Cost benefit analysis applied to reliability policies in France

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Views expressed here do not reflect the Ministry's position

Outline (1)

- Policy context :
  - Transport policies focus on managing existing capacities
  - Fluidity is the primary objective, reliability is implicit
  - Need for traffic management appraisal is increasing
    - For diverse traffic management measures

- Existing assessment practices :
  - CBA is commonly used for capacity policies
    - but barely for traffic management
  - Ex post evaluation is used for traffic management
    - in a “benefit transfer” approach for experimental measures

Outline (2)

- Existing CBA framework for transport policy :
  - Is applicable for reliability and traffic management
  - in spite of “critical” knowledge gaps

- Knowledge gaps :
  - Time value
    - Towards a scheduling reflecting opportunity costs of activities ?
  - Impact of information on behaviours
  - Links between fluidity, safety, reliability
  - Dynamic modelling : multimodal, macro-scale, pollution

1. Policy context (1)

- Transport policies in France : recent trends
  - “Shift” from capacity to flows management
    - National and local budget constraints
    - “Greening” of transport policies
    - End-user’s orientation (quality of service)
  - Impetus on multimodal approaches
      - e.g. dynamic use of road capacities for public transport
      - e.g. park and ride policies in peri-urban areas
      - e.g. multimodal door to door information
      - e.g. multimodal freight policies
  - Impetus in the road sector : draft ITS directive ?
    - Relevant level of harmonization for traffic management and traffic information practices ?

1. Policy context (2)

- Reliability is not the main policy objective
  - Congestion, environment, safety, public finance

- ... but the importance of reliability should increase
  - Multimodal approaches will increase the value of reliability / unreliability for users (connections)
  - Information to users may increase demand for reliability
  - Perception of indirect impacts of incidents and road fatalities, i.e non recurrent congestion, is increasing
  - Climate change and critical infrastructure protection concerns will raise reliability issues for extreme impacts / low probability events

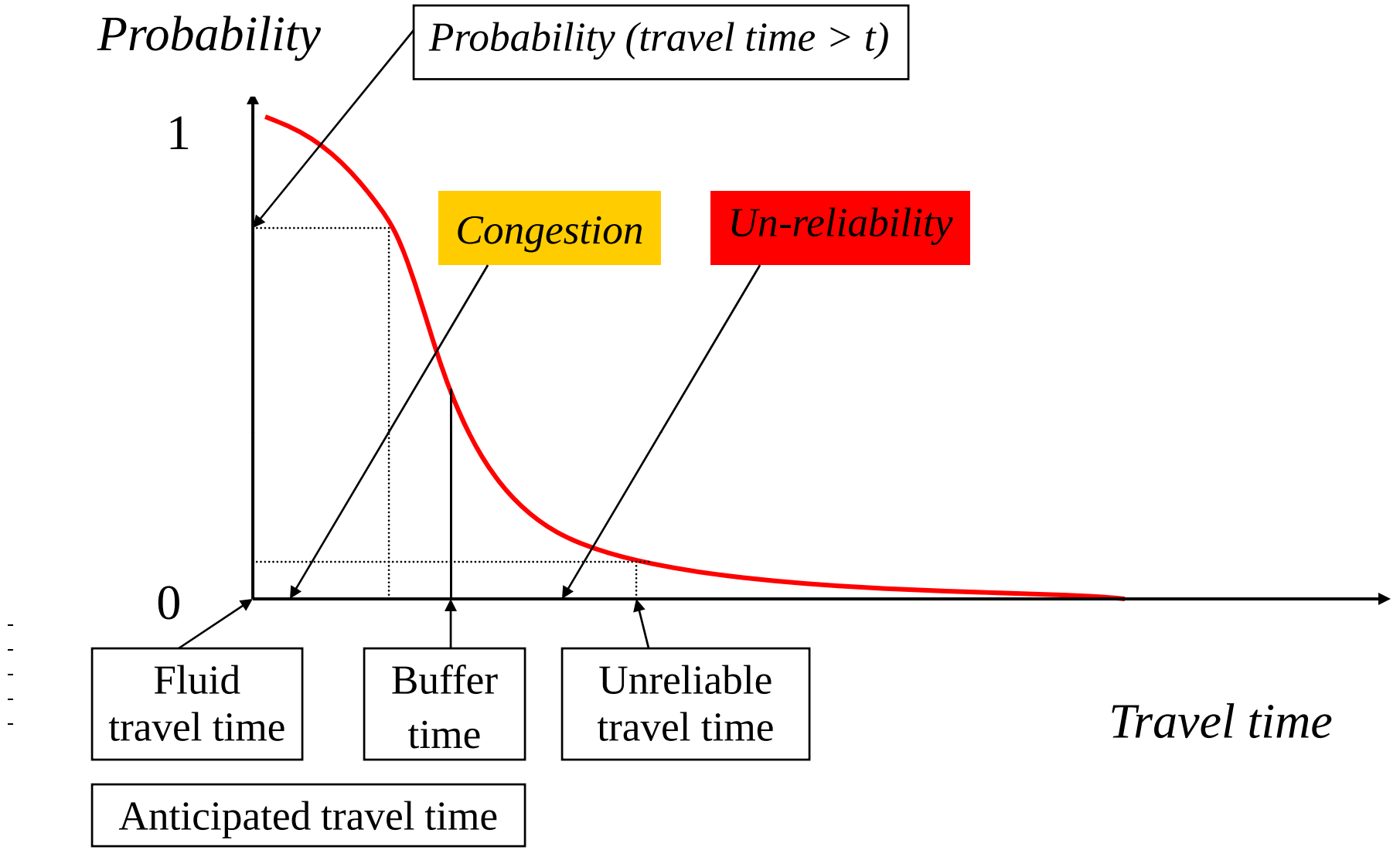
1. Policy context (3)

