportation District, Denver, US |
Annex 2. List of projects of urban rail transit PPPs

1) Manchester Metrolink - United Kingdom
2) Docklands Light Railway - London, United Kingdom
3) The London Underground(LU) Metronet and Tube Lines- London, United Kingdom
4) Delhi airport express rail link-Delhi, India
5) Line 9 Urban Rail in Barcelona-Spain
6) Kuala Lumpur STAR and PUTRA – Malaysia
7) Gautrain Rapid Rail Link - Gauteng Province, South Africa
8) MRT 3 'Metrostar Express' - Manila, Philippines
9) Bangkok Skytrain – Thailand
10) Addis Ababa Light Rail Transit, Ethiopia
11) The Eagle PPP Project in Colorado, USA
12) Canada Line - Vancouver, Canada
13) São Paulo Metro Line 4, Brazil
14) Hong Kong Mass Transit Railway, Hong Kong, China
15) Hangzhou Metro Line1, China
16) Fuzhou Metro line 2, China
17) Zhengzhou-Gongyi-Luoyang Urban Rail Transit PPP, China
18) Chongqing Rail Transit Line 2, China
19) Beijing Metro line 4, China
20) Chengdu Metro line 18, China
21) Taizhou Suburban rail transit line S1, China
Annex 3. Sector-specific knowledge, terms and terminology

A. Urban rail transit

Urban rail transit is an all-encompassing term for various types of local rail systems providing passenger service within and around urban or suburban areas. The set of urban rail transit systems can be roughly subdivided into the following categories:

A1. Rapid transit

A rapid transit, underground, subway, tube, elevated, metro or Mass Rapid Transit (MRT) system is a railway—usually in an urban area—with high passenger capacities and frequency of service, and (usually) full grade separation from other traffic (including other rail traffic). In most parts of the world these systems are known as a "metro" which is short for "metropolitan".

A2. Light rail

A light rail system is a rail-based transit system that has higher capacity and speed than a tram, usually by operating in an exclusive right-of-way separated from automobile traffic, but which is not fully grade-separated from other traffic like rapid transit is. Light rail also generally operates with multiple unit trains rather than single tramcars.

A3. Commuter rail

A commuter rail, regional rail, suburban rail or local rail system operates on mainline trackage which may be shared with intercity rail and freight trains. Systems tend to operate at lower frequencies than rapid transit or light rail systems, but tend to travel at higher speeds and cover longer distances.

A4. Tram

A tram, streetcar or trolley system is a rail-based transit system that runs mainly or completely along streets (i.e. with street running), with a relatively low capacity and frequent stops.

A5. Monorail

A monorail is a railway in which the track consists of a single rail, as opposed to the traditional track with two parallel rails.

B. Urban Rail Transit Project Cycle

An urban rail transit project cycle usually comprises of the following stages:

B1. Feasibility

At feasibility stage, a city government (in some cases, a private enterprise) identifies the need for an urban rail transit. The government would come up with a concept plan or proposal to explore the necessity and feasibility of an urban rail transit project (usually, a professional third party consultancy would involve in the drafting of feasibility study).
The government (or legislative body, depending on the local political system) would then decide whether to implement the project.

**B2. Plan and Design**

After deciding to implement an urban rail transit project, the city government would plan and design the project, the plan and design stage usually comprises of multiple stages, from the overall urban rail transit network plan, plan of the specific rail line, construction plan, all the way to working plan (working drawing). Due to its significant impact on the physical as well as economic structure of a city, the city government would usually adjust urban plan, transport plan, even economic development plan in accordance with the planning of the urban rail transit.

**B3. Investment and financing**

The investment and financing stage refers to the stage when the city government secures the financing of the urban rail transit project. This might not be a “tangible” or separate stage in that, usually the city government would secure the finance in the feasibility stage (e.g. a proved budget allocation for the project might be the prerequisite for passing the feasibility stage in some countries). In a PPP urban rail transit project, a public bidding process might take place to choose an investor to bear the responsibility of financing the project.

**B4. Construction**

After finalization of the working plan and financing in place, the project would kick off the construction. In most countries, the party responsible for the implementation of the project would choose professional constructor through a public bidding process. In a construction-oriented PPP project, the constructor would be chosen at the stage when choosing the PPP private partner. Usually, the construction of an urban rail transit project could be divided into two parts, the civil engineering part and the equipment instalment part.

