

Success Factors for Road Management

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Project Overview



- **Funded by Transport and Rural Infrastructure Services Partnership (TRISP)**
- **Goal: identify factors contributing to the successful implementation of road management systems (RMS)**
- **Findings should influence future TORs**



Approach

- Project developed a standard questionnaire covering all aspects of RMS development and implementation
- Consultants visited 21 agencies in 17 countries for 1-2 days for interviews
- Focus on national road agencies, but some provincial agencies included
- Interviewed a range of personnel, usually in planning, asset management and IT
- Direct surveys allowed for in depth interviews and exploring responses



Team

Kevin McPherson	Lead Consultant/Report Author Indonesia and USA
Chris Bennett	Manager/Report Co-Author India and Bangladesh
Sukomal Chakrabarti	China
Zuwei Deng	Bukina Faso and Cameroon
Arnaud Desmarchelier	Argentina, Chile Costa Rica, and Uruguay
Gerardo Flintsch	Botswana, Mozambique, and Tanzania
Jens Hede	New Zealand and Papua New Guinea



Agencies

Country	Organization	Length of Road Network Under Management (km)	Year of System Implementation	Year of Advanced Planning / Programming Capability
Argentina	Provincial Highway Directorate (DVP), Santa Fe	14,179	2002	2002
Bangladesh	Roads and Highways Department	21,522	1996	2000
Botswana	Ministry of Works and Transport, Roads Department	8,916	1993	1996
Burkina Faso	Ministère des Infrastructures, du Transport et de l'Habitat (MITH)	15,271	2000	2000
Cameroon	Direction des Routes	49,143	2000	2006



Agencies Continued ...

Chile	Ministry of Public Works	80,672	1980	1985
China	Fujian Provincial Highway Administration Bureau	36,000	2002	-
China	Henan Highway Administration Bureau	70,000	2003	2003
China	Hubei Provincial Highway Administration Bureau	89,674	2003	-
Costa Rica	Ministry of Public Works and Transportation (MOPT), & National Road Board (CONAVI)	7,424	1998	1998
India	National Highways Authority of India (NHAI)	24,000	Developing	1997
India	Public Works Department, Government of Kerala	22,991	Developing	2005
India	Public Works Department, Government of Rajasthan	82,024	1996	1996
Indonesia	Directorate General of Regional Infrastructure	35,000	1985	1990



Agencies Continued ...

Mozambique	Administração National de Estradas (ANE)	12,902	1997	1997
New Zealand	Transit New Zealand (TNZ)	10,786	late 1980's	1998
New Zealand	Papakura District Council	280	1998	1998
Papua New Guinea	Department of Works	27,500	2000	2004
Tanzania	Ministry of Works, Tanzanian National Roads Agency	28,892	2001	2002
Uruguay	National Highway Directorate (DNV)	8,680	1999	1999
USA	Vermont Agency of Transportation	5,310	1995	1995

