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Transport Infrastructure Ireland

TII Publications



Project Appraisal Guidelines for National Roads Unit 6.8 - Appraisal of Motorway Service Areas

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This document has been authorised by the Director of Professional Services, Transport Infrastructure Ireland. For any further guidance on the TII Publications system, please contact the following:

Contact: Standards and Research Section, Transport Infrastructure Ireland
 Postal Address: Parkgate Business Centre, Parkgate Street, Dublin 8, D08 DK10
 Telephone: +353 1 646 3600
 Email: infoPUBS@tii.ie

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**Updates to TII Publications resulting in changes to
Project Appraisal Guidelines for National Roads Unit 6.8 - Appraisal of Motorway Service
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Amendment Details:

The principle changes to this document since the October 2016 revision are as follows:

- a) Additional guidance in relation to where a proposal for a Service Area may take the form of a PPP where the Service Area will be built and operated by a private sector operator has been added to Section 3 Financial Appraisal.

1. Context

Service Areas are provided on dual carriageways (including motorways) to afford convenient and safe places for road users to stop, rest and access facilities. Service Areas provide:

- Areas for commercial vehicles to park allowing drivers take their mandatory break and rest periods;
- Areas for all road users to park and rest in order to reduce fatigue; and
- Access to facilities for road users – such as fuel stations, toilets, food outlets, etc.

The Spatial Planning and National Roads Guidelines for Planning Authorities¹ outline the leading role of TII and the relevant local authority in the provision of on-line Service Areas. TII does not have a role in the development of off-line Service Areas (located at or adjacent to junctions) or other roadside service facilities (located on single carriageway national roads).

These Project Appraisal Guidelines apply to on-line Service Areas only.

The TII Service Area Policy² is the principal policy that determines the need for Service Areas and their general location on the national road network. The policy states that the TII will:

- Include appropriate on-line service areas as an integral part of the roads when planning new or upgraded dual carriageways (including motorways); and
- Add on-line service areas to the existing dual carriageway network at a number of locations.

In deciding on the extent of on-line retrofit, the TII Service Area Policy has regard for the extent of provision of off-line facilities.

TII has published standards governing the location and layout of on-line Service Areas³ to which all such developments must comply.

This PAG Unit has been developed with reference to the Guidelines on a Common Appraisal Framework for Transport Projects and Programmes⁴, which outline the approach to the preparation of Business Cases for transport infrastructure projects.

TII have developed a Business Case Template for Motorway Service Areas that is available for download from the “Downloads” section of the TII Publications website under section PE-PAG-02027_Unit 6.8.

¹ Spatial Planning and National Roads Guidelines for Planning Authorities (Department of Environment Community and Local Government, January 2012)

² TII Service Area Policy (National Roads Authority, August 2014) – see www.tii.ie

³ The Location and Layout of On-line Service Areas (National Roads Authority NRA Design Manual for Roads and Bridges – Volume 6, Section 3, Part 3, NRA TA 70/14, June 2014)

⁴ Guidelines on a Common Appraisal Framework for Transport Projects and Programmes (Department of Transport, Tourism and Sport March 2016)

2. Cost Benefit Analysis

The appraisal of an MSA must include a quantified Cost Benefit Analysis (CBA). Where possible the impacts associated with the new Service Area should be included in the CBA. Examples of where this is likely to be possible include:

- **Change in Consumer Surplus** – e.g. time savings for road users who have a reduced journey to access facilities;
- **Change in Producer Surplus** – e.g. additional profits made by Service Area retailers;
- **External Benefits** – e.g. safety benefits associated with the reduced level of collisions due to the provision of the Service Area; and
- **Residual Value** – e.g. the value of the Service Area at the end of the appraisal period.

Where benefits cannot be quantified, a qualitative appraisal should be provided. This may include benefits such as additional road user benefits and tourism benefits.

The TII PAG Unit 6.1: Guidance on Conducting CBA should be followed. This sets the appraisal period at 30 years for National Road schemes. As Service Areas are considered an integral element of road schemes; a similar appraisal period should be used.