**B5. Operation & Maintenance**

After construction, the urban rail transit project would go into the operation and maintenance stage. During which, the local urban rail transit company (in most cities a SOE, in a PPP project, the SPV formed for the management of the project) would be responsible for the operation of the urban rail transit project, including the vehicle scheduling, vehicle transport, ticketing, and all other functions relevant to the proper provision of the urban rail transit service. The operation stage is the core stage of an urban rail transit project. Once operated, the urban rail transit service will usually become the most heavily used and irreplaceable public transport service that affects millions of citizens’ daily life. An urban rail transit
system that is operated on-time, stable, convenient and accessible for all requires high level of professional and technical capacity and extreme attention to details.

C. Application of the TOD Model in Urban Rail Transit PPP Projects

The concept of transit-oriented development (TOD) means the development of city centre or new urban area with predominant transit means of walking/cycling and public transport, built in the radius (radius at approximately 1,500 meters from station in terms of urban rail transit) of high-capacity public transport MRT stations and in particular at the core radius (500 – 800 meters radius from the station, i.e. comfortable walking distance of around 10 – 15 minutes) by high-density clustering of business hybrids and compounding spaces. From the perspective of the entire city, what TOD advocates is the development of well-organized and aligned urban space structure by stringing the public transport MRT lines along the nodes of stations.

The TOD concept encompasses two aspects at its core: on the macroscopic policy level, TOD demands for matching land development with the service capabilities of public transport MRT system, by aligning high-density and high-hybrid development in areas of proximity to the stations, and lower-density development in areas further away; on the microscopic level, TOD emphasizes on constructing compact communities of mixed purposes suitable for walking, thereby organizing city life and building public space with the stations at the core, and guiding rail station areas to develop into the centre of ancillary facilities serving the surrounding areas and centre of public life and activities.

C1. Key roles

By maximizing the service capabilities of public transport MRT system, and enhancing the land use efficiency and city operation efficiency with hybrid and high-density developments in areas surrounding the stations, ultimately TOD will achieve green and sustainable environmental and financial development of public transport MRT and the city. Specifically, TOD advocates communities and commuting environment that prioritize walking and public transport wherein people can easily choose to take the public transport, cycle or walk to commute. This enables the achievement of energy saving, emission reduction and environmental protection goals. Meanwhile, clustered developments in radius of the stations not only help public transport to operate at maximum capacities, but also enhance the use efficiency of living, employment and service facilities.

Urban rail transit is a typical high-capacity public transport MRT system. Development along the urban rail stations under the TOD model will produce sound interaction and value-adding win-win effect between rail transit and development of areas surrounding the stations to a greater level, as rail transit brings greater customer flows that will greatly drive development of real estate and modern services and higher added value to land and properties in areas surrounding the stations, while clustered developments in these areas will increase passenger flows to rail transit, thereby providing stable and continuously growing revenue to rail transit.

C2. Core principles
In TOD practice, two principles should be observed.

“Rail construction necessarily entails city development”. Different from routine public transport means, rail transit can also bring about new urban development and new opportunities for the city, as well as upgrade of development capability in addition to resolving commuting needs. Rail transit impacts on a city in ways beyond transportation, extending to industry planning, urban planning, demographic distribution, social services, real estate and finance, and public policy, and transforming the commuting choices and lifestyle of residents. Therefore, when a city plans to develop rail transit, it must take full advantage of these opportunities, and embed the principle of “rail construction necessarily entails city development” in planning and construction from the earliest stage, regard rail transit as a general urban resource for development and utilization instead of a mere transport means, carry out comprehensive and in-depth TOD research and planning, to develop the foundation for sound interaction, added value and win-win result.

“City rail operation necessarily involves city operation”. Rail transit not only involves high construction cost, but also high operation and maintenance costs. A majority of cities is unable to rely on the market to determine the fare price due to the nature of public service of rail transit. Therefore, financially the rail transit can hardly break even with its own operating revenue. For Urban rail transit with designed life spanning a century, the government will be under huge financial burden throughout the lifecycle. The principle of “city rail operation necessarily involves city operation” dictates the need to fully take advantage of development of land in radius of stations to increase passenger flows to rail transit and resource operation opportunities to increase its own revenue on one hand, and to reasonably maximize the added value of land and properties in the TOD, and seek returns on the added value to make up deficit of rail transit construction and operation funds on the city level or project level, in particular long-term operating income of properties in holding. This is of crucial importance to the sustainable financial development of both rail transit and the city.