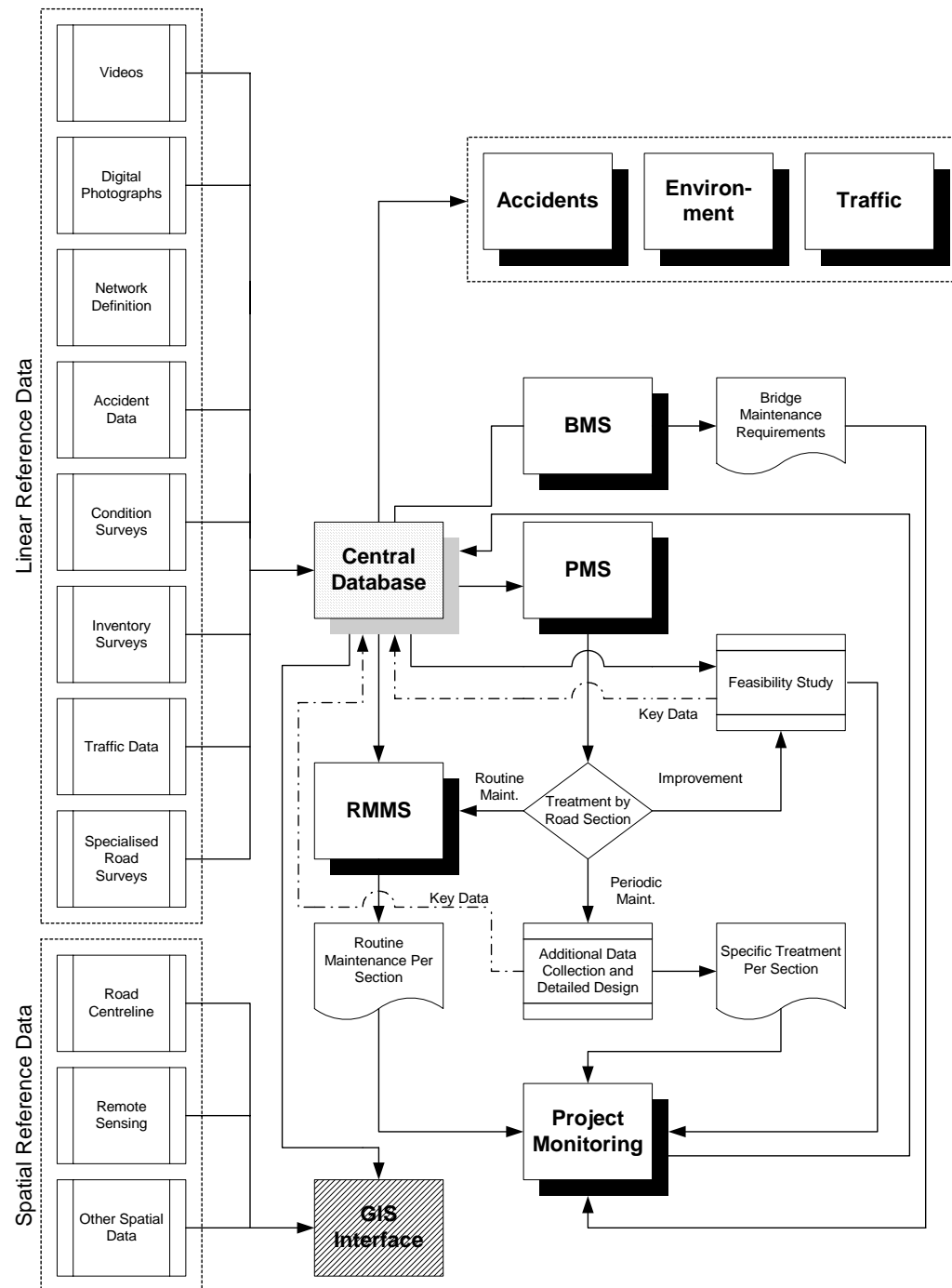


Key Definitions

- **An RMS any system that is used to store and process road and/or bridge inventory, condition, traffic and related data, for highway planning and programming**
- **Associated with the RMS are appropriate business processes to use the RMS to execute the business needs of the highway agency**



