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Chief Economist
Independent Pricing and Regulatory Tribunal (IPART)
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Australia

Information Paper - Estimating the direct cost of Rail Access

6 March 2024

Dear Mike,

Thank you for the opportunity to review the Information Paper relating to 'Estimating the Direct Cost of Rail Access", and to provide feedback on the supporting spreadsheet model (the **Model**).

The Information Paper canvases a range of topics and issues relevant to estimating the direct costs of rail access. As a general principle, Aurizon Network would expect the relevant approach to estimating direct costs would involve a combination of top-down econometric estimates and bottom-up engineering assessments relevant to the railway being evaluated. Aurizon Network considers the users and providers of the railways regulated by IPART are better placed to inform the IPART's consideration of what approaches should be employed.

Notwithstanding, Aurizon Network has some concerns about the comparability of ARTC and Aurizon Network data used within the Model. Using publicly available information, Aurizon Network has made several adjustments to the data contained within the "Aurizon" tab to facilitate a 'like for like' comparison with the ARTC data used in the regression.

As a result of the adjustments, Aurizon Network has generated the following amended Data tables, which IPART may wish to consider using.

Table 1 is presented inclusive of ballast undercutting costs, which ARTC includes as major periodic maintenance, but which is included as capital expenditure in the Central Queensland Coal Network (**CQCN**). Table 2 is presented exclusive of ballast undercutting expenditure.

Table 1 Amended Input Data for Regression (including Ballast Undercutting)

Network	Data Year	Track Km	Gross Tonne Km (billions)	Track maintenance cost incl MPM ($m 2020)
Blackwater	FY21	1,171.36	35.77	88.50
Goonyella	FY21	1,021.32	36.34	82.51
Moura	FY21	315.09	3.36	11.98
Newlands & GAPE	FY21	311.42	9.15	15.27
Hunter PZ1	CY18	305.00	27.30	56.01
Hunter PZ1	CY19	305.00	28.61	60.23
Hunter PZ1	CY20	305.00	27.41	61.99
Hunter PZ1	CY21	305.00	26.98	52.21
Hunter PZ2-3	CY18	405.00	17.91	61.48
Hunter PZ2-3	CY19	405.00	17.98	59.41
Hunter PZ2-3	CY20	405.00	18.10	64.18
Hunter PZ2-3	CY21	405.00	16.87	62.78

Table 2 Amended Input Data for Regression (excluding Ballast Undercutting)

Network	Data Year	Track Km	Gross Tonne Km (billions)	Track maintenance cost incl MPM ($m 2020)
Blackwater	FY21	1,171.36	35.77	54.49
Goonyella	FY21	1,021.32	36.34	48.12
Moura	FY21	315.09	3.36	10.92
Newlands & GAPE	FY21	311.42	9.15	11.69
Hunter PZ1	CY18	305.00	27.30	56.01
Hunter PZ1	CY19	305.00	28.61	52.95
Hunter PZ1	CY20	305.00	27.41	58.15
Hunter PZ1	CY21	305.00	26.98	52.21
Hunter PZ2-3	CY18	405.00	17.91	45.85
Hunter PZ2-3	CY19	405.00	17.98	51.36
Hunter PZ2-3	CY20	405.00	18.10	54.07
Hunter PZ2-3	CY21	405.00	16.87	47.69

Aurizon Network has summarised the adjustments that were made to generate the amended Input Data in Table 3 below.

Table 3 Summary of data adjustments

Data Type	Description of Change
Aurizon Track Km	The Newlands Track Km data (311km) already includes GAPE Track Km. Amend cell D7 in 'Data' tab to avoid double count of GAPE Track Km.
Aurizon GTK	Data updated to reflect actual FY21 GTK railed. Made provision to include GTK railed by Non-Coal Train Services. Non-coal GTK is not publicly available, Reallocate a proportion of GAPE GTK to the Goonyella System. Most GAPE Train Services traverse the Goonyella System, GAPE and the Newlands System. An adjustment has been applied to GAPE GTK to reflect the proportion of GTK railed by GAPE Train Services in the Goonyella System (i.e. remove GTK from GAPE, and add to Goonyella).
Aurizon Network Maintenance Costs	Data updated to reflect actual FY21 Maintenance Costs. Costs associated with maintaining electrical overhead line equipment have been removed from the analysis, because these costs are not comparable with ARTC. The direct costs of access to overhead line equipment are largely independent of the direct costs of track infrastructure and access to electrical infrastructure is typically subject to separate access pricing. Aurizon Network's reported maintenance cost also includes depreciation for ballast undercutting plant and equipment. These costs have been separately identified to facilitate a 'with / without Ballast Undercutting' sensitivity analysis.
Aurizon Network Capital Expenditure	Data updated to reflect actual FY21 Capital Expenditure Costs. It would seem appropriate to include Aurizon Network's Ballast Undercutting expenditure within this analysis, because such costs are included within ARTC's MPM figures. Data has been provided to facilitate a 'with / without Ballast Undercutting' sensitivity analysis. Aurizon Network's other capital expenditure categories do not appear to be comparable to ARTC's MPM and have been removed from the analysis. I note that costs associated with these activities form part of ARTC's capital expenditure.
ARTC Data	Added 2021 actual cost and GTK data to provide an additional data point. Propose that ARTC data be grouped into **Zone 1** and **Zone 2-3**, instead of Zone 1 and Zone 1-3. Such a change would help to ensure the independence of the X variables in the regression analysis. Consider whether ARTC's non-coal maintenance costs should also be added, noting that provision is made for non-coal Track Km.

Table 4 below provides references to the public documents used to source the updated data.

Table 4 Document links to source data.