C3. Keys to implementation

In view of the goals of sustainable construction and operation of rail transit and sustainable development or urban space structure, we must first understand the “product” features of TOD project. TOD is a typical product that requires cross-sector, multi-discipline and multi-industry chain integration. Its implementation requires all-dimensional and end-to-end interaction and feedback, coordination and consolidation throughout the stages of development of rail transit and land development. In particular, in a TOD project where investment and financing are based on the assumption that general development gains will be used for construction and operation of rail transit, implementation of technical, market and mechanism arrangements must be simultaneous.

Technical implementation involves integrated strategy, planning and design with comprehensive considerations of land and other resources of rail transit and radiuses of the stations aimed at a TOD product maximizing efficiency of service and optimizing overall effects through consolidating resources. In addition to resolving the problem of spatial
consolidation in rail transit and land development that arises from crossing sectors and compounding functions, emphasis should be placed on resolving planning and project interfaces from differing timings of rail transit and land development and the interconnection of works.

Market implementation involves in-depth research and validation of the economic attributes of TOD project, land resource selection, development positioning planning, property mix analysis, development timing and development value assessment based on market conditions, and providing feedback to optimize land use quota and rail transit design based on the analysis results. The economic analysis of TOD project should ideally correspond to the urban rail transit construction and operation financing plans and be conducted in a bottom-up market-derived method. This is especially important for TOD projects whose implementation is imminent or those under development in partnership with private sector investors.

Mechanism implementation: a key challenge in TOD implementation is that the existing policies, legislations, systems and mechanisms in most cities are incapable of supporting TOD product which requires cross-sector collaboration in transport infrastructure and land development, the former being by nature a public service and the latter a for-profit business. In particular, when the intention is to use gains from TOD development to support the gap in rail transit construction and operation funding, more complex issues are involved in the investment and financing model. Often this demands for optimization and reshuffling of the existing relationships of interests in the city. Therefore, analysis of policies and legislations to support implementation of TOD product and its investment and financing model and establishment of a mechanism constructive for its advancement are required to guarantee implementation.

The logical relationship among the above three dimensions of technical, market and mechanism implementations is that technical implementation is the goal of an ideal TOD product of the optimal added value effect with consolidation of resource, while market implementation is the driving force whereby market forces will in turn drive investment and financing model and system and mechanism reform, and mechanism is the guarantee in the sense that only with legislations suited for the characteristics of TOD product and its investment and financing model and the supporting system and mechanism, can guarantee be provided for lawful and compliant contractual arrangements that found the basis for TOD project implementation and returns on development.

**C4. Approach to advancement**

In the actual advancement of investment and financing-oriented TOD project, works should be carried out on different levels through different stages of the development of rail transit project in a well-organized manner.

In planning rail transit lines and network, TOD planning guidance on the city level and TOD strategic analysis should be carried out to direct planning of corridors and exchange hubs in the rail transit system, coordinate relationship between rail transit corridors and the city
structure, road structure and main hubs, strengthening public transport support and guiding the development model of land use, and providing reference basis for overall urban planning, districed planning and adjustment as well as macroscopic policies associated with the city. During this stage, the government should take control of land resources along the rail transit lines, clarify the entity responsible for advancing the TOD project, establish cross-department coordination and decision-making settings, and activate analysis in policies and legislations required in TOD.

In feasibility studies of specific rail transit lines, TOD planning guide on the line level and TOD development value analysis should be carried out. TOD planning guide on the line level defines functional positioning, construction scale, requirements on transport facilities and other public facilities and requirement for guiding public space system along the rail lines and in the radiuses of the stations, thereby providing reference basis for detailed urban planning and adjustment of related areas. Meanwhile, analysis should be carried out in the real estate market along the rail transit line, to filter out lands of TOD development potential, design property mix and development timing, and estimate development value.

In the implementation stage of rail transit, TOD planning design guide on the station level and TOD project joint development analysis should be carried out in light of rail transit line and station designs. TOD planning design guide on the station level serves to establish the three-dimensional relationship of the rail stations and development of properties in their radiuses, commuter exchange space and urban space, provide detailed guideline requirements on the setting of station exits and entrances and pedestrian system, which should be included in the detailed land planning. The TOD project joint development analysis takes into comprehensive consideration the rail transit section, stations and the adjacent TOD projects and seeks an implementation plan of the most rational functional layout and best cost efficiency through integrated and consolidated designs and project financial analysis. In particular, it works to resolve problems of interfacing and pre-existing projects arising from the different timings of rail transit and land development.

Cross-sector multi-discipline integration and multi-department and multi-stakeholder collaboration are the mainline that leads through the entire TOD process.