The change in Consumer Surplus is the additional benefits to consumers associated with the provision of the Service Area. Consumer Surplus represents the difference between the price consumers are willing to pay for a good/service and the actual market price. The change in Consumer Surplus due to a new Service Area is predominantly related to the added convenience compared with having to use alternative facilities. Effectively this is the time saving realised by road users. A survey of newly established Service Areas revealed an average user benefit of approximately €1 per user (2012 prices)⁵. In simple terms, each vehicle that uses the Service Area is expected to realise a benefit of €1 (in 2012 prices). This level can be used in the absence of more accurate or scheme-specific information. However, an alternative estimate of Consumer Surplus may be made for the purposes of the CBA provided it is suitably justified.

The change in Producer Surplus is change in benefits to producers as a result of the provision of a Service Area. Producer Surplus is a measure of the difference between the amount that a producer of a good receives and the minimum amount that they would be willing to accept. The change in Producer Surplus would therefore be the net revenue generated by the Service Areas less operating and capital costs.

However, in the case of the provision of a new Service Area, there is a diversion of net revenue from across the economy as a whole. It can be assumed that other producers (e.g. shops and fuel stations) will reduce their costs in line with any net revenue reduction. However, the profit that would have been realised on this net revenue will be lost. Therefore the change in Producer Surplus as a result of a new Service Area should not include the profits previously made by other producers.

⁵ Motorway Service Areas Tranche 1 – Post Project Review (Nov 2013)

The change in Producer Surplus is thus calculated as follows:

$$\text{Change in Producer Surplus} = (1 - \text{Profitability}) \times \text{Net Revenue} - \text{Operating Costs} - \text{Capital Costs}$$

Profitability is the expected level of profits from sales diverted from across the economy⁶.

If it can be shown that the Service Area generates additional net revenue (as opposed to diverted revenue) this will further increase the Producer Surplus. The increase will be the level of profitability on this additional net revenue.

The External Benefits associated with Service Areas generally include the safety benefits associated with fatigue related collision reduction. These are evaluated by calculating the cost of collisions along the length of road served by the Service Area. The proportion of these collisions which are attributable to fatigue and likely to be reduced by the scheme are then evaluated. The calculation is therefore:

$$\text{External Benefits} = (\text{Distance between Service Areas}) \times (\text{Annual Road Usage}) \times (\text{Collision Rate per km}) \times (\text{Cost per Collision}) \times (\text{Proportion of Collision Reduction due to Service Area})$$

The Residual Value is the expected value of the Service Area at the end of the appraisal period. This is generally based on a proportion of the initial capital investment.

A sample Cost Benefit Analysis is shown in the Table 6.8.1 with each value being a scheme specific detail, an assumption or a calculation. Only a number of years are provided - year 0 (assumed to be the year of construction), year 1 (the first year of operation), year 15 and year 30 (the final year of the appraisal). The full CBA must evaluate each year with the net economic benefit of the scheme being the sum of the discounted net economic benefits for each year.

⁶ If Profitability was set to zero the formula provided would assume that there was no diversion of custom from across the economy and all revenue generated by the Service Area was additional revenue which is not reasonable.

