

Review of UK Pavement Management Systems Core Functionality

Client:
Department for Transport

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Project summary

Approval	
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1. Introduction

The Department for Transport (DfT) has appointed TRL Limited and Atkins, through the DfT Research Framework contract, to review the UKPMS core specification in the light of the Halcrow¹ and Ebert² reports, to ensure that it addresses local authorities' future highways data analysis needs.

The objective of the commission is to produce an outline of the core functionality for highways engineering software systems (the core functional specification) which will provide the template required to replace the current UKPMS core specification. This will identify the minimum functionality that all PMS should embody, to ensure it addresses local authorities' future highways data analysis needs for UK local roads.

2. Context

The UK Pavement Management System specification was developed during the 1990's, recognising the need for a robust, practical tool to assist local authorities in managing and processing information about their road pavement assets. UKPMS provides a standard framework that combines data collection with decision making processes, and is the national standard for management systems for the assessment of local road network condition and for the planning of investment and maintenance on paved areas of roads, kerbs, footways and cycle-tracks on local roads within the UK.

A strategic review of UKPMS was undertaken by the Halcrow Group in 2005. This recommended that a fundamentally revised UKPMS be adopted as the prescribed core for pavement management systems on local roads in the UK.

A follow-up inquiry, undertaken by Dr Mike Ebert in 2006, established that development of this revised system could not be delivered purely through commercial channels, and that a degree of central funding and direction would continue to be required.

¹ Halcrow, UKPMS Strategic Development Study, March 2006.

² Dr Mike Ebert, UK Pavement Management System Strategic Review - Development of Commercial Development Environment, November 2006.

3. The project specification

The project specification sets out the requirements and objectives. There are three elements to this commission:

- determining the priorities for support and promotion of technological capabilities;
- developing the core functional specification³;
- mapping the agreed core functional specification to an indicative timetable and budget.

3.1 Determining the priorities

The aim of the first element is to produce a rationale for commonality of functions across local authorities and systems.

- Both the Halcrow and Ebert reports considered this in part, and it is not intended that the current project should re-cover that ground.
- A brief review of the previous work is envisaged, to take account of developments since the two reports were completed.

The review will look at the wider context of the PMS; in particular, it will have regard to:

- the increasing importance of an asset management approach,
- the need for asset valuation,
- Scanner functionality,
- outstanding issues from the Ekins-Hawker report, and
- the potential for making better use of existing research.

3.2 Developing the core functional specification

Each component proposed for inclusion in the core should be grounded in a firm rationale, based on such issues as:

- the need for common reporting standards;
- the need to work with other software standards such as GIS; or
- the need to ensure that local authorities can straightforwardly switch software systems if they wish.

It is important that commonality is not suggested purely on the grounds that local authority engineers say that they would like it.

The core functional specification should distinguish between:

- things that a good PMS should do (for UK local roads) (the state of the art);
- things that all PMS need to do in the same way (for UK local roads) (the common core); and
- techniques (for UK local roads) that would benefit from research being conducted centrally.

This project is primarily concerned with defining the second of these. The aim is not to produce a statement of the state of the art.

³ The term 'core specification' is used in place of "core functional specification" in this document for brevity and readability.

This project will throw up areas which, while not contenders for inclusion in the core specification, nevertheless would benefit from some preferred (or 'best practice') specification. These should form a secondary list and may include some areas where centrally commissioned research might be considered.

The Ebert report recommended that '*consistent with the principle of logical specification for UKPMS, the technology options should be left open in UKPMS*' (§4.5(1)).

Accordingly, the priorities identified will need to be considered as outcomes rather than processes. That is, **the core functionality will consist of activities which local authorities all need to do, not a specification of the IT processes which will achieve them.** The aim will be to provide as much flexibility as possible for both local authorities and product developers alike. Nevertheless, this project will also have to have regard to interoperability, both to allow software suppliers to compete for business, and to encourage development.

Although, as the Halcrow report notes, "*UKPMS was originally developed as a performance specification*" (§8.7), it has acquired specific procedures of its own, and has come to be seen in some cases as a 'bolt-on' to developers' systems.