Data Type	Table	Link
FY21 GTK	Table 6, 8, 10, 12	https://www.qca.org.au/wp-content/uploads/2022/03/aurizon-network-fy23-final-draft-maintenance-and-renewals-strategy-and-budget-redacted-feb-22.pdf
FY21 Maintenance Cost Incurred	Table 1	https://www.qca.org.au/wp-content/uploads/2021/10/aurizon-fy21-maintenance-claim-final-redacted.pdf
FY21 Electrical Maintenance	Table 6, 8	As above
Ballast Undercutting Plant Depreciation	Table 6, 8, 10, 12	As above
FY21 Renewals Expenditure	Table 2, 5, 7, 9, 12	https://www.qca.org.au/wp-content/uploads/2021/09/aurizon-network-2020-21-capital-expenditure-claim.pdf
ARTC 2021 Data	Table 3A & 3B, pg 16-17	https://www.accc.gov.au/system/files/20230517_HVAU%202021%20Att%201%20HV%20Network%20Operating%20Costs_PUBLIC_0.pdf

Once again, that you for the opportunity to review the data used within the Information Paper. Aurizon Network would be happy to discuss any of the adjustments with you in further detail if required.

Kind regards,

Michael Bray
Undertaking Development Lead
Aurizon Network

Institute for Transport Studies
FACULTY OF ENVIRONMENT

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Estimating Marginal Wear and Tear Costs: Econometric Methods and Evidence

Track Access Charges Summit

Professor Andrew Smith, Institute for Transport Studies, University of Leeds

April 4th, 2018, Amsterdam

ITS

A starting point – from an evidence based perspective

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- The **econometric evidence** from European case studies suggests that rail infrastructure maintenance and renewal costs vary substantially with traffic):
  - **Variability = high**
- **Engineering evidence (models)** underpinning current track access charges in Britain suggests costs are largely fixed:
  - **Variability = low**
- **Earlier engineering (judgement)** in Great Britain (2000; 2005) put variability somewhere in between:
  - **Variability = medium**
- **Can we better understand these differences?**

Approaches to estimating marginal cost

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- Three methods have been used in the literature to date to measure rail infrastructure marginal cost

- Method 1: engineering approach (**model**)
  - Simulate damage done by traffic (engineering model)
  - Determine action need to remedy damage (e.g. tamping)
  - Activity volume * Unit cost of activity = (marginal) Cost

Engineering approach: illustration

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Stage 1: Simulation (track section level)

Vehicles

Weight
Speed

Track type

Track

D1: Settlement

D2: Wear

D3: RCF

Damage mechanisms

Activities: tamping or grinding

Stage 2: Unit cost analysis

Δ (Volume of tamping)

x

Unit cost of tamping

ΔCost

Approaches to estimating marginal cost

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- Two methods have been used in the literature to date to measure rail infrastructure marginal cost

- Method 1: engineering approach (**model**)
  - Simulate damage done by traffic (engineering model)
  - Determine action need to remedy damage (e.g. tamping)
  - Activity volume * Unit cost of activity = (marginal) Cost

- Method 2: engineering approach (**judgement**) – or cost allocation approach
  - See next slide

Engineering (judgement) / Cost Allocation Approach

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Activity / asset class	Variability Proportion: 2000 Regulatory Review	Variability Proportion: 2008 Regulatory Review
Track - maintenance	30%	29%
Track – renewals (plain line)	36%	23%
Track – renewals (switches and crossings)	25%	17%
Signalling - maintenance	5%	5%
Civils – metallic underbridges	10%	8%
Civils – embankments	10%	5%

Source: ORR (2008)

Approaches to estimating marginal cost

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- Two methods have been used in the literature to date to measure rail infrastructure marginal cost

- Method 1: engineering approach (**model**)
  - Simulate damage done by traffic (engineering model)
  - Determine action need to remedy damage (e.g. tamping)
  - Activity volume * Unit cost of activity = (marginal) Cost

- Method 2: engineering approach (**judgement**) – or cost allocation approach

- Method 3: top down **statistical / econometric** approach
  - See next slide

Econometric approach – relate costs to traffic in statistical regression

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$$C_{it} = f(Y_{it}, P_{it}, N_{it}, \tau_t; \beta) + v_{it}$$

- C_{it} is the cost measure – say, maintenance and renewal costs
- i is the unit of observation (e.g. track section; maintenance unit; region; country); t is time period (year)
- Y_{it} - output measures (e.g. passenger tonne-km; freight tonne-km)
- β - parameters to be estimated – gives us % of cost variable with traffic and in turn, marginal cost

Notes: P_{it} - input prices (e.g. wage rate; price of materials); N_{it} - exogenous network characteristic variables (e.g. network length; linespeed capability; rail age; proportion of track in a curve; S&Cs); τ_{it} represent time variables capturing technical change over time

High level summary of econometric evidence

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- **Countries**: Britain, Sweden, France, Switzerland, Austria, plus pooled international samples (CATRIN; SUSTRAIL; NETIRAIL-INFRA)
- **Data**: sections, maintenance units / contract areas, regions, countries
- **Maintenance**: range of **mean** elasticities = **20-35%** (GB=25%)
- But the answer depends on density - range of **20-45%** (3-10m t-km/tr-km)
- **Renewal**: less evidence:
  - M&R studies from Switzerland and GB (CATRIN) – **28-35%**. M&R studies from Switzerland (SUSTRAIL) – **50%**
  - Renewal only for Sweden: **55%** (track) and **50%** (all)
  - M&R from GB Periodic Review international study (area) = **45%**
  - M&R from GB Periodic Review international study (country) = **51%**

Conclusions on the range

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- Overall evidence seems to suggest variability for M&R could be as high as **40-45%**
- The lower part of the range of estimates could suggest a possible range of closer to **25-35%**
- Some uncertainty but strong body of reasonably consistent evidence from multiple countries – similar methods
- Interesting recent evidence from **France** (econometric): **c. 20%** variable for M&R (with some models pointing to higher variability)
- Evidence does **not** support variability **below 20-25%** - so econometric evidence out of line with current GB charges