Table 6.8.1: Sample MSA CBA

	Year 0	Year 1	Year 15	Year 30	Ref	Notes
General						
Average Annual Daily Traffic	-	15,000	17,242	20,018	[1]	Scheme Detail
Annual Vehicles on Road (m)	-	5.5	6.3	7.3	[2]	[1] x 365 / 1,000,000
Estimated Turn-In Rate	-	10%	10%	10%	[3]	Assumption
Annual Vehicles (m)	-	0.55	0.63	0.73	[4]	[2] x [3]
Consumer Surplus						
Estimated Consumer Surplus per Vehicle (€)	-	1.03	1.36	1.83	[5]	Assumption
Annual Consumer Surplus (€m inc VAT)	0	0.6	0.9	1.3	[6]	[4] x [5]
Producer Surplus						
Total Annual Net Revenue (€m inc VAT)	-	2.0	2.3	2.7	[7]	Scheme Detail
Profitability	-	35%	35%	35%	[8]	Assumption
Adjusted Annual Net Revenue (€m inc VAT)	-	1.3	1.5	1.7	[9]	(1 - [8]) x [7]
Capital Cost (€m inc VAT)	-10.0	0.0	0.0	0.0	[10]	Scheme Detail
O&M Cost (€m inc VAT)	-	-1.0	-1.15	-1.33	[11]	Scheme Detail
Annual Producer Surplus	-10.0	0.3	0.3	0.4	[12]	[9] + [10] + [11]
External Benefits						
Length of Road Serviced by Service Area (km)	-	80	80	80	[13]	Scheme Detail
Annual km (million vehicle km)	-	438.0	503.5	584.5	[14]	[2] x [13]
Collision Rate (per million vehicle km)	-	0.020	0.011	0.006	[15]	Assumption
Proportion of Collisions Related to Fatigue	-	15%	15%	15%	[16]	Assumption
Cost of Casualties (per collision)	-	288,208	295,485	295,485	[17]	Assumption
External Benefits (per million km)	-	880	509	276	[18]	[15] x [16] x [17]
External Benefits (€ million)	0	0.4	0.3	0.2	[19]	[14] x [18]
Residual Value						
Proportion of Capital Investment Remaining as Residual Value	-	-	-	20%	[20]	Scheme Detail
Residual Value	0	0.0	0.0	2.0	[21]	[10 (Year 0)] x [20]

	Year 0	Year 1	Year 15	Year 30	Ref	Notes
Net Benefit						
Net Economic Benefit	-10.0	1.2	1.5	3.9	[22]	[6] + [12] + [19] + [21]
Net Economic Benefit Discounted to Year 0	-10.0	1.2	0.7	0.9	[23]	[22] / (1.05) ^{Year}
Costs Discounted to Year 0	10.0	0.952	0.553	0.308	[24]	[11] / (1.05) ^{Year}
Benefits Discounted to Year 0	0	2.2	1.3	1.2	[25]	{[6] + [9] + [19] + [21]}/(1.05) ^{Year}
Present Value of Costs	X				[26]	Sum row [24] (Year 0 to Year 30)
Present Value of Benefits	Y				[27]	Sum row [25] (Year 0 to Year 30)
Net Present Value	Y - X				[28]	[27] - [26]
Benefit to Cost Ratio	Y / X				[29]	[27] / [26]

The following assumptions are made in the sample Cost Benefit Analysis above.

- *Estimated Turn-In Rate* ranges are provided within PAG Unit 6.11, Table 24;
- *Estimated Consumer Surplus per Vehicle* is assumed to be €1 (2012 prices) based on a survey of Service Area users carried out in June 2012. This consumer surplus is equivalent to time saved by users. For years after 2012 this parameter value should be inflated in line with increases in the value of time.
- *Profitability* is assumed to be 27% based on the Input Output Tables of the Irish economy published by the Central Statistics Office⁷;
- Details for calculating *Total Net Revenue*, such as anticipated ranges of turnover and percentage profitability, are provided within PAG Unit 6.11, Table 24;
- Anticipated ranges for *Operating and Maintenance Costs* are provided within PAG Unit 6.11, Table 24;
- *Collision Rate (per million km)* for motorways, to be taken from Table 20 of PAG Unit 6.11, decreasing annually at a rate of 4% based on Table 23 of the same Unit;
- *Proportion of Collisions Related to Fatigue* is assumed to be 15% based on the Road Safety Strategy (2013 – 2020) published in 2013 by the Road Safety Authority (RSA) which indicates that fatigue-related crashes may account for 15-20% of all road traffic collisions. The 15% level is used based on the assumption that fatigue is more likely on longer journeys but that not all fatigue related collisions will be eliminated by the provision of a Service Area; and
- *Cost of Casualties (per collision)* is assumed to be €288,208 in 2015 based on Table 5 and Table 7 of PAG Unit 6.11. This cost is assumed to grow at 0.5% in real terms up to 2020 with no growth in real terms thereafter.