A key aim of the present commission is to reverse this situation. As a general principle, therefore, **the revised core UKPMS specification should be expressed so as to minimize the impact on commercial systems' internal architecture and to maximize its integrability.** Among the guiding considerations for this review will be the return on investment and possibility of market innovation for each development.

The Department for Transport has been reviewing the National Road Maintenance Condition Survey (NRMCS). It has decided to use SCANNER data in future to report the condition of the English classified network at a national level. The Department is making separate arrangements for the development of tools to support future production of the NRMCS.

3.3 Mapping to a timetable and budget

Once the core functional specification has been agreed, the contractor will need to consider the costs and timing of delivering the core. This will need to take into account to whom costs are likely to fall, and the ability of the market (not just those currently UKPMS-accredited) to deliver. The Halcrow report has a costed development programme and, to the extent that it is applicable to the new agreed core, the current project should not duplicate Halcrow's work.

The budget and timing proposals should take account of where the industry is currently, and how it would be expected to migrate.

The contractor is not required to cost and time any 'desirables' ("*techniques that would benefit from research being conducted centrally*"), but such information as arises from the project should be included in the final report.

The delivery analysis should clearly distinguish between:

- research to determine how the real world behaves (a deterioration model, for example); and
- implementation of software that embodies the results of that research (a condition project module, for example).

At present, pavement management systems are certified as UKPMS-compliant through a two stage process of accreditation and an annual 'health check'. The contractor should consider how each component of the core could be assessed as compliant (without prejudice to the certification process that might be used).

4. Project delivery

4.1 Overall approach

Our overall approach to the project is shown in Figure 4-1.

