Review of major capital projects in Scotland

How government works

AUDIT SCOTLAND

Prepared for the Auditor General for Scotland
June 2008

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Auditor General for Scotland

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- government agencies, eg the Prison Service, Historic Scotland
- NHS bodies
- further education colleges
- Scottish Water
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Note:
Prior to September 2007, the Scottish Administration was generally referred to as the Scottish Executive. It is now called the Scottish Government. When dealing with the earlier period, this report refers to the Scottish Executive. Recommendations for the future refer to the Scottish Government.

Acknowledgements:
Audit Scotland prepared this report for the Auditor General for Scotland. This study was managed by Jim Martin, supported by Gareth Dixon, under the general direction of Barbara Hurst, Director of Public Reporting (Health and Central Government), Angela Cullen, Assistant Director of Public Reporting (Central Government) and Dick Gill, Portfolio Manager (Central Government). Ernst & Young was engaged to work with Audit Scotland on the review of project case studies and the review of project appraisals.

We have had the generous support of the Scottish Government, Scottish Prison Service and Transport Scotland and the other bodies whose projects we examined and surveyed.

Audit Scotland is a statutory body set up in April 2000 under the Public Finance and Accountability (Scotland) Act 2000. It provides services to the Auditor General for Scotland and the Accounts Commission. Together they ensure that the Scottish Government and public sector bodies in Scotland are held to account for the proper, efficient and effective use of public funds.

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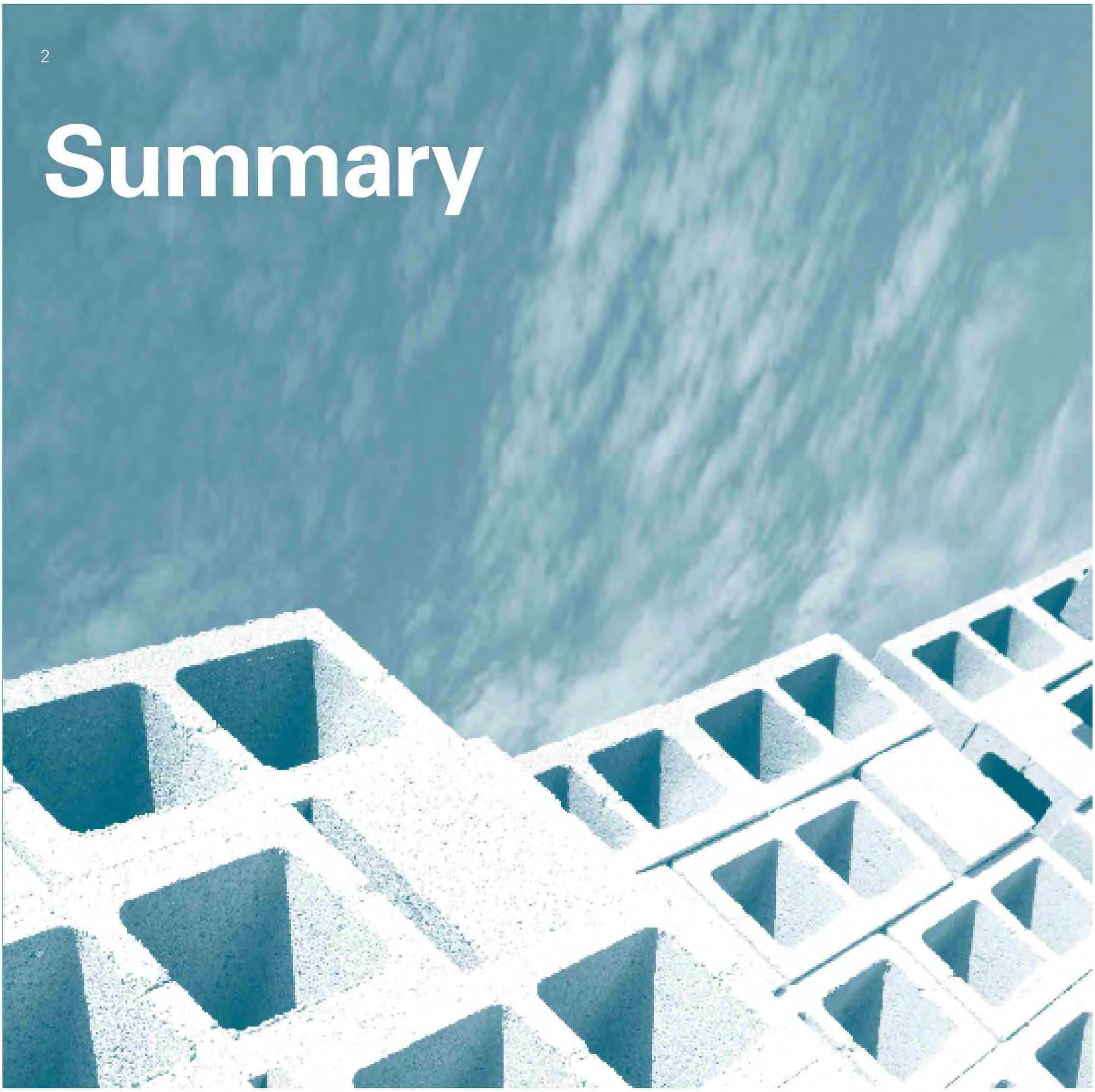
Contents