These assumptions are considered appropriate to use in the development of a Cost Benefit Analysis. Alternative assumptions may be used provided they are suitably justified.

All costs and benefits should be discounted using the social discount rate⁸. The net present value (NPV) and benefit to cost ratio (BCR) should be evaluated.

Appendix A of this Unit provides further background information on the Cost Benefit Analysis methodology that is used.

An alternative Cost Benefit Analysis methodology may be used providing it is suitably justified. Such a methodology should be set out within a Project Appraisal Plan and agreed with the TII Strategic and Transport Planning Section.

The key assumptions and scheme specific details used in the evaluation of the CBA should be subject to a sensitivity analysis.

⁷ CSO Supply and Use and Input Output Tables for Ireland 2011, Table 12. Published December 2014. Available at www.cso.ie

⁸ The social discount rate for Ireland is 5% at time of publication

3. Financial Appraisal

The Financial Appraisal allows the commercial viability of the Service Area to be assessed. The analysis should typically comprise the financial flows (capital, operational and maintenance financial outlays as well as relevant revenue streams) for each year associated with the scheme.

The Financial Appraisal should also examine the financial impact of the scheme on the exchequer.

VAT should be included in the Financial Appraisal of the scheme but excluded when exchequer cash flows are examined⁹.

A proposal for a Service Area can take the form of a PPP where the Service Area will be built and operated by a private sector operator. Typically the private sector operator will receive a subvention from TII to meet part of the cost of building and operating the Service Area. These subventions are needed to make Service Areas a viable investment for a private sector operator. In this case the financial impact of the Service Area on TII, and on the Exchequer, will be the amount of the subvention.

The level of subvention is normally determined as a result of a competitive procurement process where potential operators bid for the concession to build and operate a Service Area. In this situation the precise level of subvention may not be known when an appraisal is carried out.

The approach that gives the clearest picture of the likely level of subvention, and so of the financial impacts of the proposed Service Area is to:

- Forecast the financial implications of the Motorway Service Areas for the operator.
- Prepare these forecasts under a range of possible assumptions for the level of subvention given by TII.
- Measure the profitability of the project for the operator under each of these scenarios in terms of IRR.

⁹ Based on the assumption that revenue generated by the Service Area is diverted from other areas of the economy, there is no additional VAT revenue associated with the scheme.

Appendix A: Cost Benefit Analysis Methodology

The proposed Cost Benefit Analysis methodology is set out in this Appendix. This is for background purposes only and should not be included in the Business Case.

The net benefits of any initiative that the State undertakes are measured as the sum of the benefits to consumers, producers, third parties and any residual value at the end of the assessment period. That is, the net benefits (NB) are the sum of:

$$NB = \Delta CS + \Delta PS + \Delta E + R$$

Where:

- ΔCS is the change in the Consumers' Surplus or user benefit (see Box 1)
- ΔPS is the change in Producer Surplus (see Box 2)
- ΔE is the change in External Benefits associated with the project (see Box 3)
- R is the Residual Value associated with the project (see Box 4)

Box 1: Consumer Surplus

The economic appraisal needs to determine the change in consumer surplus (CS) associated with a new Service Area - where CS represents the difference between the price consumers are willing to pay for a good/service and the actual market price. CS is only indirectly related to the average consumer spend at a new Service Area. This is because the CS properly attributable to a new Service Area is not the CS related to the goods and services purchased, as these purchases could take place at some other Service Area or facility if the new Service Area was not built. Rather, the CS arising from the existence of a new Service Area reflects the convenience of the new Service Area to users as compared with having to locate alternative facilities.

