

# Public–private partnerships for urban road networks: A way out of the urban deficit

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## ABSTRACT

*This paper looks into the dilemma authorities are facing in keeping urban road networks up to performance while maintaining the liveability of a city, and how a Public–Private Partnership approach might help to overcome the constraints they face in doing so.*

*Three case studies of PPPs for urban road network development/maintenance are used as examples. The issues and recommendations playing a role in the case studies are: the flexibility to deal with future developments, interfacing with urban planning, government capacity to deal with complex projects and contracting arrangements, and having in-depth knowledge of the road assets under consideration.*

**Keywords:** *Public–Private Partnerships, urbanisation, urban road*

*networks, local authorities, project complexity, case studies*

## INTRODUCTION

The concept of the ‘urban deficit’ was coined by Ramanath Jha of the Indian organisation Janaagraha. In his article on public–private partnerships in urban infrastructure, he defines the concept as ‘the inadequacy of urban destinations that can “infrastructurally” support business, people and activities in an expanding national economy, forcing them to make do with whatever is available’.<sup>1</sup> This raises the question of what urban authorities can practically do to overcome the urban deficit when considering the performance of urban road networks.

In 2005, almost five out of ten people across the globe lived in an urban area with 1 million inhabitants or more. Predictions from the United Nations suggest that this number will increase to close to six out of ten in 2030. This would mean that 3.16 billion people will live in cities and agglomerations by that time. Looking at Western Europe, the percentage is significantly higher. In 2005, some 141 million people (76.1 per cent of the total population), lived in urban areas. It is projected that this number will increase to 156 million (81.7 per cent) by 2030.<sup>2</sup>

Urbanisation undeniably puts pressure



on urban transportation networks and their operation. It forces the responsible authorities to find a balance between keeping the networks in a good state with sufficient capacity to meet ever-increasing urban transport demands at the same time as keeping the city liveable. The present paper examines how a public-private partnership (PPP) approach can help authorities to overcome their constraints in dealing with the abovementioned dilemma. Three case studies are used to depict the practice of PPP and some lessons and recommendations will be drawn from them.

## CHALLENGES OF RAPID URBANISATION

### Declining performance of urban road networks

One of the main problems associated with rapid urbanisation is the increasing congestion of urban road networks and the decreasing accessibility of economic destinations in urban areas, which, as everyone agrees, is an important factor in reducing economic competitiveness. Figures from the Texas Transportation Institute's '2007 Urban Mobility Report' reveal the development of travel time delays from 1982 to 2005 for urban areas with populations of

over 1 million in the USA, as shown in Figure 1.

The researchers found that free-flowing traffic was seen only one-third of the time in urban areas with over 1 million inhabitants in 2005, as opposed to two-thirds of the time in 1982. Indeed, the problem had grown such that by 2005, extreme congestion was a fact for a staggering quarter of the time.<sup>3</sup>

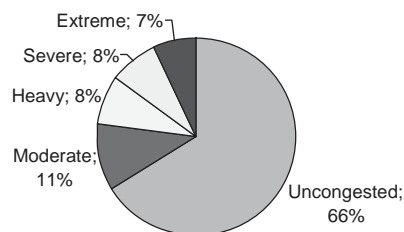
### Constraints for authorities

The figures presented above demonstrate the severe pressures on urban road networks. It is a daunting task for the responsible authorities to maintain infrastructure networks in line with mobility demand. Several constraints are faced by (local) authorities in the provision of efficient urban road networks:

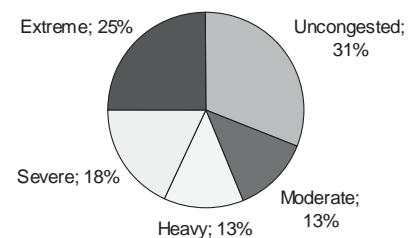
- *Spatial constraints:* constraints to the extension of urban road networks and the related high costs of land acquisition.
- *Technical and organisational constraints:* tight links between project planning and other disciplines like special planning and social policy make urban road projects highly complex endeavours from a technical point of view. In terms of organisation there are often several authorities with responsibilities

Figure 1: Travel time delays and congestion rates for urban areas with over 1 million inhabitants in the USA: (a) 1982 and (b) 2005

Total Delay = 0.7 Billion Hours (1982)



Total Delay = 3.2 Billion Hours (2005)



Source: Texas Transportation Institute (2007) 'The 2007 Urban Mobility Report', p. 11

in the urban jurisdiction, thus adding a layer of complexity.