Engineering evidence and evolution of charges in GB

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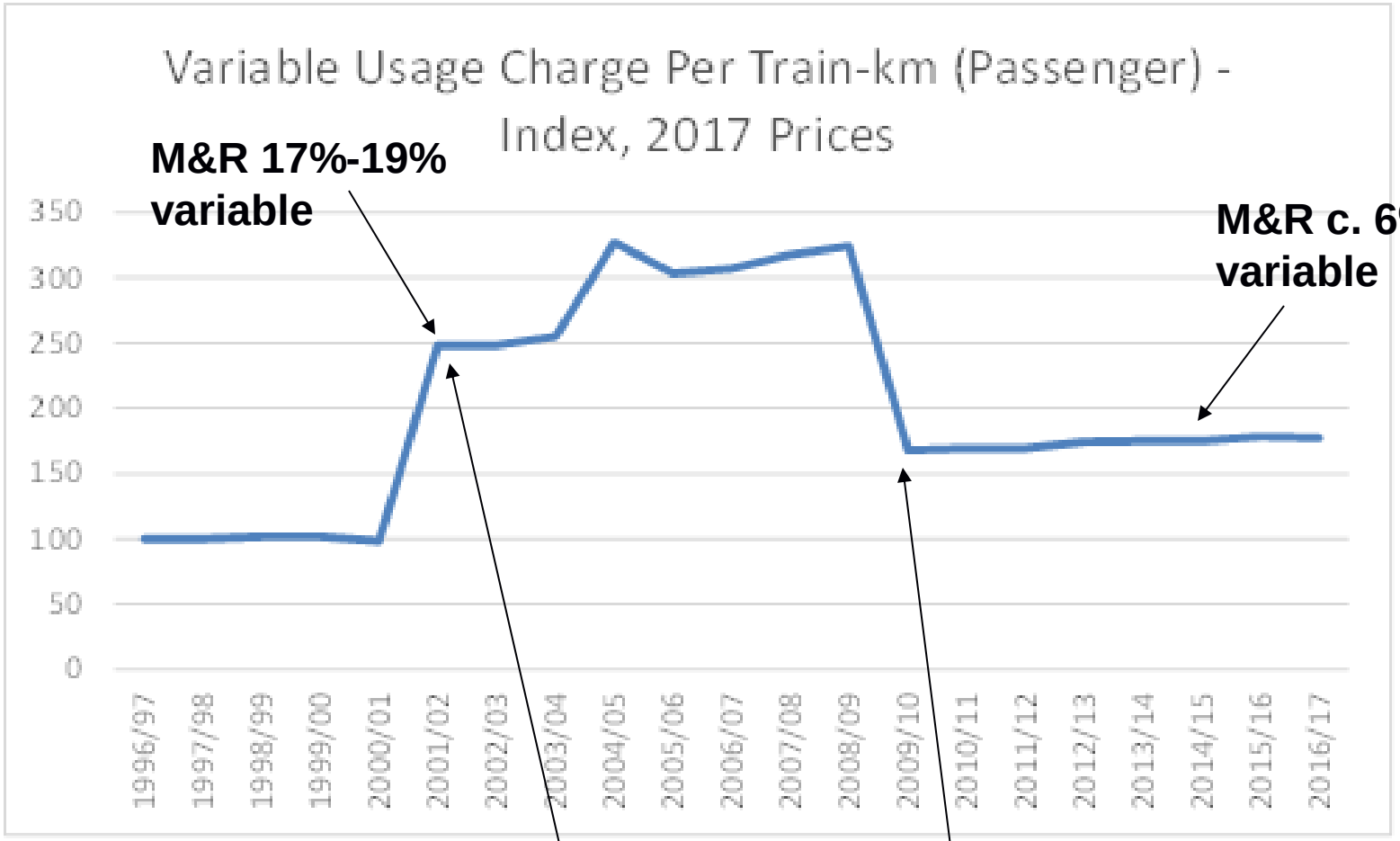

PR2000: Engineering Judgement Approach

PR2008: Engineering Modelling Approach

- Why is the evidence so contradictory?
- Challenges in econometric estimation of marginal cost?
- Strengths and weakness of the two approaches

Challenges in econometric model of marginal cost [1]

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- Dealing with lumpy renewals costs?
  - **Two-part models**: decision to renew, then how much to renew (section level data); e.g. Andersson et. al. (2012) Odolinski and Nilsson, 2017
  - **Maintenance and renewal combined** together (many studies)
  - **Steady-state adjustments** to renewals prior to estimation (Smith, 2012)
  - **Dynamic models** that take account of M&R interactions and intertemporal effects (Odolinski and Wheat, 2017 – NETIRAIL-INFRA)
- Controlling for differences between sections/regions/countries?
  - **Extensive set of control variables**. E.g. Electrification, age of rail, linespeed, no. of S&Cs per track-km, proportion of track in a curve etc.
  - **Cross-sectional and panel data approaches taken**: different panel techniques applied (fixed and random effects; and frontier models)
  - Standardisation of approach to some extent

Challenges in econometric model of marginal cost [2]

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- Data types and coverage:
  - **Range of aggregations tried**: sections; maintenance units / contract areas; regions; countries; dual-level structures
  - **Data coverage**: co-ordinated research across EU research projects – suggests a generally broad definition of M&R costs (except stations)
  - **Scaled elasticities**: can be used where narrower definitions of costs are used (e.g. in GB, focus was on track – the most variable element)
- Functional form of the cost function
  - Wide range tried from CD and translog to Box-Cox and Box-Tidwell forms
  - Issue is about ensuring sensible variation in elasticities away from the sample mean
  - Again, standard methods applied across case studies in general

So why the differences with engineering methods?

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- Strong advantage of the econometric approach is that it is based on actual data – what actually happens on the ground
- Whereas engineering approach is based on a model of what "should" happen – though which is optimal?
- Engineering models: getting from simulated damage to cost?
  - Assumptions about unit costs and timing of remedial activity
- In GB the engineering approach:
  - Is based on a standard section – not an average based on all sections
  - Some calibration involved to reconcile to budgeted costs

But can these things explain the extent of the difference?