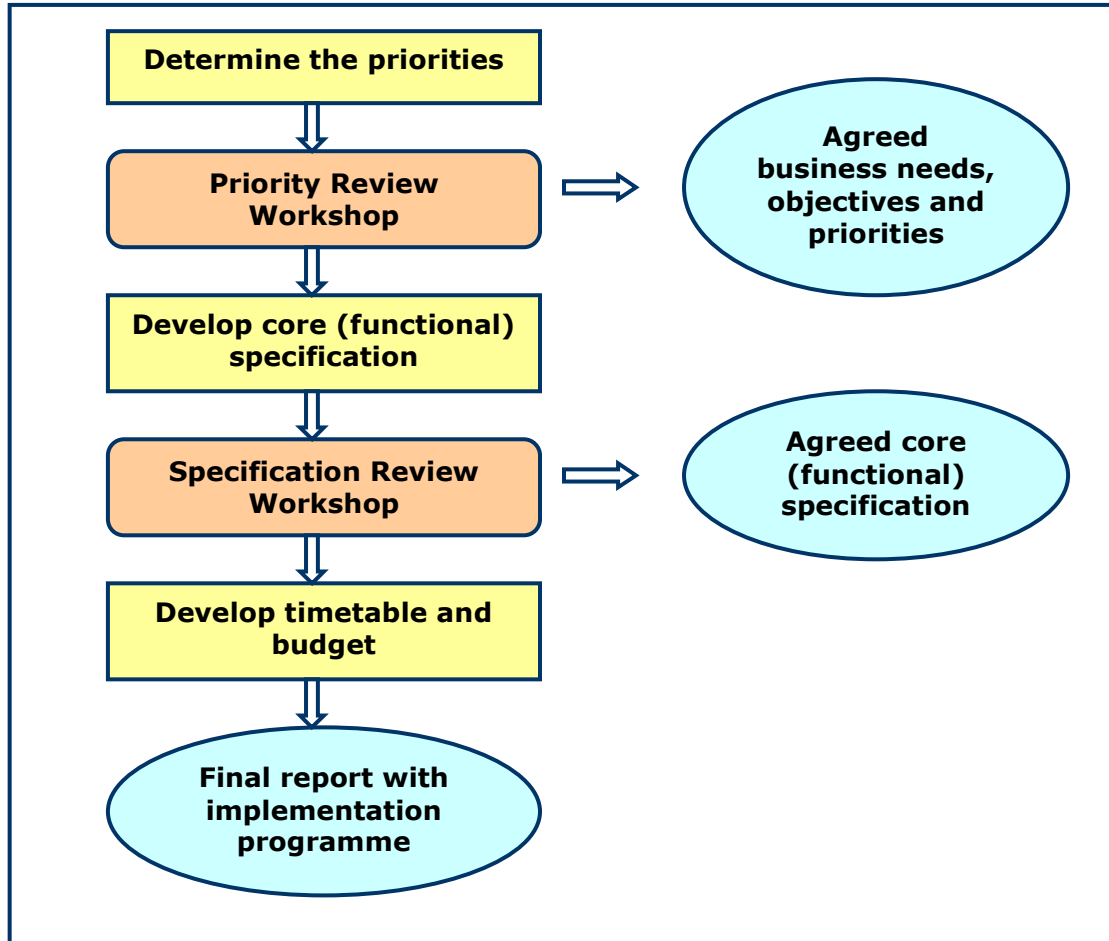


Figure 4-1 Outline approach

We have broken the project down into three phases.

- The first phase of the project (described in section 4.3) will identify the business needs, objectives and priorities for the UKPMS core specification.
- The second phase of the project (described in section 4.4) will determine the rationale for commonality of functions across local authorities and systems, building on the conclusions of the first phase. This will include identifying which elements should be in the core (functional) specification and which areas would benefit from a preferred or "best practice" specification. This will then enable us to develop the functional specification in more detail.
- The third phase of the project (described in section 4.5) will map the agreed functional specification to an indicative timetable and budget.

The project will culminate in the delivery of

- A core functional specification for UKPMS, and
- A final report incorporating all three stages of the project, for the approval of the project steering group.

4.2 Stakeholder involvement and challenge throughout the commission

We believe that a fundamental requirement of this commission will be to secure the support of the various groups of stakeholders for the proposed changes to UKPMS. We have identified several different groups of stakeholders (there may be others):

- There are four administrations (England, Scotland, Wales and Northern Ireland) that have overall responsibility for local road management policy.
- There are 150 local highway authorities in England, with very diverse road networks, with different requirements of their road networks and, by implication, of their pavement information management systems.
- There are 22 local highway authorities in Wales, 32 local road authorities in Scotland and 23 local road areas in Northern Ireland. Although these road networks are not as diverse as in England, there are considerable differences in the lengths of the networks, and the extent to which they serve rural or urban areas.
- There are five systems developers who have accredited systems to UKPMS.
- There are some other suppliers of commercial products, who already have a presence in the UK, who have expressed an interest.
- There are a number of organisations that supply services – management, consultancy and works – to local road and local highway authorities. These have an interest in pavement information systems, either as tools that they might use to deliver their business, or as commercial opportunities to develop and sell bespoke systems as part of a wider package of services.
- There are a number of organisations with a commercial interest in different types of machine survey, such as the Deflectograph, the Falling Weight Deflectometer, Griptest, Ground Penetrating Radar, SCANNER and SCRIM.
- There are a number of organisations with a direct interest in visual pavement condition surveys of various types, both within local authorities and the private sector, using both walked and driven surveys and supplying equipment for such surveys.
- There are a number of organisations with an interest in visual surveys to locate and identify inventory assets other than pavement condition, some of whom are developing new techniques, tools and approaches to record and store information about asset condition.

During the project we will hold two facilitated workshops with groups that represent the diversity of interests, as well as a range of expertise:

- One will be early in the project, to challenge and comment on our determination of priorities for support and promotion of technological capabilities.
- The other towards the end of the project, to challenge and comment on our proposals for the new core specification.

We intend that this process of review and challenge will lead to a final core functional specification that is embraced by developers and users, easing the later process of implementation.

4.3 Phase 1: Determining priorities

The aim is to identify the business needs and objectives that must be met by the UKPMS core specification, leading to a rationale for commonality of functions across local authorities and systems.