- *Fiscal constraints:* when public budgets are allocated, transportation is competing with other public service needs. Transportation budgets are usually not sufficient to maintain the infrastructure at a predefined service level. When budgets are available, they tend to be of short/medium tenure, and do not fulfil the need for sustainable financing for the continuous investments needed to keep urban road infrastructure up to the relevant standards.
- *Capacity constraints:* to be able to deal with technically and organisationally complex projects, authorities need the capacity and competence in several disciplines. These capabilities are not always present, especially in local administrations.

Setting up PPPs can help authorities to address the abovementioned constraints.

### HOW A PPP APPROACH CAN HELP

The contractual relationship for a road network project in terms of risk allocation, performance, and financing and revenue schemes, can be sculpted in a PPP agreement between a (local) authority and a private sector contractor.

Key elements of PPPs are:<sup>4</sup>

- *The combination of several tasks in a single contract:* in PPP contracts, the contractor is generally responsible for the design, construction, maintenance and operation of a road.
- *Relative autonomy for the contractor:* in PPP contracts, deliverables are output-oriented and specified in terms of functions and qualities. This 'lack' of detailed work description gives the contractor considerable freedom in planning and organising activities.
- *Specific risk-sharing arrangements:* to be

able to allocate risks between the client authority and the private entity in a PPP contract, they must be made explicit. The PPP contractor can take up risks that are within his control to manage and/or mitigate. For risks that are not controllable, sharing mechanisms may be applied.

- *Specific cost-recovery mechanisms:* in a PPP, the private entities can be reimbursed by tolls, shadow tolls, periodical payments by the client authority related to performance, or a mix of these sources.
- *Joint or private financing:* depending on the type of contract, the share of private finance in a PPP varies. Projects with private pre-investment of construction works, availability payments or shadow toll, can be described as jointly financed by the public and private sector. A toll concession contract is an example of a fully privately financed project.

Contract duration has not been included in the list of key characteristics, as many factors determine the duration of a PPP contract, which can be anywhere from five to 80 years.

Because of their characteristics, PPPs induce various technical and economic benefits as compared with traditional ways of contracting. A summary can be found in a publication by the International Road Federation (IRF) issued in 2008:<sup>5</sup>

- *Improved work planning and organisation:* the contractor has the flexibility to adapt his planning to changing conditions. A related advantage of entrusting the execution of several tasks to a single PPP contractor is better management of interfaces and coordination, both for works as well as maintenance contracts.
- *Optimisation:* a PPP contract allows the contractor to apply a lifecycle approach to the road assets under his guardian-

ship. This means activities can be planned according to the required quality level instead of the availability of maintenance budgets.

- *Innovation*: PPP contracts contribute to an environment conducive to innovation, whether of a technical or organisational nature. The long-term responsibility of a contractor for a road infrastructure asset stimulates cost-conscious behaviour and it allows the contractor to earn back his investment in research and development.
- *Risk management*: a contractor's main drives are profitability and continuity, and in order to achieve these he has to control costs. This can only be done by identifying and managing risks appropriately. For the decision to assume certain risks in a road PPP project, it is of vital importance for the contractor — and even more so for the project sponsors — to know the risks and their consequences. The benefit for the client authority is that they can use private sector experience and expertise in identifying and managing risks and obtain good value for money for the project.

## CASE STUDIES: DIFFERENT TYPES OF PROJECTS

### A working classification of urban road PPPs

To illustrate how authorities have financially benefited from urban road projects and how they have dealt with the challenges, the IRF has undertaken several case studies to examine PPPs in different settings. The following working classification of urban road projects was used:

- *Urban congestion charging*: schemes which impose a fee to vehicles to enter a certain cordoned area within an urban zone, implemented through a partner-

ship contract in which both public authority and private contractor bear financial risks.