A final remark on cost base and disaggregation

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- With track-section disaggregation there may be a concern that the process of cost allocation to sections could distort results

- If a percentage mark-up on direct costs is used – in log models the elasticity will be unaffected – but the variability proportion **is then being applied to indirect costs as well**

- If allocated based on traffic the elasticity / variability proportion will be distorted

- **That said, the evidence from sections, areas, regions, countries is still fairly clear overall**

Conclusions

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- Overall, co-ordinated research has produced a wide body of fairly consistent evidence; using a range of approaches, different case studies, and different disaggregations

- There are issues and challenges and some uncertainty – however, It is hard though to disturb the basic conclusion – that M&R cost variability is **no lower than 20-25%** and **is probably higher**

- GB engineering evidence is much lower – there are some possible explanations but further research needed:
  - Lets open-up the “black box” on both approaches to obtain a clear finding on this important issue for charging levels

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- Thank-you for your kind attention

Professor Andrew Smith

Professor of Transport Performance and Economics

Institute for Transport Studies (ITS) and Leeds University Business School, University of Leeds, Leeds, LS2 9JT

[redacted]

References

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- Odolinski, K. & Nilsson, J-E. (2017) Estimating the marginal maintenance cost of rail infrastructure usage in Sweden; does more data make a difference? Economics of Transportation, 10, 8-17.
- Andersson M; Wikberg T; Smith A; Wheat P (2012) Estimating the marginal cost of railway track renewals using corner solution models, *Transportation Research Part A: Policy and Practice*, 46, pp.954-964.
- Smith ASJ (2012) The application of stochastic frontier panel models in economic regulation: Experience from the European rail sector, *Transportation Research Part E: Logistics and Transportation Review*, 48, pp.503-515.
- Odolinski, K. and Wheat, P.E. NETIRAIL-INFRA Deliverable D1.7. Incentives Final Report - Annex 5 – Marginal wear and tear costs in Sweden using a 16 year panel.

- Additional slides not used

2017 Charges and Costs

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Costs		**Revenue from track access charges**	
Operations	554	Variable usage charge	224.2
Maintenance	1319	Capacity charge	428.3
Renewals	2774	Fixed charges	410.8
		Use of electrification assets	16.1
		Stations and depots	353.0
		TOTAL	1432.4

Implies:
M&R c. 6% variable

Source: Network Rail (2017) Statement 1 (expenditure), Statement 6a (Analysis of Income) and Statement 6c (Analysis of Income by Operator).

Cost bases

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Maintenance (most studies)

- Permanent way
- Signalling and lineside telecoms
- Electrification and plant
- Other maintenance (including inspections and overheads)
- Most studies an “inclusive” definition (except GB)
- Stations, depots and lineside buildings generally excluded
- Structures maintenance – included in Sweden and Switzerland (not GB)

Maintenance & Renewal

- Sweden and Switzerland cases
- Track
- Signalling
- Electrification
- Telecoms
- Power supply equipment
- Crossings
- Platforms (some station costs)
- Fences
- Snow removal (Sweden)

Pros and cons of different approaches

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Engineering approach

- Requires multiple model runs
- Requires detailed model relating damage to remedial activity
- Unit costs hard to estimate, as vary depending on circumstances

Statistical approach

- Uses actual costs – powerful advantage of top-down benchmarking
- Based on expenditure rather than cost needed to rectify damage
- Differential impact of passenger and freight?

Track access charges on the basis of European legal framework – Frist experiences with direct cost calculation

Track Access Charges Summit 2018

04.-05.04.2018

Christiane Trampisch
DG MOVE, Unit C3

Legal basis for track access charges in the European framework

Directive 2012/34/EU establishing a single European railway area

- Article 30 Infrastructure costs and accounts
- Article 31 Principles of charging
- Article 32 Exceptions to charging principles
- Annex VI List of market segments

Regulation 909/2015 on the modalities for the calculation of the cost that is directly incurred as a result of operating the train service

- Article 3 Direct costs on a network-wide basis
- Article 4 Non-eligible costs
- Article 5 Calculation and modulation of direct costs
- Article 6 Cost modelling

Transposition of Directive 2012/34/EU

Deadline for transposition of Directive 2012/34/EU was **16.06.2015.**

Between June 2015 and until mid 2017 member states were still transposing the directive into national law.

Since transposition deadline the European Commission checks **conformity** under two aspects:

- Complete transposition: Conformity of „paper law" (infringements)
- Conformity in application/practice (infringements)

Timetable process (network statements + charging systems)

Charging systems need to be confrom in application.

Status quo of IMs' charging systems

- New pricing scheme under Directive and Regulation in DE, FR, HR, HU, IT, LV, SL
- Processes due to the introduction of new pricing schemes ongoing (under regulatory control) in (AT), BE, BG, EE, EL, ES, LT, NL, NO, PL, PT, RO, (SE), SK
- Direct costs applied before in DK, FI, LU, SE, UK, (CH)
- No known developments in CZ, IE, FYROM

Overview charging practices

	Charge(s) reflecting direct costs (article 31.3 of directive 2012/34/EU)	Market segments? (article 32.1 of directive 2012/34/EU)	Mark-ups "*if the market can bear this*" (article 32.1 of directive 2012/34/EU)	Incentives under article 30.1 of directive 2012/34/EU
Austria	✓	✓	x[1]	n/a
Belgium[2]	x	✓	x	x
Bulgaria	✓	x	x	✓
Croatia	✓	x	x	x
Denmark	✓	x	x	✓
Estonia	x[3]	x	x	x
Finland	✓	x	x	x
France	✓	✓	✓	✓[4]
Germany	✓	✓	✓	✓
Greece	x[5]	x	x	x
Hungary	✓	✓	✓	n/a
Italy	✓	✓	✓	✓
Latvia	✓	✓	✓[6]	x[7]
Luxemburg	✓	x	x	n/a
Netherlands	✓	✓	✓[8]	x
Norway	✓	✓	✓	✓
Poland	✓	✓[9]	x[10]	✓
Portugal	x[11]	x	x	x
Romania	✓[12]	x[13]	x[14]	✓[15]
Slovakia	✓	x	x	x
Slovenia	✓	x	x	✓
Spain[16]	x	✓	x	n/a
Sweden	✓	x[17]	x[18]	x
Switzerland	✓	✓	✓	x
UK	✓	✓	✓	✓

https://www.irg-rail.eu/irg/documents/position-papers/166,2017.html (simplified)