We will undertake a brief review of the Halcrow and Ebert reports to identify the priorities for the core specification of UKPMS resulting from these reviews. We will identify the key conclusions of these reports, review the developments achieved since their delivery (e.g. new tools for asset management such as SCANNER), and hence deliver a clear rationale for the future requirements of the UKPMS core specification.

Following the review of the previous work and subsequent developments, we will review the wider context of UKPMS. We believe there are two possible approaches to identifying the wider requirements for UKPMS.

- One approach would be very radical, to start from a “zero base” and question every element of UKPMS, building up the elements one by one.
- An alternative would be more evolutionary, starting from the existing position and knowledge, and making small modifications one by one, and considering the practicality of each change.

These different approaches could result in quite different outcomes, and require very different programmes for implementation. Therefore we will consider both approaches; bearing in mind the need for a realistic and practical specification that can be implemented.

Our wider review of the core requirements for UKPMS will therefore encompass

- The requirements for effective business management, the context in which UKPMS should provide service, including financial management; contracts and works management; and network and traffic management;
- The requirements of adopting an asset management approach, in terms of condition assessment, inventory, maintenance and valuation;
- Embracing the new functionality introduced by SCANNER and other new technologies – how a new UKPMS should cater for recent research and developments;
- The requirements for national reporting – how UKPMS could assist in the assessment of the asset at the national level.

We will ask the main stakeholders for their views, in particular the five developers with accredited systems, and other developers who have previously expressed views about UKPMS. We also intend to ask some of the more active users of UKPMS, some of whom have strongly held views about both the usefulness and the shortcomings of the current systems, to give us a range of views to help us develop our views on determining the priorities for the core of the new UKPMS.

We will collate all of the areas considered in Phase 1 in order to present what we believe local authorities will require within the core specification for UKPMS, including the reasons why they are needed, in relation to local authority business requirements and processes.

The proposed business needs, objectives and priorities for the UKPMS core specification will be presented for review at the first workshop with stakeholders, which we anticipate will be held in the week commencing 16th February 2009.

This will present stakeholders with an opportunity to challenge the proposals, and will help to determine whether any key elements have been missed from the

proposed list. We will summarise the requirements for the core specification, taking account of the feedback from the workshop.

4.4 Phase 2: Developing the core specification

The final aim of the second phase is to produce the core functional specification, based on local authority business requirements and processes.

There will be a need to convert the requirements identified in phase 1 into a core specification. This will include

- Confirming the set of requirements and distinguishing between the requirements necessary for inclusion in the core specification – “things that all PMS need to do in the same way for UK local roads” and those that could be considered more as best practice – “things that a good PMS should do”. Hence ensuring that each component for final inclusion is selected on the basis of a firm rationale;
- Addressing the practicality of achieving each of the core requirements within current PMS and emerging PMS;
- Proposing how these may be implemented – effectively adding detail to the outline requirements delivered in phase 1;
- Producing the core functional specification document.

Again, as part of this stage we intend to ask the main stakeholders for their views on each of the elements we propose for the core specification. We will seek agreement on the separation between common core requirements and, secondary “best practice” requirements (i.e. desirable but, following the review carried out in this phase, not required within the common core). We will identify the techniques that would benefit from further research being conducted centrally to inform the technical specification.

We will collate the details of the proposed core specification into a clearly presented list showing what we believe should be the core specification of the new UKPMS, what any good PMS should offer (the state of the art) and where there are gaps or techniques that would benefit from further research. This will be presented as a functional specification, rather than a detailed technical specification.

This will be taken to our second workshop for review by stakeholders. At this stage we will be at a point where there are firm proposals, and outline functional definitions, for each element of the core specification, and stakeholders will be again able to review and challenge these.

Following the workshop we will summarise what we believe should be contained within the core specification of the new UKPMS, what any good PMS should offer (the state of the art) and where there are gaps or techniques that would benefit from further research.

4.5 Phase 3: Budget and timing

The lifecycle for the development of successful Information and Communications Technology products includes several stages, as shown in Figure 4-2. The delivery of the core functional specification encompasses the first stage of this lifecycle. Once this work has delivered the first stage it will become the responsibility of the Pavement Condition Information Systems support contractor to drive through its implementation, by working with the PMS suppliers.