D. Financial Subsidy Models Applied in Urban Rail Transit PPP Projects

D1. Main Reasons for Financial Subsidy for Urban Rail Transit Projects

Factors including the significantly large amount of investment in rail transit construction, high operating costs, public interest, and the need to reflect fairness make it difficult for the PPP project to break even. The long-term shortfall in financial cash flow requires subsidies in the form of fiscal funding to make PPP projects financially sustainable. The return on the investment in urban rail transit projects mainly comes from three sources: 1. ticket revenue; 2. non-ticket revenue, namely revenue from the management of the resources including commercials, communication, business and land, and 3. government subsidies.
The following reasons are behind the shortfall in the financial cash flow for urban rail transit PPP projects (Financial Viability Gap):

1. Shortfall of operating cash flow: It normally takes a long time to increase the passenger flow of urban rail transit projects. Therefore, in the early days of the project, passenger flows are low while operating costs run high. When the actual operating revenue of the project cannot cover the actual cost, there will be a shortfall in the operating cash flow.

2. Debt service: From the perspective of project financing sources, in addition to equity funds, huge debt is also required. Debt service may result in a shortfall in project cash flow.

3. Investment in new vehicles: During the project operation, as the passenger flow rises, new vehicles are needed. The additional investment required for the new carriages will lead to a cash flow shortfall for the project.

4. Equipment renovation and replacement: Urban rail transit PPP projects feature long-term cooperation. For example, the metro projects require PPP that spans for over 20 years, longer than the depreciation period of most equipment. During the long-term partnership, the equipment or facilities need to be renovated or replaced once or several times.

5. Intermediate repair and overhaul of vehicles: The maintenance of vehicles is the foundation for safe operation. In addition to routine maintenance, all types of running vehicles generally require intermediate repair every five years and overhaul every ten years. Vehicle repairs or overhauls will generate large maintenance costs which are not included in normal depreciation.

6. Apportioning of investments in public facilities: Urban rail transit lines generally develop in a networked pattern. According to the future development plans for urban rail transit lines, for the construction of new lines, we should consider the interchange with and transfer to other lines or control centres etc. The investments in the necessary public facilities need to be apportioned.

7. Compensation for the loss resulting from major accidents or force majeure. In the event of major accident during construction or operation, or any major damage to the rail transit tunnel works or other equipment (or facilities) due to event of force de majeure (such as strong earthquakes), compensation and remedy will be required.

D2. Common subsidy estimation models used in urban rail transit PPP projects

When calculating the financial gap to be subsidized in the urban rail transit PPP model, the following methods are commonly used.

(I) Negotiated price method
The negotiated price method is also known as the shadow price method, and is a “passenger flow-based subsidy model” which measurement is based on passenger flows. Using the negotiated price method, the financial viability gap is calculated as follows:

Financial viability gap = negotiated price $\times$ estimated passenger flow – actual ticket revenue – actual non-ticket revenue (1)

Of which, the negotiated price or shadow price ($P_s$) is the ticket price through simulation when the financial net present value (NPV) reaches a certain level ($NPV \geq 0$).

$$\text{NPV} = -\sum_{i=0}^{m} \frac{I_i}{(1+r_o)^i} + \sum_{i=m+1}^{n} \frac{P_s Q_i - C_i}{(1+r)^i} \geq 0 \quad (2)$$

In this formula, $m$ is the construction term (in years), $n$ is the term of concession operation inclusive of the term of construction (in years), $r_o$ is the discounting factor (base rate of return expected by the private sectors), $I_i$ is construction investment in year $i$, $C_i$ is the operation and maintenance costs in year $i$, and $Q_i$ is the passenger flow in year $i$.

Under this subsidy model, to meet the minimum return on investment for social investments ($r$), the government calculates a theoretical shadow ticket price ($P_s$) through negotiation, which is higher than actual price. The difference between the actual price and the shadow price needs to be subsidized by the government, thereby becoming the subsidy income for the special-purpose vehicle (SPV) or social department.

The advantage of this model is its operability, and sufficient incentive mechanism for the private sector. The disadvantages are that it is difficult to determine a mechanism of sharing passenger flow risks, the government is prone to incur contingent liability, and misalignment between the government subsidy and actual need for funding.