Method of calculation of direct costs used in the member states

- Method of Article 5 (division method): AT, BG, CZ, DK, EE, ES, HU, LV, PL (Article 3 and 5 and scientific research), PT, SL, SK
- Econometric approach: FI, HR, LU, NO, SE (Article 6)
- Engineering method: BE, CH, UK
- Mixed approach (econometric and engineering method): DE, EL, FR, FYROM (Article 5 and econometric method), IE, IT (Article 5 and engineering method), NL (combination of econometric, engineering and experts), RO

See table in IRG-Rail (2017) https://www.irg-rail.eu/irg/documents/position-papers/166,2017.html

Switzerland, France + Austria: decreasing values

CH: No corresponding price increase due to the calculation method according to Regulation.

"It seems that comparing with the previous econometric model, the new approach shifts costs from the freight transport (by considering other factors than weight for wear-related costs, i.e. speed and axle loads) to the passenger long-distance traffic."

FR: "The direct cost based charge in the new charging system for 2019 is decreasing for every service. Mark-up based charges for passenger trains will maintain the same level of charge for each market segment."

AT: New TAC-systems leads to a reduction of average TAC per train km

Phasing-in plan according to Art. 9 regulation

- **Yes**
  BE, BG, LV, NO, PL, PT, UK
- **On selected lines**
  ES
- **Not yet**
  EL, IE, IT, LT, SL
- **No phasing-in plan**
  AUT, CH, CZ, DE, DK, EE, FR, FI, HR, HU, LU, FYROM, NL, RO, SE, SK

Mark-ups

- **Mark-ups applied:**
  AT, DE, EE (Ramsey-Boiteux model)
  ES, FR, IT (competitiveness of market segment)
  HU (general mark-up, adjusted)
  NO (on one selected maket segment)
  UK (on one market segment (electric supply industry: coal, iron ore and nuclear waste))
  CH (politically defined mark-ups)

- **Mark-ups to come:**
  BE (market segmentation ongoing)
  LV (mark-ups to come, competitiveness of market segment)
  NL (not yet, 2020-2024, Ramsey-Boiteux)
  PT (not yet, mark-ups to come)

- **No mark-ups applied:**
  BG, CZ (but differentiated financial state support), DK, EL, FI, HR, IE, LU, PL, FY, ROM, RO, SE, SL, SK, LT

Problems with the calculation of direct costs and mark-ups (RBs)

- Issues with applying or not applying mark-ups
- Availability of data for calculation of mark-ups, for DC calculation and market segmentation challenging
- Inconsistencies found and removed when developping the calculation method of DC
- Burden of introducing DC calculation and data on demand elasticities
- Necessary cost allocation / definition of cost categories
- Procedures and terminology applied in IM's infrastructure management and cost follow-up practices are largely incompatible with the definitions and categories used + large complexity for smaller IMs
- Research support needed (launch a study)

Charges in the network statement

- Annex IV of the Directive 2012/34/EU about the contents of the network statements
- The Network statement contains
  - the relevant provisions of the national legislation
  - general information on the charging system and charging regulations.
  - provides all the methodological details concerning the new modalities of calculation.
- The applicable charges are laid down in a separate document which is attached to the network statement e.g. via a link.
- The cost allocation and charge calculation principles are laid down in the Cost Allocation Methodology.

Thank you for your attention.

Contact:

[redacted]

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RETE FERROVIARIA ITALIANA
GRUPPO FERROVIE DELLO STATO ITALIANE

RailTech
TRACK ACCESS CHARGES SUMMIT '18
HOSTED BY: ProRail

Direct Cost in Track Access Charge: the Italian case

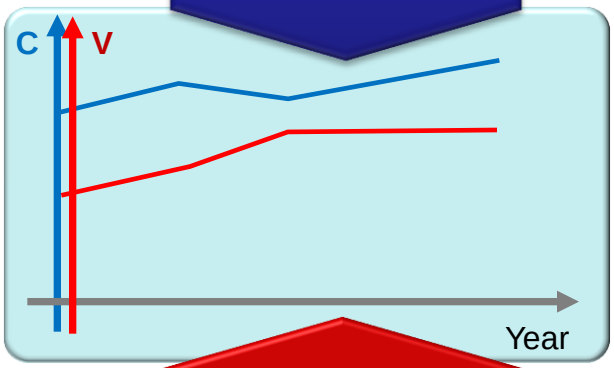
Giulio Rocco Sitongia
Charge designer at Marketing and Integrated Services Development at RFI

Amsterdam, 4-5 April 2018

Elements of the charging system

HOW MUCH
(Costing e Volumes)

TOTAL ADMISSIBLE COST
Opex (+)
Depreciation(+)
Return on capital (+)
State funding (-)