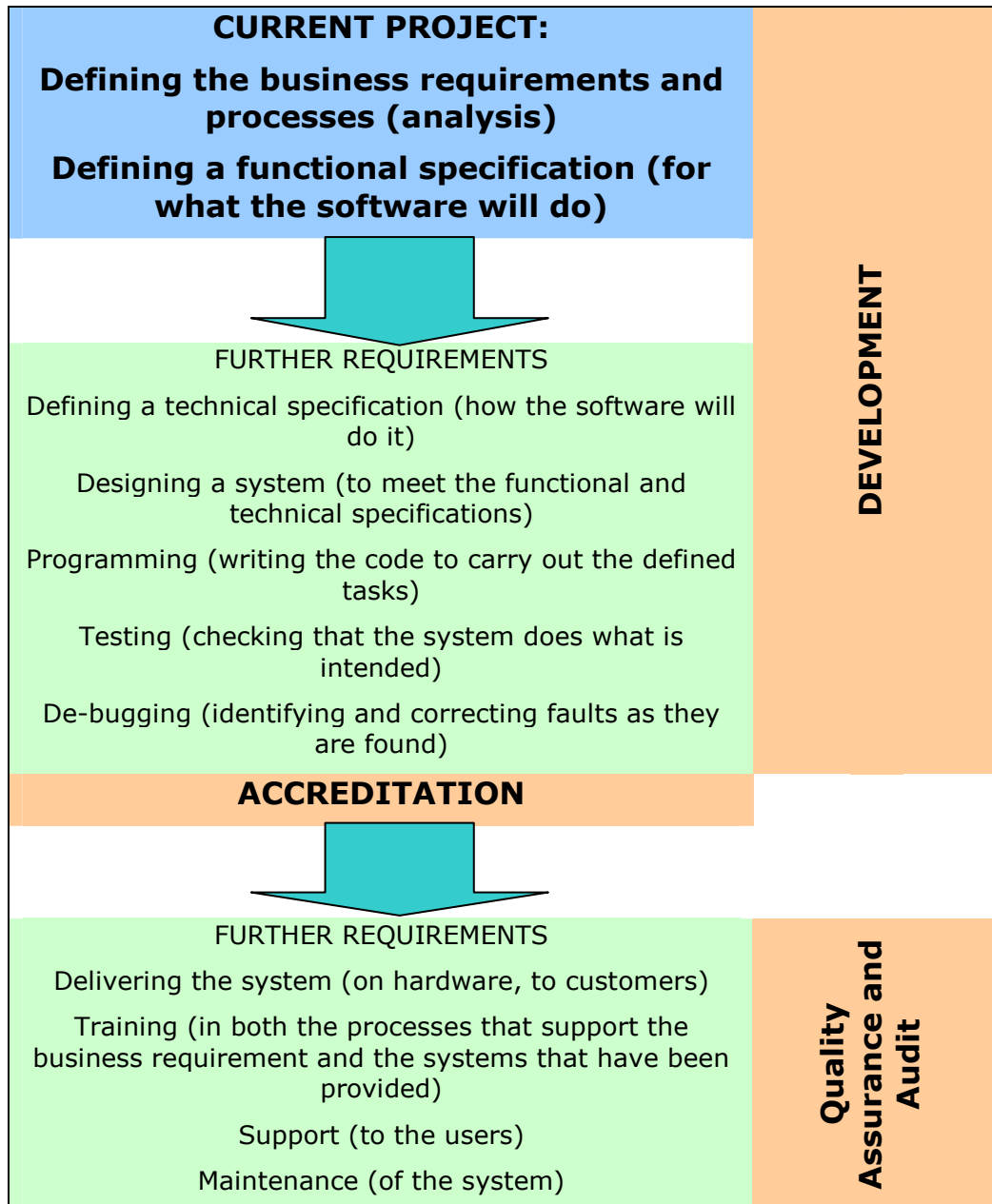


Figure 4-2: Life-cycle for an ICT product

The development and implementation of the new core functional specification will form the second and third parts of the life-cycle of the development of new UKPMS. These parts form the bottom half of Figure 4-2 (shown in green) and are not part of this project.