- Road traffic management : appraisal needs
  - Comparaison of traffic management and capacity
  - Selection of local investments by road operators
  - Relevance of national / european service standards
    - Cf. draft ITS directive
      - (e.g. maximum incident detection delay)
  - Relevance of national traffic management policies
      - (e.g. trucks overtake ban)
  - Data management
      - marginal cost of data vs marginal value for traffic management
      - expected gains of new technologies (floating vehicles)

1. Policy context (4)

- An increasing mix of objectives and instruments
  - Fluidity, safety, reliability
    - are tighly correlated from a global perspective
    - but must be de-correlated for policy analysis
  - Capacity and traffic management are multi-objectives
    - Fluidity, reliability, safety
    - with shared costs (e.g. information costs)

  → need for a comprehensive assessment approach
    - multi-impacts → CBA is generally appropriate
    - diversity of measures → CBA must be “customized”
  - Reliability policies = traffic management ?


Probability
Probability (travel time > t)
1
0
Congestion
Un-reliability
Fluid travel time
Buffer time
Unreliable travel time
Travel time
Anticipated travel time
Travel time objectives
Reliability objectives
Fluidity, environment, safety objectives

Policies	Examples
	Traffic management *Other policies*
Capacity (local)	Road capacity ; Rail traffic / slots management
Redundancy	Alternative routes / modes availability
Connectivity	Door to door oriented slots management
Prevention	Incident prevention through safety policies
Preparedness and intervention	Incident detection Emergency management plans
Pre-Information	Transparency on modes / operators / routes reliability
Real time information	Dynamic routing Real time information on schedules
Pricing	Congestion / peak pricing Un-reliability pricing

2. Traffic management : existing assessment practices (1)

- Traffic management policies are still in an experimental phase
  - Measures are tighlty linked to local situations
  - Equipments are quickely evolving
  - Relevant authorities are diverse : national road authority and its regional directorates ; motorway companies ; local authorities
- → Assessment practices aim at testing and capitalizing experiences
- → Existing assessment practices focus on :
  - “classical” transport indicators :
    - travel time, safety, CO2, local pollutants, noise
  - Acceptability / impacts on behaviours (ergonomy)

2. Existing assessment practices (2)

- Methodology (main features)
  - After – before or with – without comparaison :
    - 2 “comparable” periods
      - For dynamic measures : periods, with and without activation
      - For permanent measures : short period or annual
    - On the same section / network
  - Indicators :