(II) Mileage subsidy method

The mileage subsidy method is also known as the mileage cost method or mileage operation service fee method, and is a model that adopts the principle of government procurement of public service from the PPP special-purpose vehicle (SPV). The subsidy is calculated in a model based on the basic indicator of train operation mileage. In other words, the subsidy is calculated based on the “number of runs of the train”. The viability gap funding is calculated using the mileage subsidy method as follows:

Viability gap funding = agreed mileage $\times$ agreed mileage-based service price – base passenger transport revenue – base non-ticket revenue (3)

In the formulate, the “agreed mileage” is the mileage (sum of operating mileage of all vehicles) determined on the transit organization plan during the stage of private sector department selection; “agreed mileage-based service price” is the procurement price of mileage-based service offered by the rail transit entity by the government as agreed in the
PPP contract, which initial pricing is determined in the competitive mechanism through PPP contract negotiation; “base passenger transport revenue” is the basic ticket revenue expected by the PPP SPV, calculated by multiplying the estimated passenger flow and actual ticket price per person time; and “base non-ticket revenue” is the basic requirement for non-ticket revenue in the PPP project.

The mileage subsidy model represents the principle of government procured service, is easy for the government to control total funding, and effectively mitigate the impact of passenger flow estimation risk as pricing is based on mileage. However, the cost-based subsidy does not constitute effective incentive for the private sector department, and the consideration of cost alone poses limitations.

(III) Availability payment subsidy method

Calculation formula is as follows:

\[
\text{Amount of operating subsidy expenditure in the current year} = \frac{\text{Total construction costs} \times (1 + \text{reasonable profitability}) \times (1 + \text{annual discounting factor})^n + \text{annual operating costs} \times (1 + \text{reasonable profitability}) \times \text{amount of fees paid by users in the current year (4)}}{\text{Period of fiscal subsidy to operations}}
\]

In the formula, \( n \) represents the number of years discounted; period of fiscal subsidy to operations is the number of years that fiscal subsidy is made to operations; annual discounting factor should be reasonably determined with consideration of the year when the fiscal subsidy expenditure is incurred and in reference to the local government bond yield for the same period; and reasonable profitability should be determined based on the medium- to long-term loan interest rate of commercial banks with full considerations given to availability payment, usage payment, performance payment and other scenarios and in view of risks and other factors.

In the availability payment subsidy formula, the first part reflects the all construction and investment costs apportioned to the period of subsidy and returns, and the second part reflects the difference of the annual operating costs (including reasonable profit) and operating revenue (user charge).

The subsidies through the years calculated using the availability payment subsidy formula appears to increase at a steady rate, which helps lower the initial fiscal expenditure. The formula is defective in the way that higher operating costs may result in more subsidies, thus countering the effort of private sector department to minimize operating costs. Also, the formula requires valuation of multiple parameters (e.g. reasonable profitability, annual discounting rate) and can be manipulated to a great extent.

(IV) Annuity method
The annuity method converts the construction investment (including interests incurred during construction period) to annuities by the annuity factor of paybacks, then adds to its operating costs of the years and deducts operating revenue, to arrive at government subsidy. Detailed formula is as follows:

Amount of operating subsidy expenditure of the current year

\[
= \text{Total construction costs} \times \frac{\text{annual discounting factor} \times (1 + \text{annual discounting factor})^n}{(1 + \text{annual discounting factor})^{n-1}} \times (1 + \text{reasonable profitability}) + \text{annual operating costs} \times (1 + \text{reasonable profitability}) - \text{user charge in the current year}
\]

Wherein \( n \) represents the number of years of subsidy.

The annual subsidy expenditures calculated using the annuity method appears to be evenly distributed. However, the annual discounting factor and reasonable profitability can be influenced by many factors, while these values have large impact on the operating subsidies in the years and internal rate of return of the private sector.

(V) Cash flow subsidy method

Cash flow subsidy method is based on the PPP project financial plan cash flow statement, estimates the cash shortfall in the cash flow statement in the principle of receipt and payment recognition, and determines the direct payment obligation of the government. The subsidy model breaks fiscal subsidy down to GAP and GAS.

Government Aid for Project (GAP)

GAP is the viability gap funding based on the project’s cash flows in the financial plan, i.e. when the cumulative result of net cash flows from operating, investment and financing activities (cumulative surplus funds) becomes negative and the SPV is unable to resolve the funding gap through re-financing, the government will subsidize the viability gap of the project.

In year \( t \), the government subsidy for the project viability gap (GAPt) is calculated as follows:

\[
\text{GAPt} = \left| (\text{CI}_t - \text{CO}_t) + \text{ANC}_{t-1} \right|
\]

i.e., when \( (\text{CI}_t - \text{CO}_t) < 0 \), GAPt is the absolute value in the above formula;

when \( (\text{CI}_t - \text{CO}_t) \geq 0 \), GAPt = 0.