- *Urban toll roads*: toll motorways in urban areas which have been given out in concession to a private operator. The private operator generally designs, constructs, maintains and operates the road in exchange for the right to levy a toll on the users. High occupancy toll (HOT) lanes would also fall under this working definition.
- *Combined road and real estate development*: schemes under PPP in which functions/aspects like road development, housing development and/or business accommodation are combined to reach optimum quality and enable cross-subsidising of project elements to make a viable business case.
- *Urban road operation partnerships*: schemes under PPP which aim at making better use of existing urban road infrastructure capacity by using intelligent transportation systems. Projects concerning partnerships in parking and interfacing with other modalities, like mass transit systems and rail, could also be included under this heading.
- *Long-term maintenance contracts for urban road networks*: schemes under PPP concerning long-term maintenance (sometimes including upgrading) of the urban road network, in which revenues are based on performance.

The classification was used to provide a broad distinction between the cases and to subsequently cover a wide range of possible schemes.

The rest of this paper provides summaries of three of the case studies:

- the State Route 91 express lanes in California, USA;
- the A14 urban motorway in Paris, France; and

- Portsmouth PFI Highways Management, UK.

The categories that are examined are value pricing or congestion charging, urban toll motorways and long-term performance-based contracts for urban road networks respectively. The summaries are short project descriptions that focus on the partnership structures, the urban context and difficulties overcome/lessons learned.

### The State Route 91 express lanes, California, USA

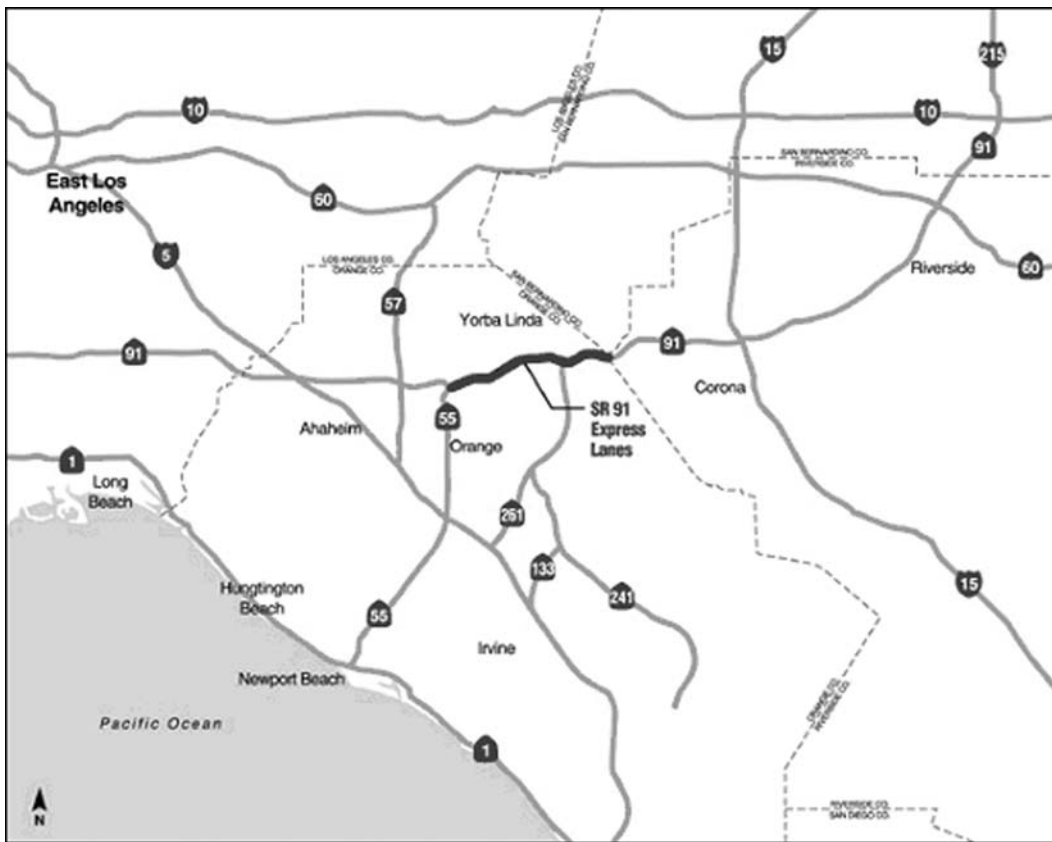
#### *Project description*

The State Route 91 express lanes in California run 16 km from the interchange of

State Route 91 with State Route 55 at Anaheim to Riverside County line. They consist of two lanes in each direction, contained in the median of State Route 91 with entry points at each end. The express lanes opened to traffic in December 1995 and were built to relieve State Route 91, which had become heavily congested due to increasing commuter travel between Orange County and Riverside. The locations of the express lanes are shown in Figure 2.