Indicator	***Measurement***
Travel time	Average speed or time spent in delays
Safety	Number of accidents / fatalities
Enforcement	Number of offenses
Acceptability	Surveys
Pollutants, noise	Local measurements

2. Existing assessment practices (3)

- Comparable to other guidelines or practices
  - EU Tempo and Easyway guidelines
    - www.easyway-its.eu
  - US ITS evaluation tool-box (RITA)
    - www.its.gov/evaluation/guide_ressource.htm
  - Cf. french method and case studies
    - www.zelt-fr.org

- Main limits
  - No “business as usual” scenario
  - No assessment of reliability
  - Safety assessment based on a limited data
  - No CBA

2. Existing assessment practices (4)

- CBA application to ex ante evaluation of traffic management
  - Traffic management measures have to be taken into account to optimize the reference situation for capacity projects
    - Cf. provisional instruction for road project appraisal, 2007
    - Cf. reference efficiency of traffic management measures

Measure	Reference efficiency (impact on transport demand)
Pre-information : route advice	3% to 8%, 20% in peri-urban
Real time information : dynamic routing	1% to 5% (year average)
Peak-pricing + information	10%
Dynamic speed limits	3%

  - CBA has to be applied for traffic management measures (recommendation : Conseil général des ponts et chaussées, 2004)

3. CBA applied to reliability : a comprehensive tool-box ? (1)

- The “tool-box” (in brief)
  - List of costs and impacts
  - Monetary values
  - Cost of public funds
  - Discount rate, life time, residual value
  - Reference / business as usual scenario
  - Alternative scenarios / optimisation
  - Risk analysis

    - http://www.statistiques.equipement.gouv.fr/IMG/pdf/Instruction_cadre_maj_2005_cle147216.pdf

3. CBA applied to reliability : a comprehensive tool-box ? (2)

- Questions :
  - Does the existent CBA tool box for “capacity” assessment correctly reflect reliability objectives ?
  - Is the existent CBA tool box for “capacity” assessment relevant for traffic management ?
  - NB : this tool-box was applied to assess vulnerability of critical infrastructures (= costs of “durable” disruptions) (2007)

Cost or impact	***Relevance for traffic management ?***
Investment	√
Maintainance	√
Operation costs	√
Travel time	√
Safety	√
Vehicles operation costs	√
Fuel costs	√
CO2	√
Biodiversity	√
Landscape	√
Local pollutions	√
Noise	√
Comfort	√

Monetary values of impacts	***Availability for « capacity » policies (in France)***	***Relevance for traffic management ?***
Travel time	√	**?**
Safety	√	√
CO2	√	√
Biodiversity	No	~ No
Landscape	No	~ No
Local pollutions	√	√
Noise	√	√
Comfort	√	**?**

Modelisation of impacts	***Availability for « capacity » policies***	***Availability for traffic management***
Travel time	√	±
Safety	√	±
CO2	√	±
Biodiversity	±	No
Landscape	±	No
Local pollutions	√	±
Noise	√	±

3. CBA applied to reliability : a comprehensive tool-box ? (3)

- Impacts beyond CBA ?
  - Existing debate in France : does CBA correctly reflect :
    - Equity, social exclusion / inclusion ?
    - Effects on geographical distribution of activities and competition ?
    - Keynesian effects ?
  - Is this debate relevant for reliability / traffic management ?

3. CBA applied to reliability : a comprehensive tool-box ? (4)

- Equity, social exclusion :
  - Are low income / fragile households more impacted by unreliability ?
    - ~ yes
    - cf. scheduling approach : costs of schedule disruptions or disturbance may be higher
- Location of activities and competition
  - Are “just in time” activities more critical for competition ?
    - ~ yes
    - competition for other activities is generally at a larger geographical scale (EU) than the project’s scale

3. CBA applied to reliability : a comprehensive tool-box ? (5)

- Keynesian effects
  - Assuming that keynesian effects have to be taken into account
  - Which is not the recommendation for project assessment
  - Are keynesian effects higher for traffic management ?
    - ~ yes and no
    - Projects can start quicker than new capacities but slower than surfacing
    - Domestic value added is higher for construction than for ITS technologies

