THE DEVELOPMENT OF SATCC STANDARD SPECIFICATIONS AND DESIGN GUIDES FOR ROADS AND BRIDGES

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INTRODUCTION

As part of the ongoing role of the Southern Africa Transport and Communications Commission (SATCC) to coordinate the development and use of the Southern Africa Development Community (SADC) regional transport system, the CSIR's Division of Roads and Transport Technology (Transportek) was contracted to review and develop road and bridge design standards and specifications, and pavement rehabilitation guidelines. The study was initiated in 1997.

The stated objectives for the standardisation of regional roads and bridge standards and specifications were to[1]:

- Achieve economic and technical efficiency in road transportation within the SADC region through provision of uniform road networks at optimal cost.
- Provide the same quality of service throughout the region.
- Improve the efficiency of the road transport system by minimising road accidents.
- Improve the efficiency of the road transport system by reducing energy consumption and hence the unnecessary use of foreign exchange.

BACKGROUND

Prior to the development of the new documentation, each country used a variety of design standards and specifications. These had been developed in previous years using different countries' specifications as a basis, with emphasis and focus often dependent on the countries funding the studies and the consultants appointed to do the work. The following SATCC documents were available at the start of the project:

- Road and Bridge Specifications (1994)[2]
- Geometric design standard (1992)[3]
- Pavement design standard (1992)[4]

Initial consultation with a number of countries with regard to the SATCC documentation, as well as country specific documentation, revealed that[1]:

- The original SATCC specifications were not being widely used, as they were not considered appropriate for the region.
- Specific criticism was aimed at both the geometric design and the pavement design guidelines as being overly conservative and unsuitable for local conditions.
- The existing SATCC specifications and guidelines were perceived to require major and extensive revision in order to accommodate local conditions.

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- Most of the country's in-house specifications and guidelines (ie not SATCC) were based predominantly on South African practice, although British and American practice was also followed.
- The quality and comprehensiveness of the currently available documentation in the member states at the start of the project was variable.

STUDY PROCEDURE

The procedure adopted for the preparation of the documents entailed the following phases:

- Consultation with country representatives and review of existing documentation
- Preparation of an Inception Report
- Preparation of draft revised documentation
- Workshop to present revised documentation
- Review by member countries
- Workshop to discuss changes
- Preparation of final draft documents
- Implementation

The process was overseen by a steering committee comprising representatives from SATCC-TU and selected SADC countries.

CONSULTATION AND REVIEW

Specifications

Meetings were held in most member countries during this phase, during which shortcomings in both the SATCC and country specific documentation were discussed. Copies of the relevant documentation were also obtained. Telephonic interviews were held with representatives from those countries that were not visited.

After the consultation and review phase, the study team and steering committee concurred that the SATCC Standard Specifications for Road and Bridge Works document was fairly well laid out and made reference to most of the necessary requirements in a systematic order. However, there was a mixture of standards and testing procedures from different countries, some of which conflicted within different sections of the specifications leading to discrepancies and inconsistencies[1].

It appeared that significant parts of the current specifications were based primarily on earlier South African Committee for State Road Authorities (CSRA) specifications, but had been simplified often to a point where their completeness was affected. Many of the requirements were inadequately defined with the result that they could easily be misinterpreted with potentially significant legal and financial consequences.

In many instances, the specifications appeared to be inappropriate for southern African conditions, highlighted by the materials specifications that were mainly based on old AASHTO requirements, known to be unsuitable for the region. Different countries also used different specifications and testing protocols, requiring consensus on applicable test methods to be used and the choice of a single method being specified for any particular item.

There appeared to be confusion between the terms “standard specifications” and “general conditions of contract”, which would need attention to avoid contractual conflict.

Design Guidelines
In terms of the design guidelines for geometrics and pavements, it was clear that United States standards formed the basis for both documents. Apart from the major cost implications of using the designs, the standards were considered generally inappropriate for the region.