Tolls for the express lanes are collected through a free-flow tolling system; users are required to have a transponder in their vehicle. Toll rates vary by hour, by day and by travel direction; some 20 different toll levels have been preset. The project

Figure 2: Location of the State Route 91 express lanes



Source: US Department of Transport (2003) 'A guide for HOT lane development'

involved the first application of variable pricing in the USA.

California was among the first US states to use PPP arrangements for the development of toll roads. In July 1989, the Californian legislature approved Assembly Bill 680, thus enabling the Californian State Department of Transport, CalTrans, to ask private sector investors to state their interest for demonstration projects in transportation PPPs. The projects would be implemented without any state financial support. Under an unsolicited proposals principle, the State Route 91 express lanes was one of four projects proposed, and the only one to be implemented in a timely manner. Another project, the State Route 125 SouthBay Expressway, was implemented with about ten years of delay due to environmental issues. Two projects were simply abandoned.

Although the need for improvements to tackle heavy congestion was evident, public funding for State Route 91 was not available at the time and would not materialise in the near future. With private finance, transportation infrastructure would come available years earlier than under state funding, as would societal benefits.

#### *Partnership structure*

The project was originally sponsored by CalTrans. The project was operated from 1992 until 2003 by California Private Transportation Company (CPTC) — a private concessionaire with the following shareholder companies: Kiewitt Construction, Level 3 Communications and Cofiroute France. The express lanes were constructed under a build-transfer-operate contract. After construction, CPTC transferred ownership to CalTrans, which in turn leased the lanes back to CPTC for a 35-year period. Liability stayed with CalTrans, as the owner of the infrastructure.

Since January 2003, the 91 express lanes have been owned by the Orange County

Transportation Authority (OCTA) — a regional public entity, following a buy-out of the concessionaire.

#### *Urban context*

Following rapid population growth and a decline in the availability of affordable housing in the coastal area during the 1980s, new inland residential areas were being developed in the east (Riverside). This induced higher traffic demand due to increasing volumes of commuter traffic to and from the Orange County job centres in the west. This resulted in State Route 91 becoming one of the most heavily travelled routes in Orange County and one of the most congested corridors in California. Delays during peak hours could amount to 30 to 40 minutes.

From a spatial planning point of view, planning the express lanes in the median of the existing highway had several advantages. Land was already owned, which allowed for a speedy implementation of the project and which limited its environmental impact to the surroundings.

Commuter travellers represent the bulk of traffic on the 91 express lanes. The toll rates are set so as to guarantee free flow on the express lanes. As at 1st April, 2009, the rates vary from a minimum of \$1.25 to a maximum of \$9.55 during rush hour, depending on the day of the week.

In a cost-benefit analysis of the 91 express lanes published by California Polytechnic State University in 2006, user travel time savings dominated the benefits. During rush hours, the two express lanes carry about 40 per cent of the total traffic, because traffic is kept at free-flow speed, compared with 60 per cent of the traffic on the four general-purpose lanes.<sup>6</sup>

#### *Difficulties overcome*

From a public sector perspective, the main issue related to the contract's lack of flexibility. In 1999, CalTrans started plans to

widen the Riverside expressway; this was in violation of a non-competition clause in the concession agreement. The clause stated that no improvements (including widening the free lanes or building a mass-transit transport link) along 48 km of the Riverside freeway could be implemented during the contract period, in order to ensure the profitability of the express lanes. OCTA decided to buy out the private interest and purchased the express lanes in January 2003 for \$207.5m. This represented a *de facto* return to public ownership.

### The A14 urban motorway in Paris, France

#### Project description

The A14 motorway is an urban motorway located in the west of Paris, linking the business district of La Défense to the western suburbs. It consists of two lanes in each direction, with a total length of 15.6 km. The A14 motorway opened to traffic on 6th November, 1996. It was built to relieve the A13 between Paris and Normandy, which had become heavily congested due to increasing commuter travel between the western suburbs of Paris and the city. The location of the A14 is shown in Figure 3.