4. Main knowledge gaps (1)

- Time value : relevance of the scheduling approach
  - Just in time is increasing (social activities, business)
    - Value of un-reliable time is increasing faster than value of time
  - Reliability is a significant modal choice criteria :
    - Need for differenciated time values among users
      - (e.g. type of freight)
  - Costs of un-reliable time depend on available alternatives for re-scheduling activities
    - Need for differenciated time values
      - among social groups
      - between geographical locations

4. Main knowledge gaps (2)

- Time value : relevance of the scheduling approach
  - Traffic management measures are diverse :
    - Traffic management can address :
      - high delays - low probability events
      - or short delays – high probability events

      → need for different time values for different delays
    - Traffic information can address :
      - real travel time : information favours dynamic routing
      - value of time : information enables scheduling reorganisation
      - buffer time : information enables choices based on existing reliability

      → need to separate buffer time / un-reliable time

      → need to differentiate values of un-reliable time depending on delays

4. Main knowledge gaps (3)

- Reliability assessment and the scheduling approach

  (simplified presentation)

N users : i = 1,...N

P events : p = 1,....P

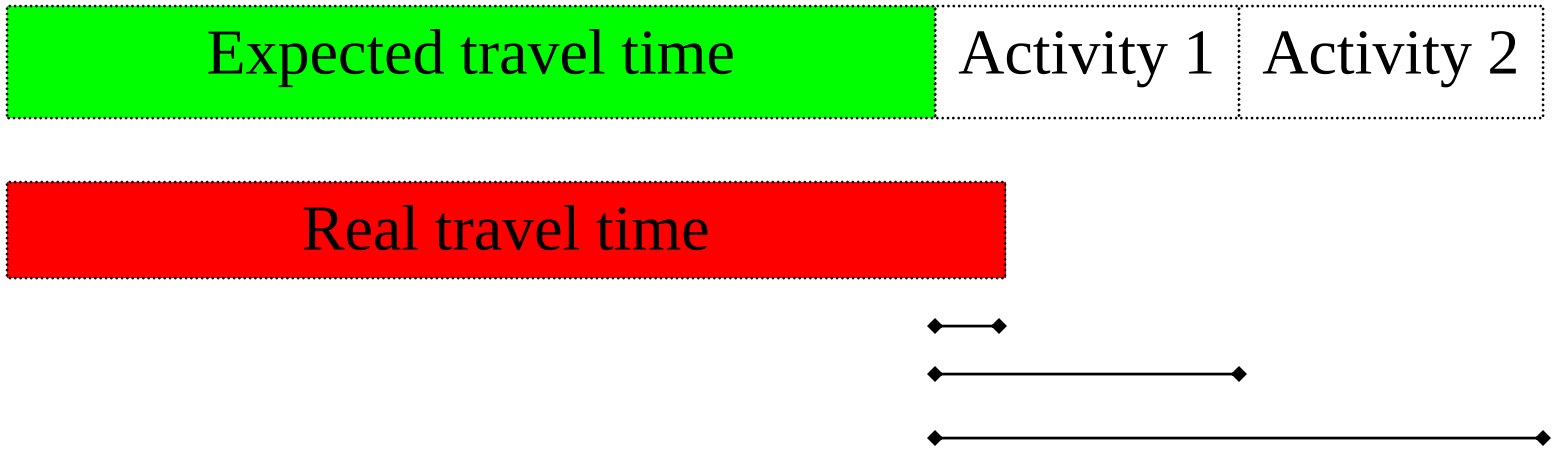
Total unreliability =

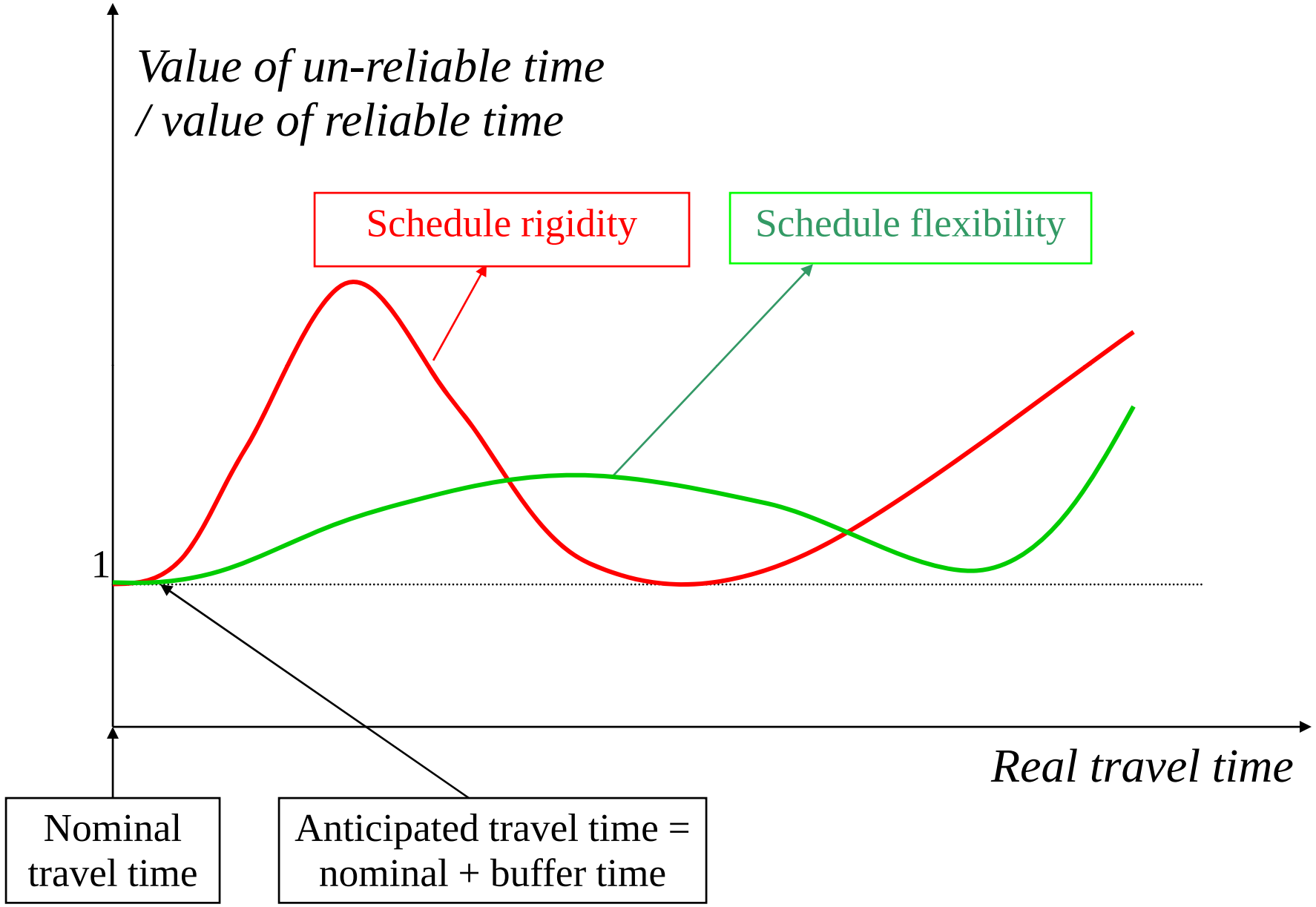
$\sum_{i,p}$ (value of unreliable time)$_{i,p}$

* [(real travel time)$_{i,p}$ – (buffer time)$_i$ – nominal travel time)]

Component	Real time information	Pre-information	Incident management	Dynamic capacity allocation or routing	Fluidity (if anticipated)
value of unreliable time per user	√	√			√
value of unreliable time per event	√		√	√	
real travel time per user	√	√			√
real travel time per event	√		√	√	
buffer time per user		√			√

References in France	Value of unreliable time / value of time	Comments
STIF (2000)	6	Public transport in the Paris region : un-reliable time is defined as « delays »
Delache (2008)	2 to 20	Scheduling model (utility losses of « disrupted » activities due to non expected delays – beyond buffer time) with different assumptions on schedules rigidity