General
Certain countries expressed concern as to whether a single regional standard specification could be applicable to all member states, given the geological, geomorphological and climatic variation across the region. It was therefore suggested that aspects of the specification that could be regarded as generic and specific to all countries of the region be identified and incorporated into a regional specification, with supporting guidelines highlighting country-specific requirements (preparation of these was outside the scope of the study). It was further agreed that the documentation would be developed primarily for the trunk road network and would serve as a minimum standard. Countries would be able to raise the standards, but not relax them.

The findings of the consultation and review phase were summarised in an Inception Report[1].

PREPARATION OF REVISED DOCUMENTATION

The following documents were produced from the study:

- Standard specifications for road and bridge works[5]
- Code of practice for geometric design[6]
- Code of practice for pavement design[7]
- Code of practice for bridge and culvert design[8]
- Code of practice for rehabilitation[9]

Standard Specifications for Road and Bridge Works
The main problem with the SATCC Road and Bridge Specification document, leading to most of the criticism, was the lack of cohesiveness arising from the manner in which it was developed. Rather than try and correct the existing document, which was unlikely to be wholly successful, the preparation of a new document was proposed. The recommended approach was to begin with a coherent specification document already developed within the region, and to introduce additional relevant clauses identified in the current SATCC document as well as any other existing national specifications. A complementary task would be to rationalise on test standards applicable in the region, and to eliminate the problems of having conflicting requirements. It was anticipated that this approach would eliminate the problems identified, would enable each member country to maintain its own country-specific requirements and would have immediate regional applicability.

The preliminary review of current practice clearly identified the CSRA specification[10] as the most appropriate basis from which to develop the SATCC specifications. The following advantages were identified:

- They had already been used or referred to by a number of member states in country specific documentation, thus there was a first hand familiarity.
- They had contributed significantly to the existing documents (even if modified).
- They had been developed and revised, from local research, as a coherent whole for the unique climatic and geological conditions primarily in South Africa, but clearly more widely applicable in southern Africa.
- They already incorporated research findings relevant to the region and, at the time, were nearing completion of revision ensuring the most up-to-date basis[11].

The table of contents and format of the CSRA, Colto (Committee of Land Transport Officials) and new SATCC documents are similar, with additions and omissions to suit the region. For example:

- A specification for unsealed roads was included, as a portion of the trunk road network in certain countries is unsealed.
- Waterbound macadam bases were included as this is a common design in a number of countries.
- Detail on plant-mixed paver-laid pavement layers was excluded as this is not widely used in the region and was considered too high a standard for a minimum standards document.
- Certain asphalt mixes (gap graded) were excluded.
- A subsection on cattle grids was added.
- Only one quality control scheme was adopted.

Code of Practice for Geometric Design

The SATCC code of practice for the geometric design of trunk roads[3] was reviewed in terms of:

- The fundamental design criteria and specifically design speeds and sight distances
- Introduction of a two-tier approach design concept, based on design speed or operating speed, allowing for desirable or minimum standards respectively
- Ensuring, through close liaison with member state representatives, that proposed standards were suitable, applicable and met local needs

As with the Standard Specifications document, the CSRA geometric design document (TRH17)[12] was considered as the most appropriate basis from which to develop the revised SATCC code of practice. The revised document differs considerably from its predecessor and uses a table of contents and layout similar to TRH17.

Code of Practice for Pavement Design

The need was identified for closer alignment of the existing document with SADC conditions, which necessitated a complete revision of the design approach. The new document is centred on a design catalogue. However, the previous document was strongly based on the AASHTO method, while the revised document makes greater use of the proven regional methods used in CSRA's TRH4[13] and TRL's Road Note 31[14]. The table of contents and format of the revised SATCC document does not follow the format of any particular document.