To minimise the visual impact, the A14

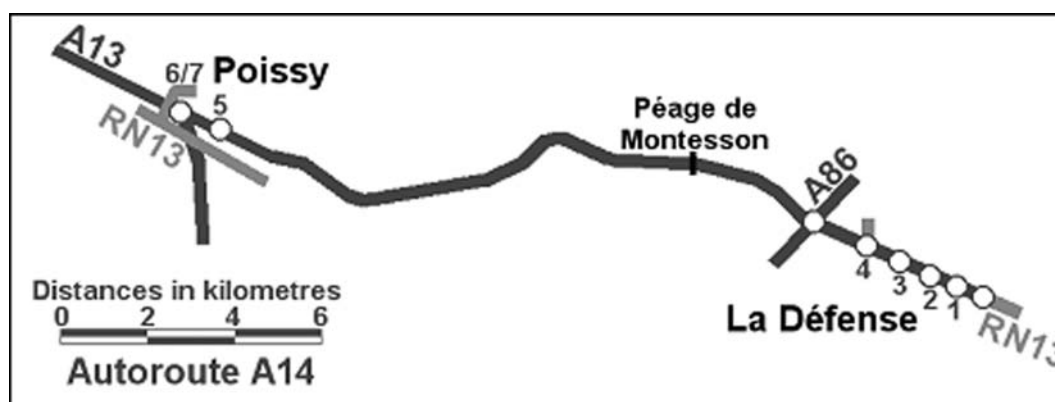
motorway runs below ground level for 13.4 km, which represents 86 per cent of its total length. It crosses the river Seine by means of two viaducts of 550 m and 665 m respectively.

Tolls for the A14 are collected through a single toll barrier located at Montesson. The toll plaza is an open system (fixed rate) with barriers, but it integrates non-stop (50 km/h) payment lanes for commuters equipped with a tag — thus making traffic more fluid by eliminating delays in toll payment. Toll rates vary by period of the day; two toll levels (peak and off-peak) have been preset, encouraging driving outside peak times, and meeting the particular needs of businesses and salesmen.

In 2008, the annual average daily traffic of the A14 exceeded 28,000 vehicles per day. Weekday traffic amounted to 34,000 vehicles per day, with 4,000 vehicles per hour during the peak hour in the morning in the direction of Paris.

Significant civil works were recently performed on the A14 to comply with new tunnel safety regulations and to meet the recurring demands of neighbouring municipalities and inhabitants. These included upgrading of the tunnels and cuttings in 2007–08 and the construction of an interchange near Saint-Germain, which will open in 2009.

Figure 3: Location of the A14 between Poissy and La Défense, in the western suburbs of Paris



### *Partnership structure*

The project was implemented under a French concession contract, with the French state being in charge of the preliminary design and procedures, taking the public utility procedure risk, until the concession agreement was signed. Société des Autoroutes Paris-Normandie (SAPN), an affiliate of Sanef, is the concessionaire. SAPN took the risk for the final design and construction costs and delays, financing and operations costs. It is also taking full traffic risks. The toll rates are defined under the concession agreement and authorised by the French state.

### *Urban context*

Two aspects will be addressed here: the urban mobility aspect of the project and its landscape integration.

The A14 provides services dedicated to meet customers' demands, which are specific to an urban infrastructure. From an urban mobility point of view, the most interesting services include free access for carpooling drivers (ie vehicles with at least three passengers), thus encouraging vehicle sharing, and the bus service (Express A14) which has three lines linking the western suburbs (Mantes La Jolie, Les Mureaux, Verneuil et Orgeval) and the business centre of La Défense. Currently, 15 per cent of the people on the A14 are using the Express A14 bus service. It is the first bus rapid transit service in the Paris area. Furthermore, discounts are offered to frequent commuter and business users with transponders.

Fifty per cent of the total project budget was set aside for aspects of environmental protection and for the visual and acoustic insertion of the motorway in its surroundings. The motorway is fully lit, and the pavement is constructed using draining asphalt, a material that enhances safety, as well as a smooth and quiet ride. All run-off water is collected in a separate sealed

system and processed before being discharged. Practically, the entire stretch of this motorway runs either in deep cutting or in cut-and-cover and bored tunnels, the tunnel configuration accounting for more than one-third of the length. The two bridges carrying the road over the Seine are acoustically screened. The open-air stretches are bounded by walls or earth banks planted with noise-reducing shrubs, etc. Nearly 1 million new plants were needed for the 47 hectares of new landscape around the motorway.