RMS Framework





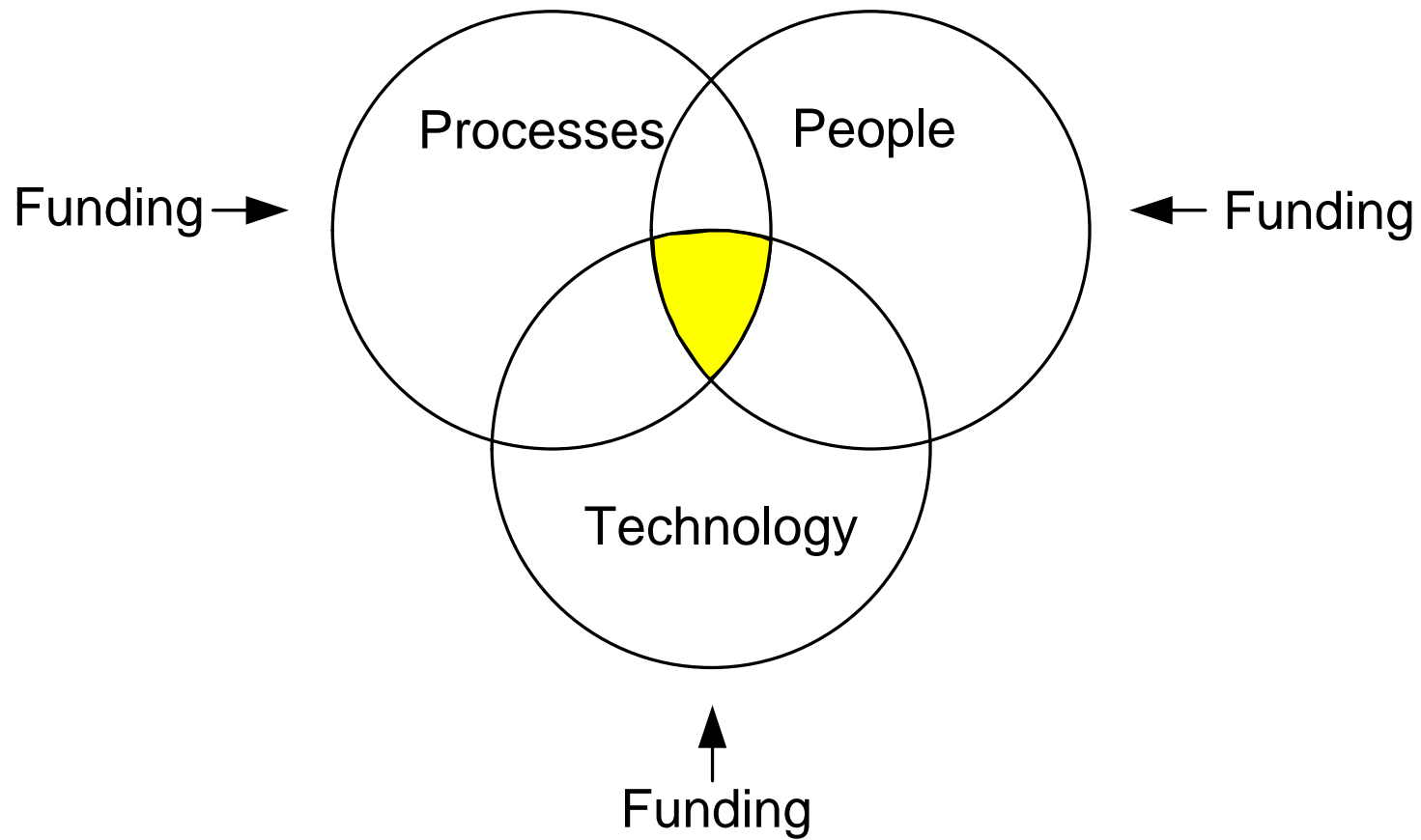
RMS Functions



- **Major activities include:**
 - **Needs Assessment;**
 - **Strategic Planning, including budgeting for new development and asset preservation**
 - **Development, under budget constraints, of multi-year works expenditure programs**
 - **Data collection**
- **Project focus:**
 - **Data collection**
 - **Central database**
 - **Pavement management system**



The Key to Success





Processes



Processes

- **Key Success Factor:**
 - **The RMS must have an active role in the agency**
- **To Achieve This:**
 - **The RMS must be an integral part of the agency's monitoring and planning process**
 - **Outputs should be used to prepare annual reports to ensure data are regularly collected and the system applied**



Annual Reports

- Provide a structured framework for reporting the performance of the agency and plans
- Elements typically include
 - Key performance indicators
 - Five-year goals
 - Annual asset management plan
 - Financial plan
- Relying on RMS for input to report helps ensure sustainability



Annual Report Extract – Transit New Zealand

Level of service and standard	Actual 2001/02	Actual 2002/03	Target 2003/04	Actual 2003/04
	Percent			
Percent of network classified as smooth	99	99	97	99
Percent of expectation of smooth travel	99	99	97	99
Percent of network <20mm ruts	99.9	99.8	99	99.6
Percent of network with good skid exposure above threshold level	99	99	98	99
Percent of network with texture greater than 0.5mm	99.5	99.6	98	99.5

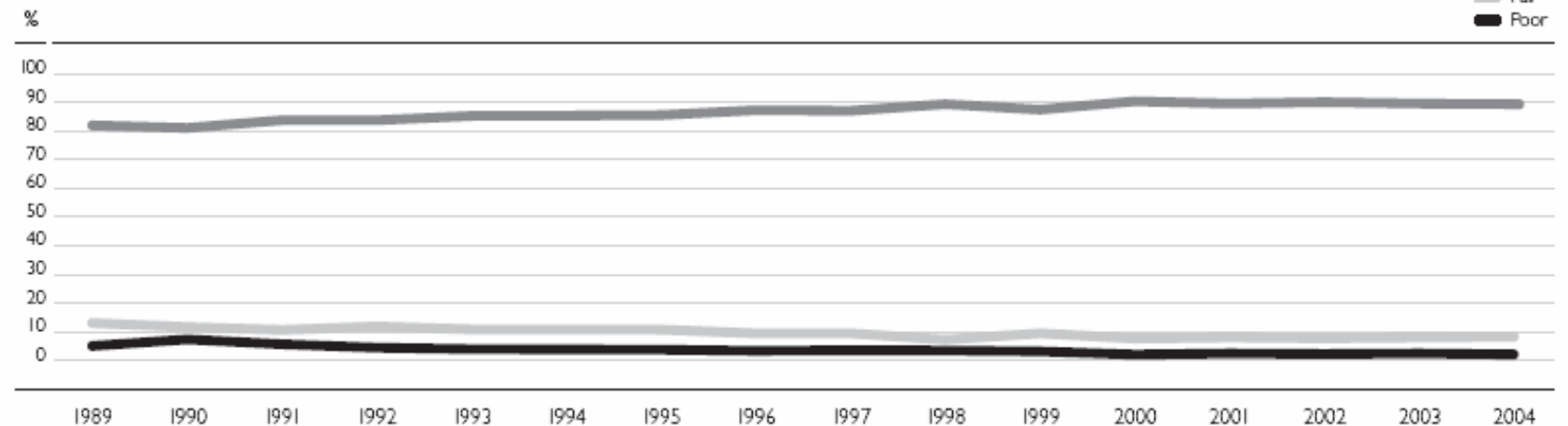


Annual Report Extract – New South Wales RTA

FIGURE 01: Trends for Fatalities Since 1978



FIGURE 02: Ride quality on State Roads (including National Highways)



