



SOURCE¹, a large-scale benchmark tool for road networks

(1) S.O.U.R.C.E. = Standard Overall Ultralite Road Care Estimate

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Contributions

The development and finalization of the SOURCE method have been supervised by L. Fernique from the RMI team, and coordinated by ISTED (JP. Lanet and G.Poirier). B. Ninnin, consultant and the LCPC (P.Autret and P.Joubert) were members of the task force that made important contributions to this research.

The Road Authorities of Cameroon, Ghana, Guinea and Madagascar were also an integral part of the taskforce on this project.

How the SOURCE project began

Major changes in the road sector

Over the past ten years or so, the road sector has undergone major reforms in a number of Sub-Saharan African countries. This process has been encouraged by the donor community, especially through the Road Management Initiative (RMI). New policies have been introduced, such as the off budget financing of road maintenance and the direct participation of road users in the road management entities. Ways of doing business are changing: more dependence on market mechanisms, further decentralization; new types of entities and operators.

The resulting new institutional framework has evolved through the experiences of various countries in the developing world and the transition economy countries. Sub-Saharan Africa has drawn inspiration from Latin America and in turn Central and Eastern Europe is learning from the experiences of West and East Africa. It is a process of iteration in which many countries, despite blockages and setbacks have undeniable progress.

What tools to measure and analyze progress?

A number of the shortcomings in the progress of reform are quite specific. For example, the disposal of public plant pools can often result in gaps in capacity where market prospects and conditions do not favor an immediate private sector response. Other shortcomings can be manifested after review of the situation on the ground in reforming countries.

Real evidence of impact on the ground is something that all partners in the reform process, is a requirement naturally put forward by all the partners involved in these processes, whether road sector stakeholders or donors, would like to see. All these players have a strong need for efficient monitoring instruments to assess progress, achievements and the eventual relevance of the reforms.

Within the countries, the new management entities in which road users are involved are generating a demand for easy-to-use, objective performance monitoring methods. For example, if the representative of the road haulage industry is to agree to the imposition, extension or increase of a road user charge and to convince his constituency of the relevance of the measure, he must have access to regular and concrete measurements of the impact of the financing reforms on the ground. The question of "How to correctly monitor and assess progress in road maintenance" is of universal importance and not just for the reforming countries of Sub-Saharan Africa.



The status of road statistics

*Commonly used road statistics in the form of national aggregates are mostly **qualitative** (despite appearances which are deceptive) and therefore are not readily usable. It is a fact, that far too few countries have permanent road data banks, locally managed and regularly updated, based on objective technical data.*

Example: out of 45 African countries interviewed in 1998, 41 replied that their data bases did not meet these criteria, 20 road administrations could only provide statistics that were “commonly accepted but with no precise statistical basis”.

Overall traffic-related data are rarely available except under specific programs. That is why in practice, large-scale systematic monitoring can only exceptionally be based on a pre-existing road data bank.

On a supranational scale (for country-to-country comparisons), the apparent comparability of present statistical series is deceptive due to (1) the lack of unified criteria (from the measurement of deflection to “what the expert says”), and (2) the existence of reference networks that are extremely inconsistent and unstable (in the series examined, we have noted jumps and drops approaching 70% in length over 8 years. The extent of these defects is such that they can cause complete misinterpretation of the basic question “progress / no progress?”.

Upstream solutions, downstream solutions

Upstream, there must obviously be monitoring of institutional progress, for which new tools are being set up. These tools measure mostly the political will reflected by a reform, but not the operational efficiency.

There is also conventional monitoring of the implementation of intervention programs or the functioning of the new road agencies themselves: technical audits and management audits, for example. This involves checking that the financing system is working appropriately, but does not cover the efficiency.

Downstream, in terms of results on the ground, the engineer has a full range of excellent, proven tools and methods to assess road condition. In increasing order of quality and accuracy of results (but at the same time, in increasing order of complexity and cost): visual, multi-

criteria reports on damage, roughness or equivalent measurements and deflection measurements. None of these tools, even the lightest visual surveys, is suitable for overall, recurrent, and large-scale monitoring, for which they have not been designed. Their field of application begins at the pre-programming stage of work. Besides requirements for heavy logistics and specialized skills, the cost of these campaigns over a main road network would usually be unjustifiable, weighed against the low size budget devoted to road maintenance. When the monitoring cost is more than a quarter of the cost of maintenance work, a very different solution should be sought.

In terms of road policy monitoring and assessment, except for a few countries, we thus come up against a lack of reliable tools.

SOURCE – to provide hard evidence

What is the *real* condition of the road network? How do new and rehabilitation work programs stand the test of time? What is the actual level of service provided for users? How is this level of service changing? Does the response from the road sector match up to potentialities and requirements?

The answers to these crucial questions for road and road transport policy, provided by existing statistics and data, are few and far between.

Monitoring of the **actual level of service** of the road network, taken as an overall indicator of the physical performance of a network, is precisely the aim of the “SOURCE” project launched in 1998 by the RMI.

SOURCE, a brief insight

The actual level of service offered by the road network (i.e. the quality of service) is assessed through mean travel times, the most direct expression of users’ expectations. (In fact, measuring these mean travel times and measuring mean travel speeds amounts to the same thing).

A complementary assessment of traffic volumes also measures the quality of service in terms of production of road transport.