### *Difficulties overcome*

As stated above, many efforts have been put into reducing the environmental impact and ensuring the urban integration of the motorway. This has resulted in a high level of quality for the project. However, there are some issues remaining and upcoming:

- Congestion outside the A14, for example at the entrance of the tunnel area accessing La Défense, affects the performance of the project itself. The position of tolled motorways relative to freeways in a motorway network is something to consider.
- The concession agreement does not allow for the introduction of more innovative pricing mechanisms, like dynamic pricing, which could be used as a traffic management tool.
- The availability of land and the aspect of urban integration may pose constraints with respect to dealing with further traffic increases on the A14.

## **Portsmouth PFI Highways Management**

### *Project description*

Portsmouth City Council has outsourced its highways management and maintenance in a 25-year private finance initiative (PFI) contract. Much of the information

on this project was obtained from the 4ps 'Project Information Briefing'.<sup>7</sup>

The contractor, Ensign Highways Ltd, is responsible for the day-to-day, 'fence-to-fence' management and maintenance of 480 km of roads, 19,000 street-lighting units and 84 structures. The objective of the project was to bring all highways infrastructure to appropriate and defined standards, optimise the lane availability for road users, provide a highways management service, achieve safe passage and reduce the number and value of third-party claims.

The contract was signed on 30th July, 2004 and will last until 31st March, 2030. After a six-month mobilisation period, service delivery and a five-year 'core investment' period commenced on 31st January, 2005.

The contractor is paid a monthly fee by the sponsoring authority, based principally upon availability and performance and including an element related to usage of the network by heavy goods vehicles.

**Partnership structure**

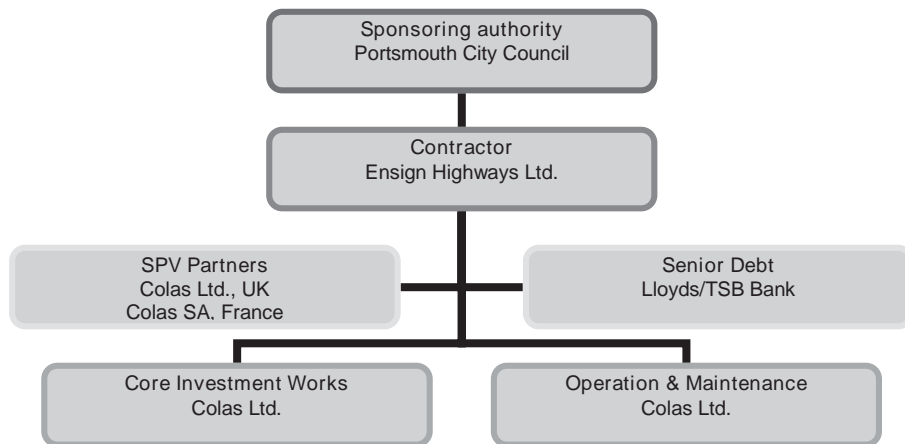
Portsmouth City Council is the sponsoring

authority of the 25-year PFI contract. The contractor is Ensign Highways Ltd, a special-purpose entity with Colas Ltd and Colas SA as equal shareholders. The contractual relations between the partners can be depicted as per Figure 4.

Ensign is responsible for upgrading and replacing highways, day-to-day highway management, upgrading street-lighting to modern standards and inspection and licence management. The services to be delivered concern:

- traffic signals;
- traffic management;
- maintenance of the highway network, including footways and adopted alleyways, street-lighting, highway embankments, road signs, etc;
- New Roads and Street Works Act 1991;
- landscaping;
- street cleaning;
- customer interface; and
- miscellaneous other functions (eg emergency response, dealing with antiquities, preparing performance indicators).

Figure 4: Contractual relations for Portsmouth PFI Highways Management



Source: 4ps (2005) 'Project Information Briefing: Portsmouth City Council Highways Management PFI Scheme'

Portsmouth City Council retains some of the highway functions. A number of the Council's highways management personnel have been transferred to the contractor.