Needs Assessments

- **Key functions of RMS to:**
 - **Justify budgets**
 - **Direct investments where most benefits**
- **Needs analysis ‘unconstrained’ analysis which determines total network needs**
- **Only about half agencies perform such an analysis**
- **One third who could do the analysis do not**

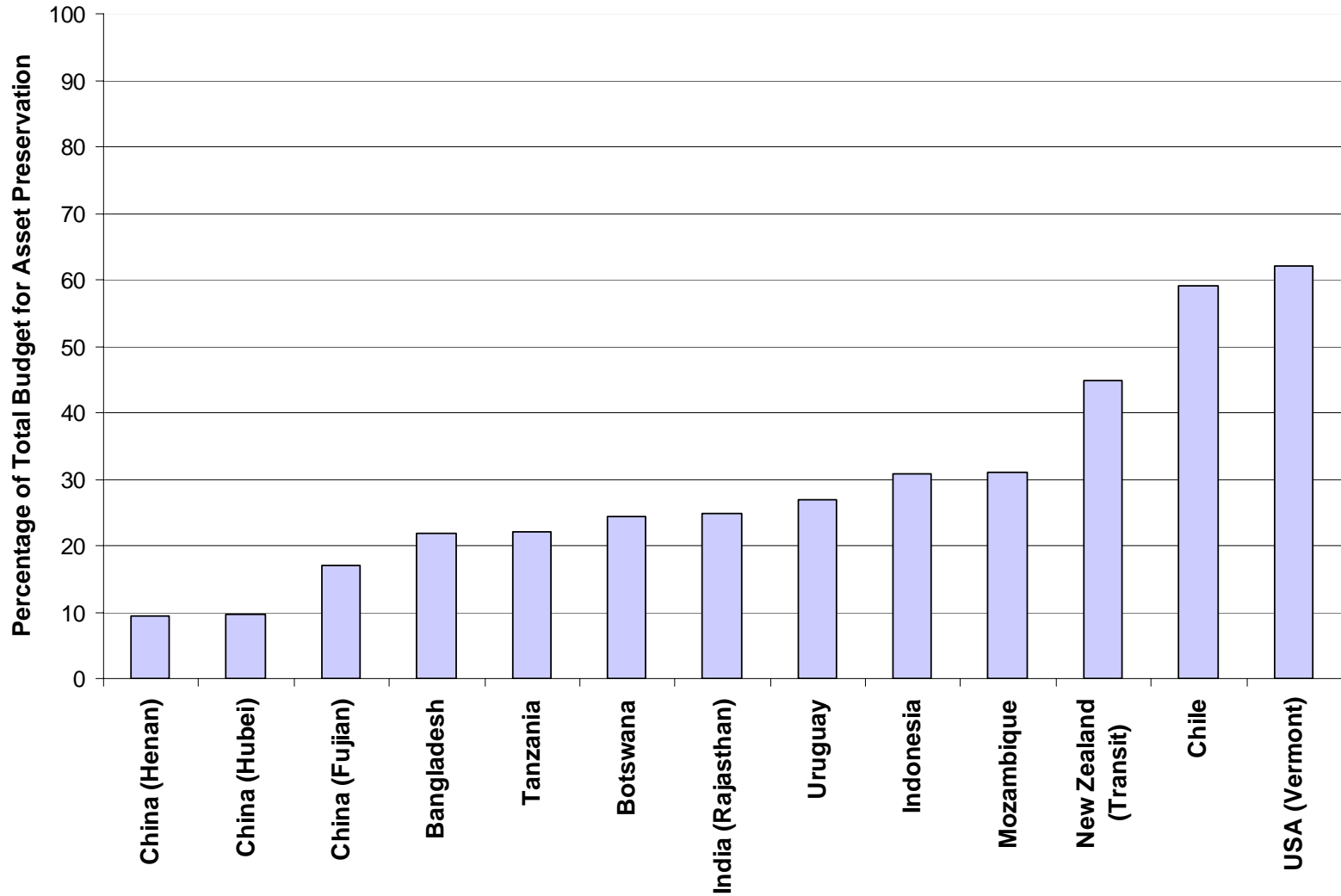


Asset Management Budgets

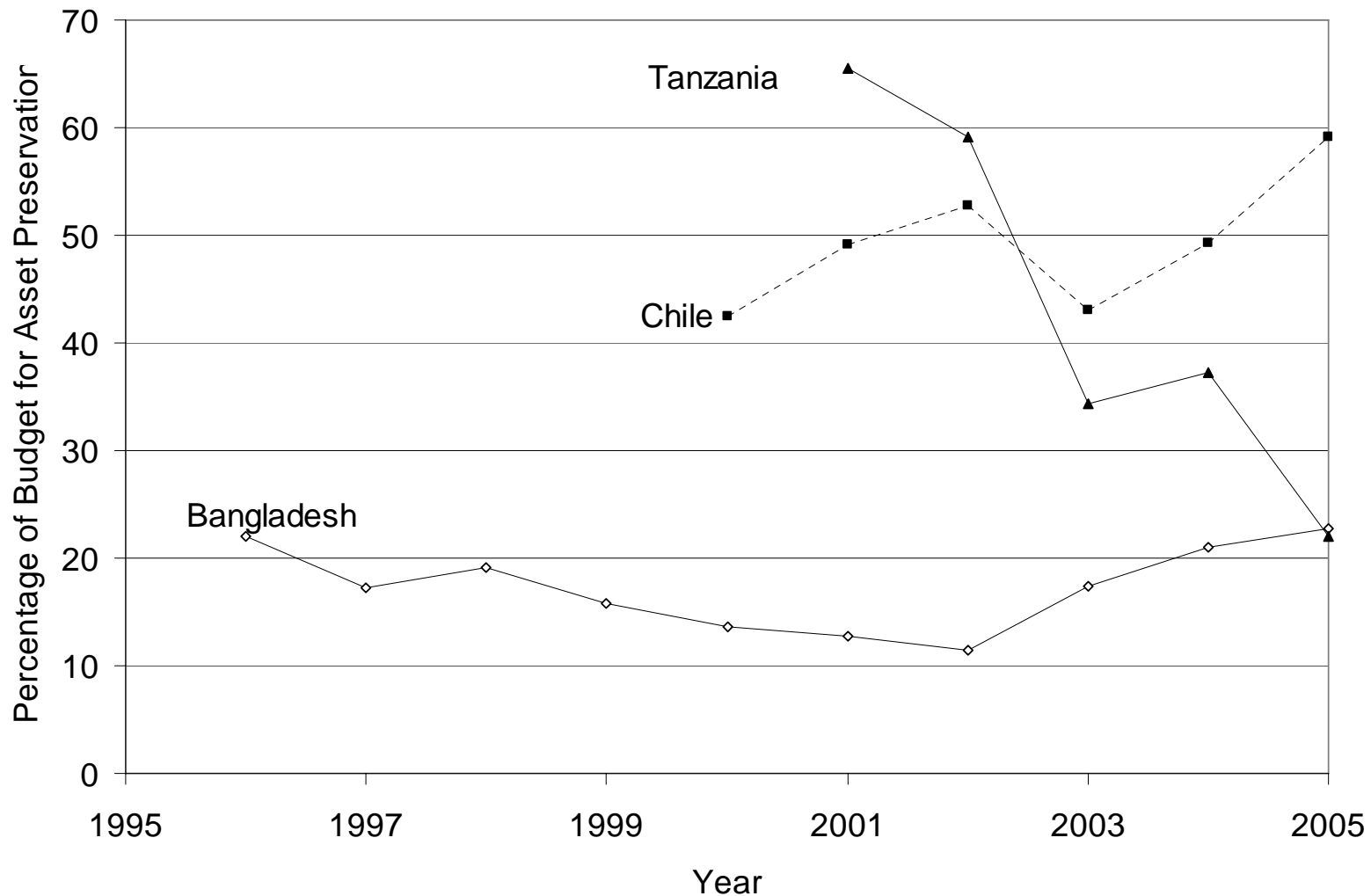
- Sign of effective use of RMS is effective use for allocating funds to maintenance
- Study found wide variations between agencies



Budget Allocation For Asset Preservation



Comparison of Budget Allocations Over Time





Asset Value



- Often used as key performance indicator
- The value of the road network over time good reflection of investment needs
- Only New Zealand and Vermont do this analysis



Example of Asset Value Reporting – New Zealand (2002)



Description	Actual			Previous Year		
	Replacement Cost (\$M)	Accumulated Depreciation (\$M)	Depreciated Replacement Cost (\$M)	Replacement Cost (\$M)	Accumulated Depreciation (\$M)	Depreciated Replacement Cost (\$M)
Roads	11,145	1,463	9,682	10,320	1,418	8,902
Bridges	2,831	1,187	1,644	2,692	1,122	1,570
Other	806	186	620	757	173	584
Total	14,782	2,836	11,946	13,769	2,713	11,056



Accuracy of Forward Work Program

- Most RMS used to prepare forward work programs
- Predict future investment needs on section-by-section basis
- Prior to implementation agencies need to conduct a “hit-rate” analysis to confirm correctness of predictions
- Only 4 of 17 agencies (Chile, NZ x 2, Vermont) performed such an analysis