As such, the change in consumer surplus associated with the provision of a new Service Area should be estimated as:

$$\Delta CS = CS_i * DU$$

Where:

- CS is the consumer surplus
- CS_i is the average consumer surplus associated with each user of the Service Area
- DU is the number of daily users of the Service Area

A survey of newly established Service Areas users implemented in June 2012 identified a proxy value for the convenience associated with the availability of the Service Areas as compared to having to use alternative facilities. The average consumer surplus value was identified as €1 per user (2012 prices).

Box 2: Producer Surplus

The economic appraisal will also need to identify the change in producer surplus (PS) associated with the Service Area.

The total change in PS brought about by the existence of a new Service Area is not measured by the estimated change in PS in the new Service Area alone: rather there is a need to take account of the loss of PS as spend is diverted from other parts of the economy.

Owing to the difficulty associated with measuring the change in the Producer Surplus in other parts of the economy, another approach can be taken. The approach is based on the fact that the Net Revenue gain to the new Service Area will divert expenditure from across the economy generally. It can be assumed that all other producers will be marginally affected and will be able on average to reduce their operating costs in line with their loss of revenue. In this situation, the loss of producers' surplus elsewhere in the economy will be determined by the profitability of enterprises across the economy as a whole. Input-Output tables can be used to identify the profitability of the retail sector as a percentage of Net Revenue. Using this approach, the full change in producers' surplus associated with the new Service Area Project would be measured as:

$$\Delta PS = (1-P) * NR - OPC - K$$

Where:

- PS are the producer surplus
- (1-P) is equal to 1 minus the overall profitability rate in the retail sector as a % of NR (for example if the profitability in the retail sector is 27%, 1-P = .73)
- NR is the net revenue after cost of sales in the new Service Area
- OPC are the operating and maintenance costs in the new Service Area
- K represents the capital outlays to put in place the new Service Area

Box 3: External Benefits

Safety benefits comprise the external effects associated with a new Service Area. Safety Benefits should be calculated as follows:

$$\Delta E (SB) = Akm * a * f * c$$

Where:

- E are the external benefits i.e. the safety benefits (SB)
- Akm – represents the distance between Service Areas
- a – represents the collision rate associated with road usage (per km)
- f – represents the proportion of collisions attributable to fatigue
- c – represents the established monetary values associated with casualties

Box 4: Residual Value

The residual value of a Service Area at the end of the appraisal period will be a combination of property, transport elements (slip roads, off ramps, bridges etc.) and structures.

The TII Guidance on Conducting CBA (Unit 6.1 of the Project Appraisal Guidelines) recommends acknowledging the residual value of the scheme where its lifespan significantly exceeds the appraisal period. This is the case for Service Areas.

The residual life of elements of the scheme beyond the appraisal period should be based on the expected lifespan of the individual elements and should not exceed 30 years.

The present value of the residual life should be included within the calculation of the benefits associated with the Service Area.

In summary, the Net Benefits associated with the provision of a new Service Area are calculated as follows:

Box 5: Summary

$$NB = (CS_i * DU) + (((1-P) * NR) - OPC - K) + (A_{km} * a * f * c) + R$$

Where:

- CS_i is the average consumer surplus associated with each user of the SA
- DU is the number of daily users of the SA
- (1-P) is equal to 1 minus the overall profitability rate in the retail sector as a % of NR (for example if the profitability in the retail sector is 35%, $1-P = .65$)
- NR is the net revenue after cost of sales
- OPC are the operating and maintenance costs
- K represents the capital construction costs
- A_{km} – represents the distance between Service Areas
- a – represents the collision rate associated with road usage
- f – represents the proportion of collisions attributable to fatigue
- c – represents the established monetary values associated with casualties
- R – represents the residual value associated with the project



 Ionad Ghnó Gheata na Páirce,
Stráid Gheata na Páirce,
Baile Átha Cliath 8, D08 DK10, Éire

 www.tii.ie

 +353 (01) 646 3600

 Parkgate Business Centre,
Parkgate Street,
Dublin 8, D08 DK10, Ireland

 info@tii.ie

 +353 (01) 646 3601