The payment mechanism consists of:

- payment of a monthly lump sum fee of £1,359,000 (2004 value);<sup>8</sup>
- a shadow toll of £1.15 per heavy goods vehicle; and
- deductions in case of non-performance.

#### *Urban context*

Portsmouth is predominantly urban and has very dense housing with extensive areas of terraced housing with little locally available open space. The city is geographically bounded in the south, east and west by the Solent and two harbours, which leaves little space for development. This influenced the choice of location for the contractor's depot. Ensign decided to redevelop the depot of the previous contractor, which was owned by the City Council. Procedures had to be followed to obtain permits for the modified use of the site. This determined the length of the minimum mobilisation period.

#### *Difficulties overcome*

During the procurement stage, it appeared that the information on the conditions and the inventory of the road assets, and notably the level of detail, was not sufficient for candidates to prepare their bid. The information on road conditions had to be supplemented through additional surveys. The inventory information was not centrally organised and properly updated and had to be obtained from different departments within the City Council administration. Updates were undertaken as necessary.

Another problem during the procurement process was that the City Council had underestimated the lifecycle costs by underestimating the cost of maintenance

activities starting after the core investment period. Furthermore, new regulations imposed by the Department for Transport (DfT) had unforeseen cost implications. City Council staff had little experience of maintaining a network to required standards and were accustomed to planning for general reactive maintenance under tight budget constraints. As a consequence, the affordability of the PFI scheme came under serious threat. Through reprioritising budgets and applying for additional DfT funding, Portsmouth City Council covered the funding gap.

## **LESSONS LEARNED AND CONCLUSIONS**

The IRF investigated a number of projects in order to understand better the specific issues that play a role in PPPs for urban road networks. These case studies underlined the benefits of a PPP approach for the projects, but also brought to the surface some issues to be addressed in recommendations.

### **Benefits captured in the projects under study**

For the State Route 91 express lanes, it is clear that without private finance involvement, the project would have been significantly delayed or not implemented at all. The socioeconomic benefits would also not have materialised in this timeframe. Furthermore, thanks to the unsolicited proposal principle which formed the base for the State of California to embark on transportation PPPs, the project benefited from various innovations, such as free-flow tolling and variable pricing.

The A14 project in western Paris is a good example of a project that has been well embedded in a complex urban environment. The project has given much attention to urban integration and protection of the environment. Although not

actually within the framework of the concession contract, the urban mobility aspect has been addressed with the introduction of an express bus service (not operated by SAPN) and stimulation measures for car-pooling. The concession approach has led to a high-quality project.

Within the present paper, the Portsmouth PFI is the only project to be initiated and to a large extent sponsored by a local authority. The PFI has brought continuous focus on the quality of the Portsmouth road network, compared with previously, where the City Council was only able to conduct general responsive maintenance. The contract allows for the optimisation of investments and a lifecycle approach by the contractor.

### Issues and recommendations

#### *Flexibility to deal with future developments*

Both for the State Route 91 express lanes, where it led to a rather drastic decision by the public authority to buy out the contractor, as well as the A14 project, where there is a need to deal with changing circumstances of congestion and traffic increase, the need for a certain degree of flexibility in the PPP contract is clearly demonstrated. This need can come from either the public authority side (eg in the case of the 91 express lanes) or from the contractor side (eg in the case of the A14).

#### *Interfacing with urban planning*

The complex environment in which PPPs for urban road networks are implemented necessitates constant interfacing with urban planning and other considerations for embedding the project in its surroundings. This is demonstrated especially in the case of the Portsmouth PFI, with the location of the depot, as well as with the A14, where half of the project budget was dedicated to do exactly this.

#### *Capacity to deal with complex projects and contracts*

When a public authority chooses to issue a partnership contract, it needs to have the capacity (either in-house or through the support of good external advisers) to manage the project. The main fields of competence needed are legal expertise, financial expertise and negotiation skills.

#### *Know your network*

Demonstrated by the Portsmouth PFI, when transferring responsibilities regarding the urban road network from the public sector to a private entity, it is important to have precise and up-to-date information about the road assets under consideration, preferably at a single point in the public authority's organisation.

### ACKNOWLEDGMENTS

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