Code of Practice for Bridge and Culvert Design

The bridge design guide was a new document in the SATCC portfolio. The code covers the design of concrete highway bridges and culverts and is aimed at achieving acceptable levels of probability so that the structure being designed will remain fit for the required purpose during some reference period, with its intended life taken into consideration. The code is based on the principles of Limit State Design outlined in ISO 2394 - "General principles for the verification of the safety of structures"[15] and is modelled on Volumes I and II of the International System of Unified Standard Codes of Practice for Structures[16].

The main reference is the South African Bridge Code, TMH7[17], which in turn makes reference to BS5400, Parts 1,2 and 4[18] and the National Building Code of Canada[19]. The table of contents and layout of the SATCC document is similar to TMH7.

Code of Practice for Rehabilitation

The code of practice for rehabilitation was also a new document to the SATCC portfolio. Very little documentation on rehabilitation is currently available in SADC countries. After discussions with the member country representatives, it was agreed that the SATCC document would be closely based on the CSRA TRH12 document - "Pavement Rehabilitation Investigation and Design"[20]. A number of detailed changes of varying significance were introduced in order to make the guide more appropriate to the SADC region.

The table of contents and layout of the SATCC document is similar to TRH12.

REVIEW BY MEMBER COUNTRIES

Draft documents were reviewed by representatives of each of the member states. Comments were forwarded to the CSIR, collated and then discussed in detail at a workshop. Agreement on discussion points was reached at this workshop. The documents were then finalised and submitted to SATCC-TU and each member country in September 1998 for distribution. Acceptance of the documents as minimum standards for trunk roads was agreed at a meeting of Transport Ministers in 1999.

IMPLEMENTATION

Institutional changes, both in SATCC-TU and in the member countries, resulted in the documents not being widely distributed and implemented by the member countries. Although certain countries are using some or all of the documents on most projects, other countries have retained their own documents because they exceed the minimum standards or appear to be continuing work with their old specifications and designs that were in place before the development of the new documentation. The problem has been complicated by the subsequent development of country specific design guides by certain member countries, which conflict with the SATCC documentation on certain areas (mostly materials testing), and appointment of some overseas consultants and contractors who continue to use the specifications and designs of their own countries. The availability of the documents in English only may also be contributing to the limited use of the documents in certain countries.

Numerous sets of documents have been distributed by CSIR, at the request of SATCC-TU, mostly it appears, to consultants and contractors on a project-by-project basis. Although documents have been ordered by companies in most SADC countries, most of the documents distributed were for projects in Mozambique, Zambia and Malawi. It is not clear to what extent documents have been copied and distributed by road authorities within member countries.

The establishment of the Association of Southern African National Road Agencies (ASANRA) has provided an ideal vehicle for the adoption, distribution and implementation of the documents. A proposal to hold a series of country workshops to facilitate this process has been submitted.

CONCLUSIONS AND RECOMMENDATIONS

The development of standard specifications and codes of practice for road and bridge design has been completed and the documents officially adopted as minimum standards for SADC countries. However, widespread implementation of the specifications and designs has not been satisfactory, with some SADC countries making wide use of the documents and others continuing to work with the specifications and designs that were in place before the development of the new documentation. This is attributed to institutional changes within SATCC-TU and in member countries. The establishment of ASANRA is seen as an ideal opportunity to implement the use of the documents on a wider and more formal basis.

The following recommendations are therefore made:

- Re-evaluate country specific documentation that has been developed since the release of the SATCC documents to ensure that they meet or exceed the minimum standard proposed and do not conflict with the SATCC documentation in any way.
- Hold a series of country workshops during which road authorities and engineers can be introduced to the documents and the benefits of using harmonised designs and specifications in the region explained.
- Translate the documents into Portuguese and French to facilitate implementation in countries where these languages are widely spoken.
- Establish a timetable for implementation and feedback on the use of the documents, after which time they can be reviewed and updated.
- Prepare country specific documentation, linked to the SATCC documentation, to address particular climatic, geological, geomorphological and traffic detail of each country where required.

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