Summary



The scale of investment means that good decision-making about the capital programme and good management of individual projects are vital.

Capital investment in the public sector is significant

1. Public investment in infrastructure touches most aspects of Scottish life. It provides new and upgraded facilities, such as roads, railways, hospitals, schools, museums, prisons and major IT projects. Between 2002 and 2007, the Scottish Government and its agencies, non-departmental public bodies (NDPBs) and the NHS completed 43 publicly-funded major capital projects valued at £811 million (Appendix 1).[1]

2. There are currently 104 major projects valued at £4.7 billion in progress (Appendix 2). Most of these are in the transport and health sectors (Exhibit 1). There are:

- Nine large projects – seven transport and two health projects – with a combined value of £2.8 billion. The value of these projects ranges from £120 million to £692 million.
- Thirty-seven medium projects – mainly in the transport, health and justice sectors, valued at between £15 million and £85 million each – with a combined value of £1.4 billion.
- Fifty-eight smaller projects – covering all government portfolios, valued at less than £15 million each – with a combined value of £0.5 billion.[2]

3. The scale of investment means that good decision-making about the capital programme and good management of individual projects are vital.

4. In May 2008, the Scottish Government proposed the further development of the Scottish Futures Trust initiative. This includes plans to provide a focal point for coordinated public sector infrastructure planning and investment. If approved and implemented, this coordination may help address our recommendations below.

Summary of key messages

- At project approval stage, the early estimates of cost and time were too optimistic for many major projects. Performance against cost and time estimates is better after contracts are awarded, as plans are more certain and risks clearer. Two-thirds of projects were completed within five per cent of the contracted cost and within ten per cent of the contract time. Most current projects reviewed also appear on track to meet the contract cost.
- Most completed projects have successfully delivered the required roads, hospitals and other assets, and all current projects are forecast to do so. However, few projects have been evaluated to demonstrate that they have delivered the expected wider benefits which originally justified the investment.
- Project management and governance arrangements of individual projects are broadly effective. However, the quality of project appraisals could be improved. Initial cost estimates also need to better reflect risk and uncertainty, and consider a range of inflation scenarios.

Exhibit 1
Major capital projects by government portfolio

Portfolio	Completed projects 2002-07		Projects in progress		Projects examined by Audit Scotland	
	Number of projects	Actual cost	Number of projects	Estimated cost	Number of projects	Estimated or actual cost
		£m		£m		£m
Finance and sustainable growth (mainly transport projects)	10	198	50	3,357	8	1,463
Justice	12	213	11	350	4	181
Rural affairs and environment	1	33	5	53	2	49
Health and well-being	11	258	28	737	3	186
First Minister	1	32	7	127	2	78
Education and lifelong learning	8	77	3	52	1	38
Total	**43**	**811**	**104**	**4,676**	**20**	**1,995**

Source: Audit Scotland

1 We define a major project as having a capital cost of £5 million or more.
2 We have defined small, medium and large projects as less than £15 million, £15 -100 million and over £100 million respectively.