Speeds weighted by traffic volumes

The SOURCE method is based on standardized measurements of traffic and common speeds of light vehicles, made for each country over a standardized reference network. The two series of data (traffic/speeds) are aggregated for the entire reference network in the form of a single macro-indicator (a pseudo-speed) that reflects the actual level of service provided by the main roads in each country. Various by-products are also obtained, which include a macro data bank for the network in question.

The aim of the SOURCE project was to create and test a low-cost, simple, practical tool, to monitor the status of the road network in a country by an objective, easy, standardized method: **an overall benchmark instrument.**

The idea: Supply on a country-by-country basis, an accurate standard picture of the main network, produce aggregate front-line information of well-controlled statistical quality, (not determined by the availability or quality of already-existing bases).

The key product (but not the only one): a single macro-indicator per country, which will be the most relevant tool for users.

At the center of the method: the floating vehicle

Speed and traffic levels are measured simultaneously using the special “floating vehicle” protocol. An ordinary vehicle (the floating vehicle) is integrated into the traffic and alternatively follows a fast vehicle (which has overtaken it) and a slow vehicle (which it has caught up). On the way, the traffic encountered in the opposite direction is counted. This procedure is detailed in the SOURCE handbook.

A statistical integrator

The accurate measuring protocol assigned to the floating vehicle makes it a “statistical integrator” able to provide high-quality results. This is the key to the method. It means that once is enough for this “living” statistical integrator (so to speak) to travel the entire network under review, at speeds close to common speeds, without fixed facilities or instrumentation systems.

Common LV speed : a judicious approach

Experimenting has shown that measuring the common speed of light vehicles (LVs) in the dry season offers sufficient correlation with the surface condition of a road (unlike trucks owing to the unknown load factor). The method does not have to take into account other permanent speed-influencing factors (such as the type of road layout).

The method applies equally to paved and unpaved roads unlike conventional methods of assessing road condition, all of which are discontinuous by nature.

Through suitable processing of the various distortion factors and after adjustment, the sensitivity of the indicator to disparities or changes in the car population is of minor significance (because the speeds are systematically brought back to 90 km/h). **As a result, despite the low cost of the macro indicators, their**

configuration guarantees adequate statistical soundness (the specified quality thresholds are attained for any distance of at least 150 km).

SOURCE, an ultralight method

Minimum equipment of the measuring team

YES :

- Vehicle (ordinary 4-wheel drive)
- Timer
- Ordinary road maps
- Pocket calculator

NO :

- No microcomputer
- No radio transmission equipment
- No special instrumentation systems

Both in the field and at the desk, this method is simple. The program aid spreadsheets (see further on about the CD-ROM content) are not necessary but are a plus in terms of productivity. Local engineering firms can easily master the method.

Reference networks – for country-to-country comparisons

A fundamental aspect of the SOURCE method for making comparisons is the establishment of specific reference networks (on which the measurements are made), which statistically reflect basic transport requirements. They provide a standardized method that takes urban demography into account, with additional criteria for trans-border routes, port areas and transit or regional development corridors, but not traffic levels.

Not a substitute for the usual road management tools, SOURCE provides the minimum information, no more no less, essential for:

- *Authorities in charge of roads, to justify to user-payers the performance levels obtained on the network, through transparent, well-informed dialogue,*
- *Decision-makers at all levels, to assess the impact of road policies on the basis of physical results.*

In brief, **to inform macro-decisions.**

The reference networks are classified into 4 ranks of priority (from 1 to 4 depending on the extent of transport requirements). There is a single measurement method, which does not take the rank into account.

These networks act rather like “the shopping basket” used to monitor consumer prices. They change little over a time scale of a few years and they are restricted enough to always be within the priority networks determined at national level. It is essential to use these reference networks (only the 3 main ranks) as a basis for making comparisons between countries.

However, each SOURCE measurement campaign in a given country ought to be extended to the national priority network. By producing a double series of statistics in this way, it is possible to satisfy two complementary needs (national and transnational).

The recommended frequency for assessing overall network condition from the angle of service provided for users is one measurement campaign every three years. Broad and valuable outputs are obtained with a minimum of measurement campaign costs and of logistical constraints. **Direct field costs: USD 2 per km measured.**

The SOURCE toolbox: a freely distributed CD-ROM

The following basic tools make up the SOURCE “toolbox”. They are all included in both English and French versions in the SOURCE CD-ROM, where are collected, in addition to the methodological papers, to the specialized reports and to some helpful reference documents:

- **The SOURCE practical Handbook**, with the following models in annex:
 - Section Data Sheet
 - Data Page
 - Calibration Sheet

The SOURCE handbook also exists as a half-size format file (A5) consisting of strong, practical thumb-index cards, designed to remain permanently in the storage tray of the measuring vehicle throughout the measurement campaign. This file is for restricted distribution.

- **Reference network graphic and display software**

This software for Excel includes a full library of SOURCE reference network data for the 48 countries of Sub-Saharan Africa. It allows to adapt or create easily any specific network, from simple road maps, previously scanned.

- **The SOURCE data processing spreadsheet**

For Excel, the results once processed can be reintegrated into the display software to produce standard maps illustrating network-wide speeds and traffic, as hard copies or electronic versions (the electronic versions can be consulted simply by clicking).

SOURCE Booklet: The CD-ROM also contains, in a *.pdf version, the SOURCE booklet (17 pages + 3 annex cards) where you will find a more developed presentation of the SOURCE method, while it was inevitably summarized for this brief technical note. Or order this booklet in English or in French in hard copy.

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