The aim of phase 3 of this project is to produce an indicative timetable and budget for the development and implementation of the new core specification. We intend to carry out much of this work in parallel with the previous two phases.

The project specification requires us to consider the costs and timing of delivering the core specification, to take into account where costs are likely to fall, and the ability of the market (not just those currently UKPMS-accredited) to deliver.

We intend to consider the cost and timing of our proposals at each stage of the project, rather than at the final stage, because we anticipate that the practicability of delivering our proposals and recommendations will depend crucially on who has to pay, how much they have to pay, and what they have to pay for.

Our vision, for the long term future of UKPMS, is that:

- It will exist to meet a technical need recognised by all local highway authorities.
- Local authorities will be willing to purchase the systems to meet their need, because they have found it to be the most cost effective way to do so.
- Local authorities will be prepared to pay a price for the systems that enables developers to recoup their investment in the core system, and to invest in developing additional functionality which they can sell at a fair price.

Our budget and timing proposals will take account of the “art of the possible”, based on the current state of the industry, both the developers with currently accredited systems, and those who may be interested in entering the market, and how they might be expected to migrate.

4.6 Final report

The output from this final phase of the project will be a detailed final report setting out:

- What local authorities need from the core specification, and why they need it, in terms of their business requirements and processes.
- What should be contained within the core specification of the new UKPMS.
- A functional specification for the core of the new UKPMS.
- Recommendations on elements identified within the project that should be considered under the title of “what any good PMS should offer”, but are not required for core functionality.
- Where there are gaps or techniques that would benefit from further research.
- What the budget and time constraints are for each core component.
- An indicative timetable and budget for the development and implementation of the new core specification.

This report will be presented in draft for the project steering group to review by 15th May 2009.

5. Timetable

The project specification requires this project to be completed within six months, and we have planned our timetable accordingly (Figure 5-1). The project commenced on 14th November 2008 and we plan to complete the work by 15th May 2009.

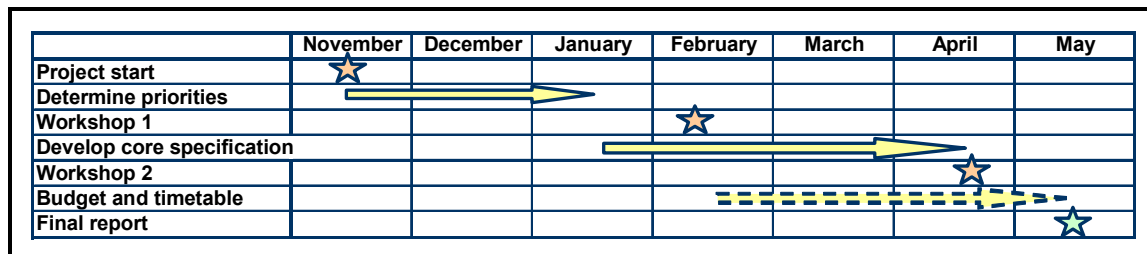


Figure 5-1 Outline programme

This project sets the whole process of UKPMS redevelopment in motion, and we understand the importance of completing this work as swiftly as possible, so as not to delay the development of UKPMS.

However, as this is possibly the single most important stage in the development and implementation of the new UKPMS specification, the quality of the recommendations is of key importance. There is therefore a balance between achieving high levels of quality and the risk to slippage of timetable.

We intend to employ workshops to seek input, direction, feedback and critical review on our proposals for the core specification. We feel this is essential for achieving good quality with “buy-in” from local authorities and industry.

5.1 Phase 1 – Determining priorities

The first workshop will be held in the week commencing 16th February 2009, probably in central London.

5.2 Phase 2 – Developing the core specification

The second workshop will be held in the week commencing 20th April 2009, probably in central London.

5.3 Phase 3 – Budget and Timetable

We intend to deliver our draft final report on 15th May 2009.