VOLUMES
- Estimation of future volumes

UNIT CHARGE
€/train·km
Cost/volumes

HOW

A COMPONENT *(DIRECT COST)*
- Weight classes
- Speed classes
- Catenary usage

Modulation on the basis of TRACK'S WEAR AND TEAR

ALGORITHM

TARIFFS

B COMPONENT *(MARK UPS)*
- Market segmentation
- CAPS

Modulation on the basis of ABILITY TO PAY

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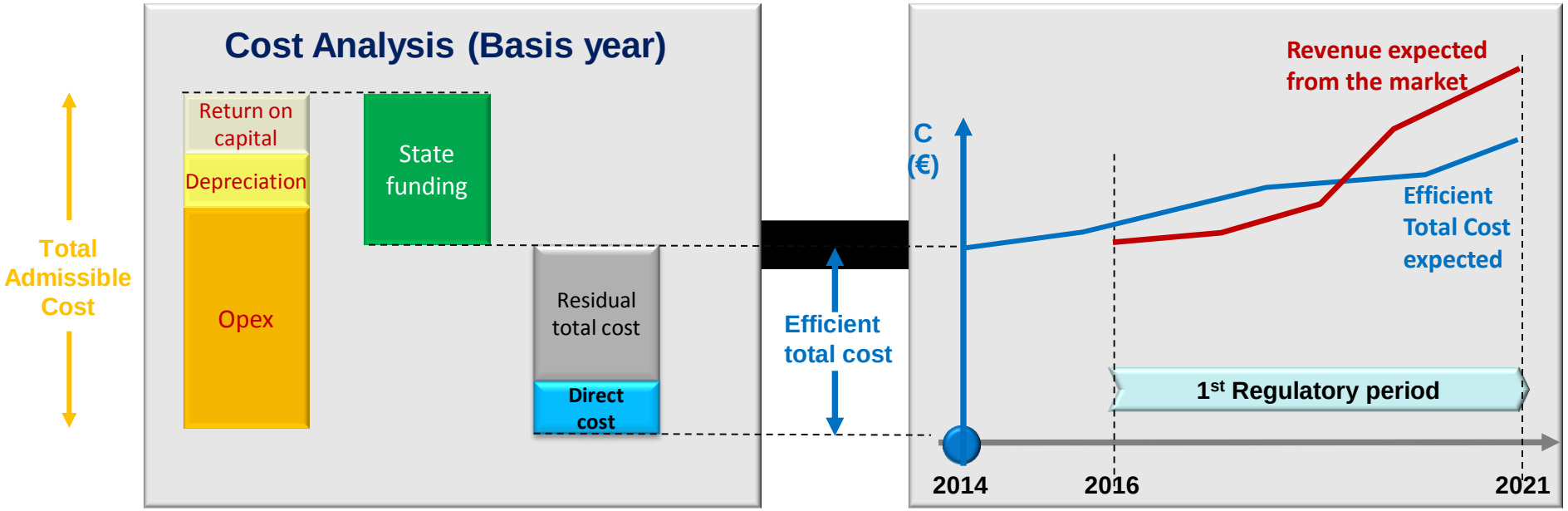
RETE FERROVIARIA ITALIANA
GRUPPO FERROVIE DELLO STATO ITALIANE

Costs, revenues and their forecasting

At the end of Regulatory period 2016-21

Efficient Total Cost = Revenue from the Market

(Financial Equivalence)



*According to the last Regulatory Accounting (**2014**)

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GRUPPO FERROVIE DELLO STATO ITALIANE

Track Access Charge Algorithm

A B

GIVEN BY RB

A + B

$$TAC = A1_{(MASS)} + A2_{(SPEED)} + A3_{(OL)} + B1_{(PRODUCT)} + B2_{(NETWORK)} + B3_{(TW)}$$

$$T_A * [(\gamma_M * K_M) + (\gamma_S * K_S) + (\gamma_{OL} * K_{OL})] * km + T_B * [(\gamma_P * j_P) + (\gamma_N * J_N) + (\gamma_T * J_T)] * km$$

CHOSEN BY IM

γ

50 %	46 %	4 %
16%		

CHOSEN BY IM

γ

100 %	0 %	0 %
84%		

CHOSEN BY IM

k

MASS Classes	SPEED Classes	OVERHEAD LINE wear and tear Classe
0 - 500 t	0 - 100 km/h	Diesel Traction
500 - 1000 t	100 - 150 km/h	Electric Traction
1000 - 1500 t	≥ 150 km/h	
>1500 t		

Classes and threshold values

GIVEN BY RB

PRODUCTS
Premium
International pass.
Basic
PSO – Long haul
PSO - Regio
Freight
Technical