- There is a case for better cross-government coordination of capital investment programmes, including consideration of the capacity and capability of suppliers and contractors.

Summary of recommendations

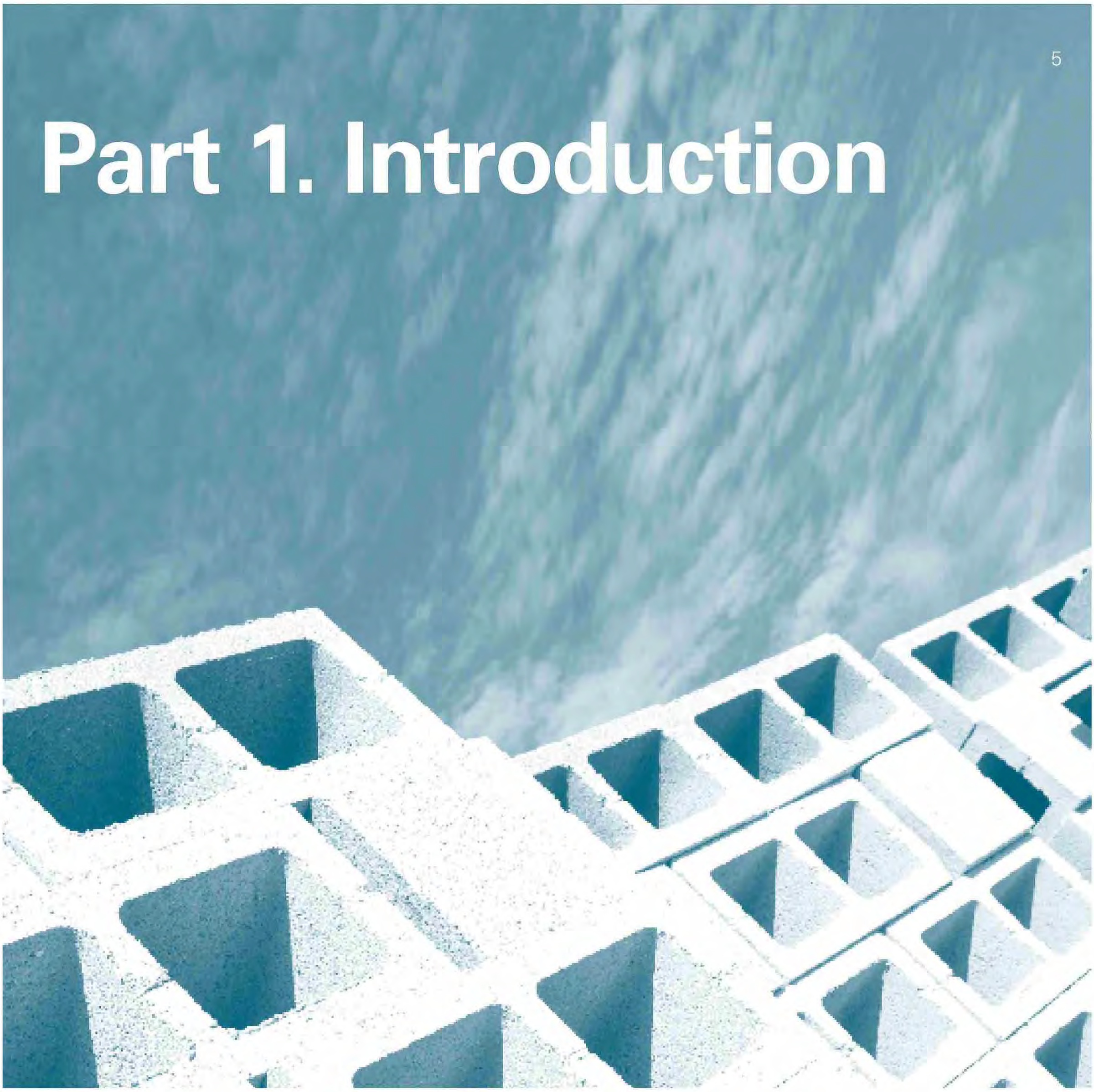
The Scottish Government should:

- collect information on all projects and get explanations for cost, time and quality changes, and lessons learned. It should report performance publicly.
- strengthen strategic direction and investment planning through a senior, government-wide, investment coordination and challenge function
- ensure robust procurement strategies and cost estimates have been developed prior to awarding funding to projects
- take account of market conditions and construction inflation when developing its capital programme.