Wherein:

\( t \)—— year \( t \) in the PPP project (generally speaking, \( m \leq t \leq n \)), the same applies hereinafter

\( \text{CI}_t \)—— sum of cash inflows from operating, investment and financing activities in year \( t \) as shown in the cash flow statement in the project financial plan;

\( \text{CO}_t \)—— sum of cash outflows from operating, investment and financing activities in year \( t \) as shown in the cash flow statement in the project financial plan;
ANCt-1 — Cumulative surplus fund in year t-1 as shown in the cash flow statement in the project financial plan.

In other words, when in year t, the project’s cumulative net cash flow is positive, the government does not need to provide viability gap subsidy; when the cumulative net cash flow in year t become a negative value, the government subsidy in year t is the absolute value of cumulative cash net flow of the project in year t.

2. Government Aid for Social Investor (GAS)

GAS is the government aid for social investor based on the cash flow statement of the private sector, i.e. when the cash inflows of project operating activities are greater than cash outflows (positive cash net flow), the government subsidizes for the funding gap to reach reasonable return on social investment or private sector based on the project’s distributable profit, cumulative fund surplus and performance evaluation.

(1) First, calculate the theoretical return on social investment in year t (ROSt), as follows:

$$ROSt = \left( CI_{opt} - CO_{opt} \right) \times K_t$$ (7)

Wherein

When $\left( CI_{opt} - CO_{opt} \right) \leq 0$, $ROSt = 0$.

$CI_{opt}$ and $CO_{opt}$ —— Total cash inflow and outflow from operating activities in year t in the cash flow statement of the project financial plan;

$CI_{opt} - CO_{opt}$ —— Net cash flow from operating activities in year t.

$K_t$ —— Adjustment factor of reasonable return on social investment in year t.

(2) Calculate government aid for social investor in year t (GAS) as follows:

$$GASt = ROSt - \left( P_t + NC_{spt} \right)$$ (8)

Wherein:

When $ROSt \leq P_t + NC_{spt}$, $GASt = 0$.

GASt —— The government aid for social investor in year t of PPP term at the return on investment determined by the government (ro)

ROSt —— Reasonable return on social investment in year t

$P_t$ —— Actual profit distributable to social investor in year t.

$NC_{spt}$ —— After the government aid for social investor is accounted in the project financial cash flow in year t, surplus fund that can be used to pay for reasonable return on social investment.

D3. Recommendations on the Selection of Subsidy Model

In selecting and applying subsidy models, the following key factors should be considered.

(1) Foundation of preliminary works of the project. For urban rail transit projects, if preliminary works such as passenger flow forecasts are thoroughly carried out, in particular if similar projects are in operation in the local city, the new urban rail transit PPP project may adopt the principle of same price for same network to determine the actual ticket price. In this scenario, the negotiated price method can be a good option of subsidy models.
(2) Expertise of the government. PPP contract performance is a joint obligation of the government and the SPV. As the ticket price mechanism and minimum passenger flow design may bring about contingent liability to the government, if the government lacks expertise in managing urban rail transit, which includes the ability of PPP contract negotiation and process supervision, it is best to avoid using the negotiated price and mileage subsidy methods.

(3) Fiscal ability. In designing subsidy plan, local medium- to long-term fiscal budget and expected expenditures of the project in each year need to be taken into consideration. For instance, if the local fiscal expenditure is under high pressure in recent years, the availability payment subsidy method may be a good option as the distribution of amounts of subsidies over the years appears to be “lower in the beginning and higher in later years”. Without the fiscal expenditure pressure, annuity method may be adopted. In areas with lesser fiscal strength, analysis of other operating resource support plans and TOD model feedback mechanism may be actively explored to minimize the reliance of PPP project on cash subsidies.

(4) Actual project funding gap. The subsidies over the years for the project should match the actual funding gaps and efforts should be made to avoid impact of subjective and manmade factors such as calculation of parameters or selection of indicators on the subsidy results. The cash flow subsidy method is exclusive and reflects the actual funding gap of project and interest claims of the parties concerned with relative objectivity.

(5) Performance evaluation-based incentive mechanism. Under normal conditions, social investments or private sector should have a reasonable expectation of returns which, however, should not be a constant value guaranteed by government. The urban rail transit PPP project should have a lifecycle evaluation mechanism to link project performance evaluation results with government expenditure obligation.