CHOSEN BY IM

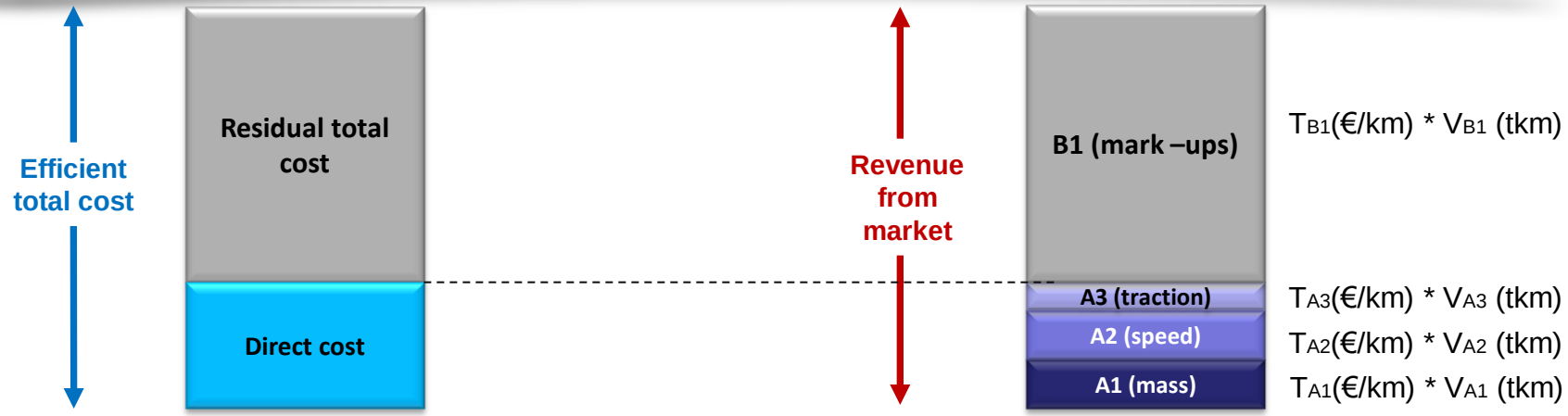
NO Network

NO Time windows

j

Ability to pay differentiated on the basis of other pairs added by IM

Modeling direct cost and tariffs

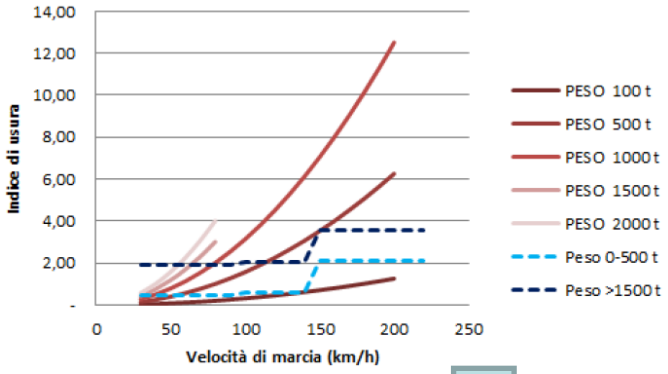


Estimation of Total Amount of Direct Cost through an **allocation model**:

- ✓ Consider some category of maintenance operations on the track and on the overhead line
- ✓ Considered just one year of observation (according to Regulatory Accounting 2014)

Modulating total amount of direct cost through a **Wear and Tear model**:

- ✓ Formula was imposed by the RB (simple linear [redacted] onsidering only 3 parameter)
- ✓ Formula doesn't consider line parameter



Wear and Tear Model

Model fitted with TAC system

June 2019: One model for both (econometric or engineering model)

Setting Direct cost tariffs

Direct Cost (Total amount) from Allocation Model (€)

Volume (Trainkms)

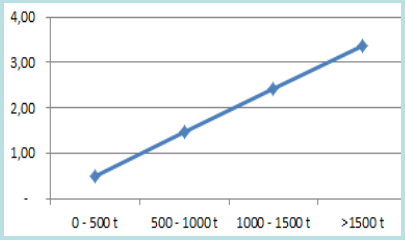
T_A (€/km)

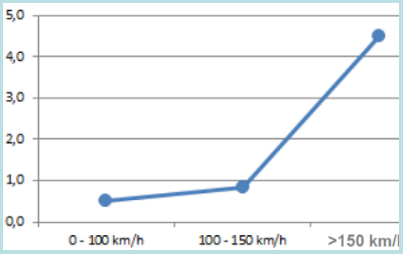
$T_{A1} = T_A * 50\% * \gamma * k$

$T_{A2} = T_A * 46\% * \gamma * k$

$T_{A3} = T_A * 4\% * \gamma * k$

Thresholds given by RB





The K coefficients are weighted according to the volumes expected for each wear class

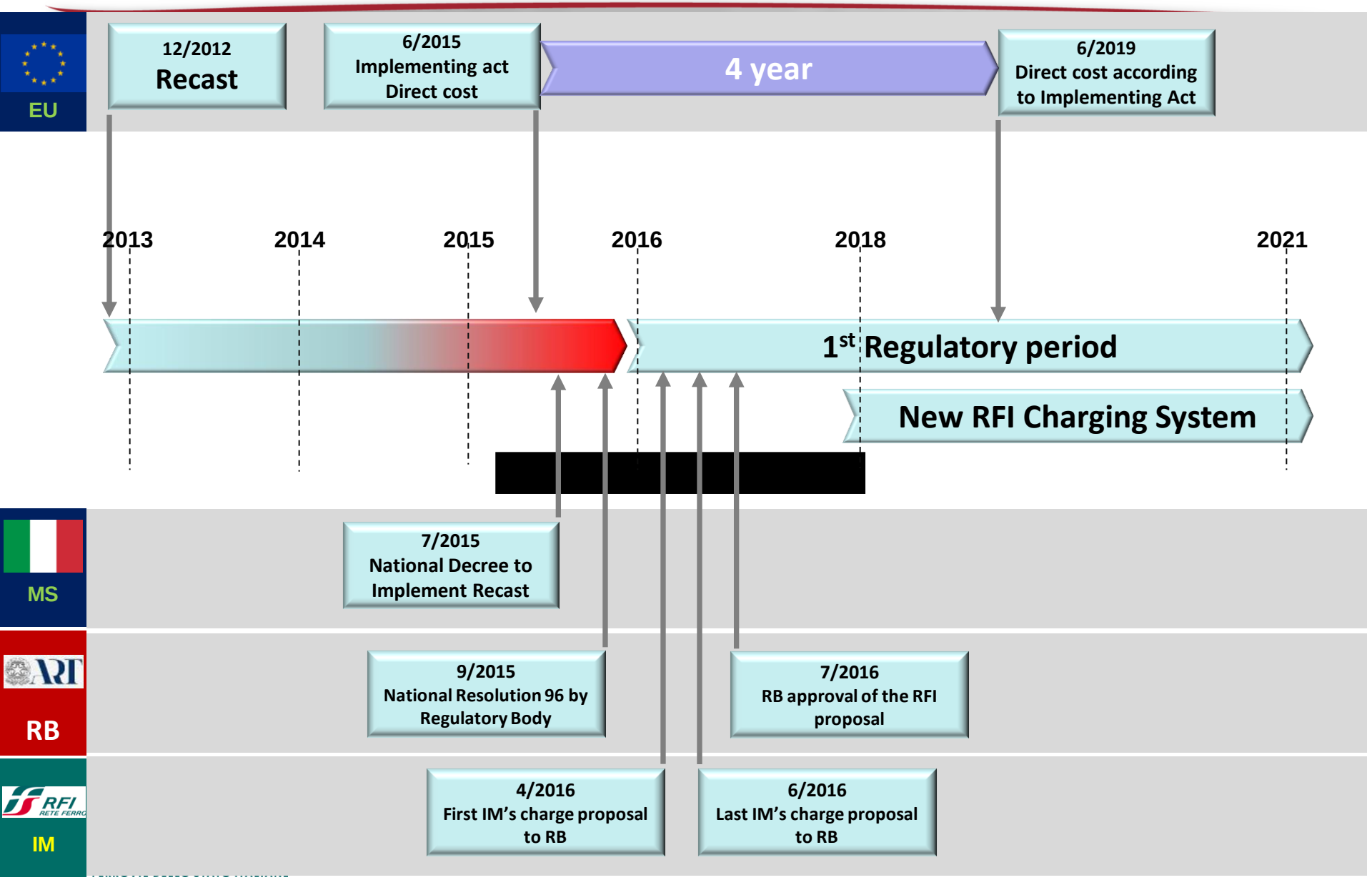
Weight Class	TA1 (€/km)
0 - 500 t	0,130
500 - 1000 t	0,378
1000 - 1500 t	0,626
>1500 t	0,874