Agency	Implementation of Planning / Programming Capability	Hit Rate Analysis
Argentina (Santa Fe)	2002	No
Bangladesh	2000	No. Planning on doing one in 2006 after condition data updated in 2005
Botswana	1996	No
Burkina Faso	2000	Calibration test sections only
Cameroon	2006	No
Chile	1985	Yes
China (Fujian)	No	No
China (Henan)	2003	No
China (Hubei)	No	No
Costa Rica	1998	No
India (Rajasthan)	1996	Not done
India (NHAI)	1997	System being Developed
Indonesia	1990	Preliminary
Mozambique	1997	No
New Zealand (TNZ)	1998	Yes
New Zealand (PDC)	1998	Yes
Papua New Guinea	2004	No
Tanzania	2002	No
Uruguay	1999	No
USA (VTrans)	1995	Yes



Implementation of RMS Program



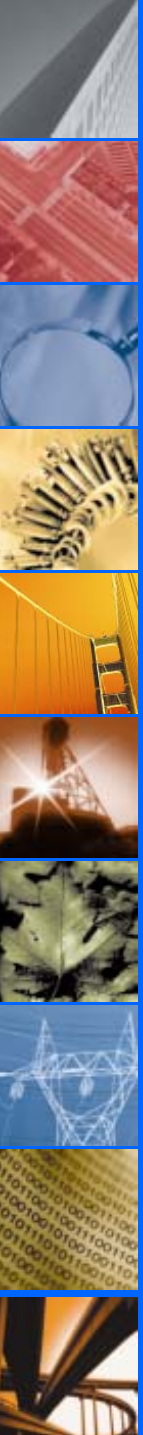
- **What is the degree to which the actual predicted program is implemented?**
- **Indication of importance of RMS to planning process**
- **Few systems designed to monitor this**



Key Success Factors - Processes

- Agency must follow basic asset management principles
- Annual Reports/Business Plans should be prepared using RMS outputs to monitor performance
- Asset value should be monitored
- Must be commitment of leadership to RMS
- Provide annual budgets for data collection and operation of RMS
- Have policies and procedures for RMS operation, data collection, and other processes
- Need a program of continual quality improvement and auditing





People



People

- **Key Success Factor:**
 - **The RMS must be fully institutionalized and supported**
- **To Achieve This:**
 - **There must be an organizational unit to manage, monitor and continually improve the RMS**
 - **Unit must have appropriate staff, clear job responsibilities, sufficient budget, clear reporting lines to upper management**





Institutionalization



- **NZ and USA have well institutionalized and supported systems**
- **Few agencies interviewed in developing countries have ‘institutionalized’ their RMS**
 - **12/21 had no job descriptions for RMS staff**
 - **10/21 had no formal data QA procedures**
 - **12/21 did not perform hit-rate analysis**



Comments from Agencies

- **Tanzania:** “ambiguous job descriptions with overlapping tasks... it has not been clear who was doing what”.
- **Argentina:** “Approximately ten staff members were trained and almost all have left the group”
- **India:** “The inventory updating was not completed ... because the person making the efforts left on a 5-year leave”
- **Botswana:** “The PMS section comprises five positions, but all were vacant at the time of the survey”



Training

- Need to ensure that staff are trained in all elements of the RMS, from data collection procurement through management
- Most agencies claimed 5-10 days a year of training
- Bangladesh supports higher education (eg master's degrees)
- Several countries reported training was carried out only at the end of the project just before consultant demobilized
- Few, if any, projects had produced complete (or any) training materials



Continual Quality Improvement

- **Quality management vital to the success of any business enterprise**
- **Those agencies that have successfully used RMS for several years have commitments to QA**
- **No system, and no organization, is static. Continual effort is required to improve it at all times**





Key Success Factors - People



- Organizational unit dedicated to RMS
- Budget allocated for all aspects of system
- Clear job descriptions and a career path
- Jobs filled with appropriate quality staff
 - Road network management
 - Data collection
 - Data QA
 - Management reporting
- Continual training and development
- Commitment to continual improvement





Technology





Technology



- **Key Success Factor:**
 - **The IT components should be appropriate**
- **To Achieve This:**
 - **Need a strong IT division – or outsource**
 - **Need an IT strategy**
 - **RMS must fit into IT strategy**
 - **RMS must be properly supported from an IT perspective**





IT Management



- **IT a challenge to all organizations**
- **Any sizable organization implementing an RMS should have a separate IT division**
- **They need to define**
 - **IT Policy**
 - **Strategy for development and use of IT across the agency**
 - **Consistent IT implementations**
- **Findings:**
 - **5/21 agencies had no separate IT Divisions**
 - **6/16 remaining had significant IT vacancies**
 - **About 50% of agencies short of basic IT staff**