6. Background

6.1 The UKPMS Strategic Development Study

The UKPMS strategic development study (Halcrow report) was commissioned to review the role of UKPMS and the strategic direction that future development and implementation should take. The study considered:

- Whether a nationally prescribed system was required, and if so
- Whether a fundamental redesign was necessary to reflect more closely present needs and technology.

The study reported that:

"The general view seems to be that the present system is not used to its full potential, primarily because it is not user friendly, users have little confidence in its outputs, and because it is not seen as adding value to the management process. The evolution of the system and its benefits are not always fully realised and for many users the boundary between UKPMS and their developer's Pavement Management System (PMS) is not clear."

"It is not a government requirement for authorities to show that expenditure on their networks is optimal. One of the main criticisms of the existing system is that it requires significant resources but provides insufficient benefits. The system is often seen merely as a repository for routinely collected data, but providing no useful, trustworthy information. It is considered to be a very expensive tool just to provide the BVPI values each year."

The report recommended that:

"A fundamentally revised UKPMS is adopted as the prescribed core for Pavement Management Systems in the UK. It should comprise the key mechanism for encouraging the delivery and support of consistent practice in Highway Pavement Maintenance Management and Asset Management."

"It will be promoted as the cornerstone of a national strategy for providing data at a local level and for monitoring local authority roads. It will be developed progressively to support the adoption of Asset Management practice including valuation of pavement assets and estimation of the maintenance backlog."

*"UKPMS should be **leaner, fitter, and funded**"*

"Funding for support and development should be assured for a minimum of five years."

The report set out a proposed development programme in three phases over four years, commencing at the end of 2005 (three years ago).

6.2 Development of commercial development environment

The UKPMS strategic review (development of a commercial development environment, Ebert report) was commissioned to address six questions about the potential for commercial development of UKPMS:

- The market for such software (around 230 local authorities across the UK) is small and saturated. **Do local authority software procurement arrangements encourage migration over time towards more effective and cost-efficient systems?**

- Only five software developers have successfully gained certification as UKPMS compliant. **If such compliance were replaced with a non-compulsory best practice specification (with, perhaps, an accreditation scheme), would more developers enter the market?**
- Given the size of the potential market, **can we expect software developers to offer, without significant public sector investment, their own enhancements to the existing state of the art?**
- If the public sector were to conduct research and make its results freely available, **could the software industry be relied on to incorporate them into new or improved products without financial incentives to do so?**
- **To what extent is are (a) the existing arrangements; and (b) a more commercial, hands-off approach, consistent with the Departmental policy framework for intelligent transport systems?**
- A major component of Halcrow's suggested way forward is to encourage greater use of pavement management IT in local authorities. **How could individual software developers be encouraged to bundle this with their products?**

In summary, Dr Ebert concluded that:

- UKPMS should be carried forward into the future. It should be underpinned by clear business and information and communication technology (ICT) strategies under the Roads Liaison Group.
- Each agreed functional area should be underpinned by clear and firm policy, at both national and local level, identified where necessary by research.
- The Department for Transport and the local authorities should both clarify their business needs and objectives.
- It would make sense to take forward the various developments with the ITS Policy Framework clearly in mind.
- The Department for Transport should continue to take a lead role in the support, development and funding of core UKPMS, and local authorities should continue to take responsibility for ensuring that their own needs are articulated and funded appropriately.
- The role of the UKPMS Steering Group should be to identify developments to UKPMS that are consistent with national and local policy, and decide which developments to include in core UKPMS, and which to leave outside to be procured from the individual PMS developers.
- If UKPMS is to continue to be a useful strategic tool it will need to be brought up-to-date.
- The most obvious mechanism for taking UKPMS forward is to launch a UKPMS Development Programme containing a number of projects, including an initial functional review of the existing UKPMS, and various projects for taking forward the identified functional upgrades to the system.
- The existing UKPMS functions should be reviewed for current relevance and inclusion or exclusion, perhaps leading to a smaller UKPMS core. The review should also cover the need for the other main functions highlighted in the Halcrow Review, notably
 - Asset Management,

- Scheme Support, and
- Finance and Accounting functions
- Consistent with the principle of a logical specification for UKPMS, the technology options should be left open in UKPMS.
- The interface definitions should be re-visited and updated, but specific user interfaces like Geographical Information Systems (GIS) should not be included in the core UKPMS.
- UKPMS should continue to define the rules and BVPIs, which UKPMS allows to be collected consistently.
- There is a tension between
 - the argument for Department for Transport support of UKPMS – because efficient IT systems have great potential to assist highway engineers, and
 - the argument against – because many local authorities do not in fact use UKPMS, despite possessing the technology.