Speed Class	TA2 (€/km)
0 - 100 km/h	0,119
100 - 150 km/h	0,196
150 - 200 km/h	1,073

Catenary usage	TA3 (€/km)
Electric Traction	0,023
Diesel Traction	0,000

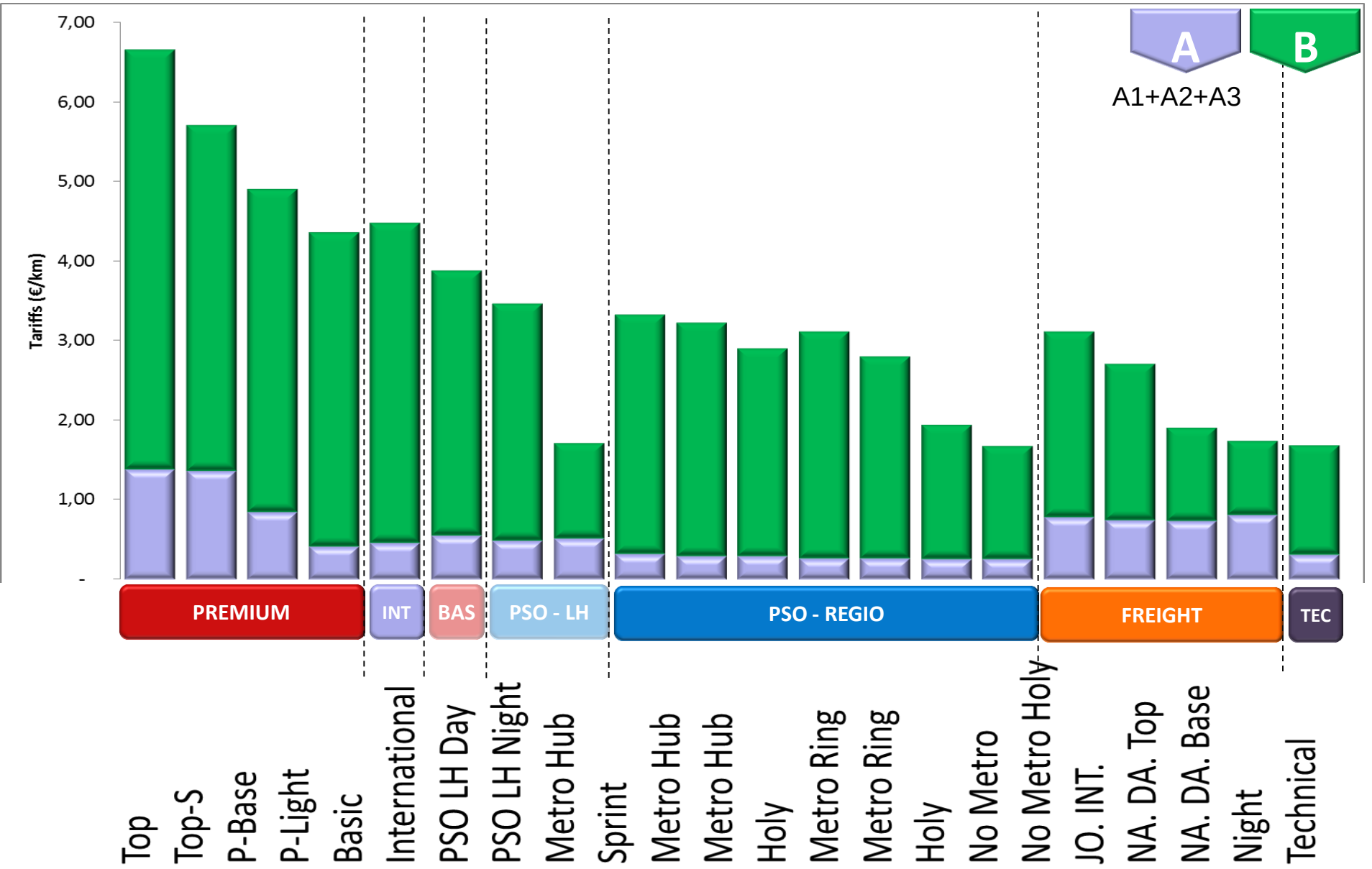
Direct cost Tariffs published in Network Statement 2018

Road Map


EU
12/2012
Recast
6/2015
Implementing act
Direct cost
4 year
6/2019
Direct cost according
to Implementing Act
2013
2014
2015
2016
2018
2021
1st Regulatory period
New RFI Charging System
MS
7/2015
National Decree to
Implement Recast
RB
9/2015
National Resolution 96 by
Regulatory Body
7/2016
RB approval of the RFI
proposal
IM
4/2016
First IM's charge proposal
to RB
6/2016
Last IM's charge proposal
to RB

List of Tariffs 2018

TARIFFS



Thank you for your attention!

[redacted]

RFI
RETE FERROVIARIA ITALIANA
GRUPPO FERROVIE DELLO STATO ITALIANE