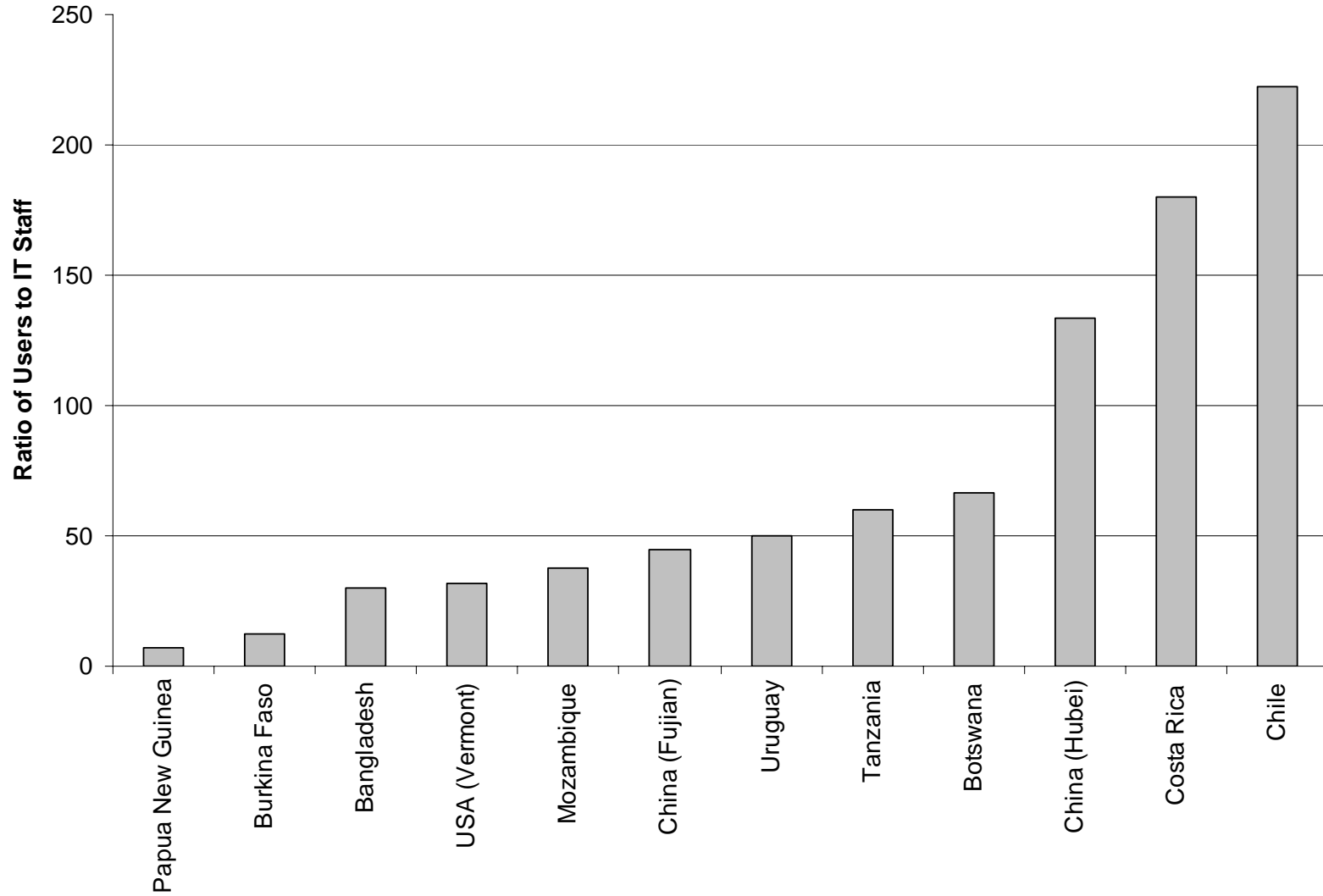


IT Support?

- 2/21 reported that IT Division does not bother with Planning Division needs: more concerned with other business functions such as financial management
- General impression in IT Divisions of road agencies that Planning Divisions do not perform a critical function and therefore do not get high priority for IT funding and support
- Few agencies have sufficient IT budget overall



Ratio of Users to IT Staff



IT Architecture and Standards

- **‘Technology Architecture’ is a series of principles, guidelines and rules directing the IT process**
- **Framework which all IT infrastructure should be established**
- **Should support applications and data required to perform business functions**
- **Without formal architecture and procurement control there will be a piecemeal IT implementation resulting in higher costs and reduced efficiency**