Expected travel time
Activity 1
Activity 2
Real travel time


Value of un-reliable time
/ value of reliable time
Schedule rigidity
Schedule flexibility
1
Real travel time
Nominal
travel time
Anticipated travel time =
nominal + buffer time

4. Main knowledge gaps (4)

- Impacts of time values for existing CBA
  - Case of automatic incident detection : inter-urban motorway (2*3)

	Normal time value	5 * normal time value
Impact	*% benefits*	*% benefits*
Travel time	0,8 %	4,0 %
Safety	99,1 %	96,0 %
Environment and energy	0,1 %	0,0 %
Total impacts	*1*	*1,03*

4. Main knowledge gaps (5)

- Impacts of time values for existing CBA
  - Case of automatic incident detection : peri-urban motorway (2*3)

	Normal time value	5 * normal time value
Impact	*% benefits*	*% benefits*
Travel time	12,0 %	40,6 %
Safety	86,2 %	58,2 %
Environment and energy	1,8 %	1,2 %
Total impacts	*1*	*1,5*

4. Main knowledge gaps (6)

- Impacts of time values for existing CBA
  - Case of automatic incident detection : urban motorway (2*3) (e.g. Paris area)

	Normal time value	5 * normal time value
Impact	*% benefits*	*% benefits*
Travel time	25,4 %	63,0 %
Safety	71,2 %	35,3 %
Environment and energy	3,4 %	1,7 %
Total impacts	*1*	*2,0*

4. Main knowledge gaps (7)

- Impacts of time values for existing CBA
  - Case of automatic incident detection : urban motorway (2*3) (Paris region)

	Normal time value	5 * normal time value + recovery < buffer time
Impact	*% benefits*	*% benefits*
Travel time	25,4 %	79,9 %
Safety	71,2 %	19,2 %
Environment and energy	3,4 %	0,9 %
Total impacts	*1*	*2,7*

4. Main knowledge gaps (8)

- Impacts of time values for existing CBA
  - Case of traffic management in the Strasbourg area (Gutenberg)

	Normal time value	5 * normal time value	5 * normal time value + recovery < buffer time
Impact	*% benefits*	*% benefits*	*% benefits*
Travel time	41,5%	31,7%	22,8%
Safety	57,2%	67,3%	76,5%
Environment + energy	1,4%	1,1%	0,8%
Total impacts	*1*	*1,3*	*1,8*

4. Main knowledge gaps (9)

- Challenges for time value studies along the scheduling approach
  - Possible explanatory factors
    - Value of instant activities affected (personnal vs business)
    - Occupation
    - Revenue (are unpredictible agendas « marketable » ?)
    - Time of the day (transition activities may have higher costs)
    - Availability of information (on alternative route, modes)
    - Disruption duration
    - Predictability of disruption duration
    - Reproductibility of events (« experience curve »)

4. Main knowledge gaps (10)

- Stated or revealed preferences studies ?
  - Stated preferences may be more appropriate to differenciate reliability values among users
  - CBA and modelling are presently based on a revealed preferences approach
    - Explore revealed preferences studies including reliability factors in route / modal choices ?
    - Explore on route vehicles tracking in un-reliable events ?

4. Main knowledge gaps (11)

- Other knowledge gaps
  - Impact of information on behaviours
    - Existing ex-post evaluation needs to be capitalized
    - Develop simulators-based studies on representative users ?
    - Develop stated preference surveys ?
    - Develop on route vehicles tracking ?
  - Links between fluidity, safety, reliability
    - Existing ex-post evaluation needs to be capitalized
  - Dynamic modelling :
    - Multimodal and macro-scale models
      - (beyond road traffic micro-simulation)
      - Integration of information dependant behaviours
    - Links between dynamic modelling and pollutant emissions
      - e.g. “stop and go” impacts on emissions

Sétra

Service d'études sur les transports, les routes et leurs aménagements

Thank you

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Ministère de l'Écologie, de l'Énergie, du Développement durable et de la Mer