6.3 Recent Developments

Since the completion of the above work, there have been significant developments in highway asset management. Following the publication of the CSS Framework for Highway Asset Management (July 2004) and the Roads Liaison Group's Guidance Document for Highway Infrastructure Asset Valuation (July 2005) there has been extensive adoption of Highway Asset Management Plans (HAMPs) and Transport Asset Management Plans (TAMPs) in England, Scotland, Wales and Northern Ireland. In England, for example, in the guidance on preparing Local Transport Plans (second edition, published in January 2006) the Department for Transport encouraged local authorities to draw up Transport Asset Management Plans (TAMPs), informed by their Local Transport Plans and other services and corporate plans.

There have also been significant developments in survey technology. In 2005 the SCANNER specification was being used for the first time in England (following the TTS specification that was used in 2003/04 and 2004/05), the B and C roads were being surveyed for the first time, and the SCANNER Road Condition Indicator was being developed by the Defects Index Working Group. Since then there have been three years of surveys in England using SCANNER accredited vehicles, covering the A and B roads at least twice in one direction and once in the other, and the whole length of the C road network in one direction, providing a comprehensive set of measurements. The SCANNER specification has also been adopted in Scotland for the SRMCS, in Wales for the national performance indicators and is being used in Northern Ireland for the first time this year. Last year (2007-08) more than 120,000 km were surveyed in Great Britain using the SCANNER specification.

The SCANNER survey itself has also undergone significant development, stimulated by the research programme. The research, to which TRL made a key contribution, led to the delivery of new methods for measuring condition in ride quality, edge condition, cracking and texture variability. These have been rapidly implemented via the SCANNER Accreditation and QA process, and delivery of these new measures commenced in the 2007/08 survey data.

Other research has been completed on Highway Service Levels and smaller, quicker, cheaper automated carriageway surveys miniSCANNER⁴, and the SCANNER RCI has been revised to reflect engineers' requirements more closely.

In England, Scotland and Wales automated carriageway condition surveys have been adopted as the basis for national performance indicators on the condition of road carriageways and people are increasingly looking to them as a basis for valuing the condition of the pavement asset.

6.4 Meeting local authority future highways data analysis needs

Local authorities need to be able to analyse highway data to support various decision making processes. These processes feed information into several different areas covering local authority policy, strategy and finance. Information is required for strategy and policy which may be defined in many ways, including the LTP and HAMP/TAMP. Information is also required for budgeting purposes, which may start by being analysed at a network level but which ultimately relates to the need for the design implementation of individual schemes. Finally the information also informs as to whether the objectives of policy and strategy are being met and whether the budgets are being used wisely. The type of detailed information and analysis that may be required therefore includes:

- How much money is required to maintain the road network now and in the future?
- How should expenditure be prioritised to meet budgets and Best Value requirements?
- What are the effects of budget uplift or constraints on current and future objectives?
- What are the most cost effective treatments based on condition and budget?
- What is the most effective timing for the treatments?
- Are set service levels being achieved or how can they be met?
- How are decisions affecting the value of the asset?
- What are the KPIs and how are they changing with time?

In determining the core functionality of UKPMS for the future a thorough understanding of the current and future requirements of the local authorities using the system is essential. This also needs an understanding of the policies and strategies of central government and how these will determine the information that will be required for local authorities to report.

⁴ Gallagher K A, Wright A, King P C, Pickett A, Smaller, Quicker, Cheaper Automated Carriageway Surveys, TRL Published Project Report, PPR 290