Commercial Off-the-Shelf (COTS) Software

- Most large commercial organizations have policy of using COTS instead of custom software because:
 - Lower cost
 - Independence – many consultants Timeframe – implemented much faster
 - Experience – reflects inputs and testing from a larger number of users
 - Functionality – more functions
 - Ongoing development – continual upgrades and improvements
 - Exchange of ideas – conferences and other users





COTS - Disadvantages



- **Requirements – Functionality may not be *exactly* what is required**
- **Customization – time to develop new ideas may take longer since other clients also need to be taken care of**
- **Cost – agency may have problems meeting ongoing support and maintenance agreements**



COTS - Recommendations

- COTS from a good supplier is almost *always* preferable to custom development
- Many packages available
- Careful review and assessment required prior to procurement
- Biggest issue is that client's business processes do not exactly match the software
 - Software can usually be modified
 - Often, business processes should be improved





Outsourcing

- IT infrastructure is complex, and getting worse
- Outsourcing often beneficial to agencies
 - Ensures up-to-date skills are available
 - More in depth support (often 24 x 7)
 - Often faster response times (no funding limitations)
 - Eliminates staff recruitment and retention problems
- Requires strong, local IT companies
- Some larger RMS suppliers host both software and data with access through VPN





Integration with HDM-4



- Many RMS systems have had custom interfaces developed with HDM-4
- Few have been successful, although COTS are generally better
- TORs too vague on requirements:
 - “*The Consultant shall integrate the client’s Road Management System with HDM-4*”
- Consultant’s also under-estimated the task of interfacing
- Must ensure that TORs are explicit with the interfacing requirements and expectations of clients



Web-Enabled Systems

- Many TORs call for “web-enabled” RMS
- Prior to deciding to web-enable need to determine:
 - Is this required?
 - What is the scope of the web-enabling
- Issues:
 - Internal vs external audience?
 - Is there sufficient IT infrastructure available?
 - What functions require web-enabling? Reports? Data access? Everything?
 - Should maps be available? If yes, will they be static or dynamic?



Web-Enabling Continued ...

- **Data issues are very important**
 - **Does the agency have the right to publish all the data (some may be from other sources)**
 - **Must have metadata available or there will be misunderstandings data (eg meaning, accuracy, how recent, who collected it, reliability)**
- **Web-enabling requires very careful planning and a good TOR**



Key Success Factors - IT

- Need to have an IT division or else outsource
- TORs need to reflect agency's IT capabilities
- Need technology architecture for direction
- Should use COTS wherever possible
- Need to have clear definitions of functional and technical requirements for the RMS
- Need long-term budget strategy
- Clearly define HDM-4 integration
- Carefully consider web-enabling issues





Data Collection





Data Collection



- **Data collection must be appropriate and sustainable**
- **Only collect:**
 - **The essential data**
 - **At the minimum level of detail**
 - **With the most appropriate technology given the agency's constraints and capabilities**
- **Agency must have explicit data collection policies and procedures**
- **There must be strict data QA procedures**



Findings

- Most agencies had problems with data collection
- Both in-house and contracted data were problematic (for different reasons)
- Not easy to contract out data collection
 - Requires many checks and good contract management
 - Need liquidated damages for poor performance
- Only 50% of agencies did any formal QA on data





Agency	Data Quality Assurance Procedures
Argentina (Santa Fe)	No
Bangladesh	Formal documentation/Manual
Botswana	No
Burkina Faso	No
Cameroon	No
Chile	Yes (applying for ISO certification)
China (Fujian)	Some formal documentation
China (Henan)	Some formal documentation
China (Hubei)	Some formal documentation
Costa Rica	No
India (NHAI)	Some formal documentation
India (Kerala)	No
India (Rajasthan)	No
Indonesia	No
Mozambique	No
New Zealand (TNZ)	Yes
New Zealand (PDC)	Yes
Papua New Guinea	Yes
Tanzania	Yes
Uruguay	No
USA (VTrans)	Yes





Conclusions



Success

- Depends on the convergence of processes, people and technology
- If any are weak or fail then the RMS will be compromised
- Overall satisfaction
 - Everyone 5/10 (several are not using system)
 - Using System 7/10 (COTS – 7.5; Custom 6.5)
- Too many projects focus on technology and underestimate processes/people issues
- Need to spend most effort on institutionalization and not technology





Agency	Overall Satisfaction
Argentina (Santa Fe)	7.5
Bangladesh	6
Botswana	7.4
Burkina Faso	8.5
Cameroon	6
Chile	7
China (Fujian)	(not used)
China (Henan)	(not used)
China (Hubei)	(not used)
Costa Rica	5
India (NHAI)	(under development)
India (Kerala)	(under development)
India (Rajasthan)	(not used)
Indonesia	6
Mozambique	5.5
New Zealand (TNZ)	8
New Zealand (PDC)	8
Papua New Guinea	5
Tanzania	6.7
Uruguay	8
USA (VTrans)	9.9





The end ...