Public bodies should:

- prepare robust business cases for every project. These should be clear about the project aims and benefits, and include assessment of: risks; the range of options to be considered; and a clear basis for assessing, reviewing and reporting
- build whole-life costs into business cases and subsequent project reporting
- ensure cost, time and quality targets are clear from the outset, and properly recorded
- improve early-stage estimating of the cost and time of projects. They need to ensure better assessment and quantification of risk and uncertainty, and should include a specific risk allowance, optimism bias allowance and take account of construction cost inflation in early cost estimates
- develop an appropriate procurement strategy which considers all procurement routes, competitiveness and capacity within the construction industry. Ensure that risk management strategies explicitly consider and mitigate the risk of changes in scope after the contract has been awarded
- make more use of tools available to assess and confirm both the quality of design and environmental sustainability to get the best of benefits from the available funding
- ensure appropriate project management and governance arrangements are put in place for every project
- from the outset, ensure they have project managers with appropriate experience and knowledge of effectively managing major projects
- ensure independent gateway or similar reviews at the key stages in projects
- ensure project budgets are sufficient to allow for post-project evaluation in all projects
- carry out post-project evaluations within a reasonable timescale to determine whether projects have delivered the benefits intended (benefits include satisfying the business requirements as well as providing good-quality design and functionality). Evaluations should consider performance against cost, time and quality targets.
- set a clear plan with regard to the need for independent gateway or similar reviews at key stages in projects

Part 1. Introduction



There has been significant investment in public sector assets across the UK over the last few decades but this has not always resulted in assets that were fit for purpose or delivered value for money to the public purse.

There continues to be significant capital investment in the public sector

5. The Scottish Government is investing significant sums of money in capital projects. The latest *Infrastructure Investment Plan*, published in March 2008, sets out the government's proposals for capital investment in Scotland.[3] It provides details of £10.5 billion of major projects that will be funded directly through public investment and those that will be funded partly or wholly by private capital. It aims to contribute to the government's five strategic objectives of making the country:

- wealthier and fairer
- smarter
- healthier
- safer and stronger
- greener.

All major investment projects involve significant risks

6. There has been significant investment in public sector assets across the UK over the last few decades but this has not always resulted in assets that were fit for purpose or delivered value for money to the public purse. In the past, a number of large public sector capital projects did not meet cost, time and quality targets.

7. Audit Scotland has previously reported on a number of major capital projects in our reports on the Holyrood Parliament building, overview of transport in Scotland and the Edinburgh transport projects:

- In our reviews of the Parliament building we found significant difficulties associated with the construction of a very complex, unusual building against very tight deadlines.[4] Difficulties with the procurement method lay at the heart of the problems that arose. Although a distinctive landmark building has been delivered, the cost and time objectives were not met. Final costs on completion in 2004 were more than four times the initial estimate in 1998. Lessons for public sector procurement included: the importance of selecting the best procurement route; setting agreed budgets and other indicators to measure performance; and ensuring clear leadership and proper planning to ensure that good competition provides fixed and firm prices.

- Our 2006 overview report of transport in Scotland commented on a number of major road and rail transport projects.[5] In six major projects completed between February 2003 and November 2005, actual construction costs had exceeded the pre-tender estimated cost by up to 33 per cent. For projects in progress, the report found a variable picture on estimated time to completion and outturn costs.

- In June 2007, we conducted a review of the Edinburgh Airport Rail Link (EARL) and Edinburgh tram projects.[6] Our report concluded that the tram project was relatively well advanced and arrangements to manage it looked sound. There was more uncertainty about EARL, which was at an earlier stage of planning, and we highlighted some particular concerns about its governance and procurement.

8. The Scottish Government has published two infrastructure investment plans since 2005.[7] The Scottish Executive set up an overarching Infrastructure Investment Group (IIG) in 2006, but there is currently no reporting mechanism that brings together current progress on all major projects across the government. The Scottish Executive also developed a database of major projects, but there are no plans to report publicly on the progress of individual projects.

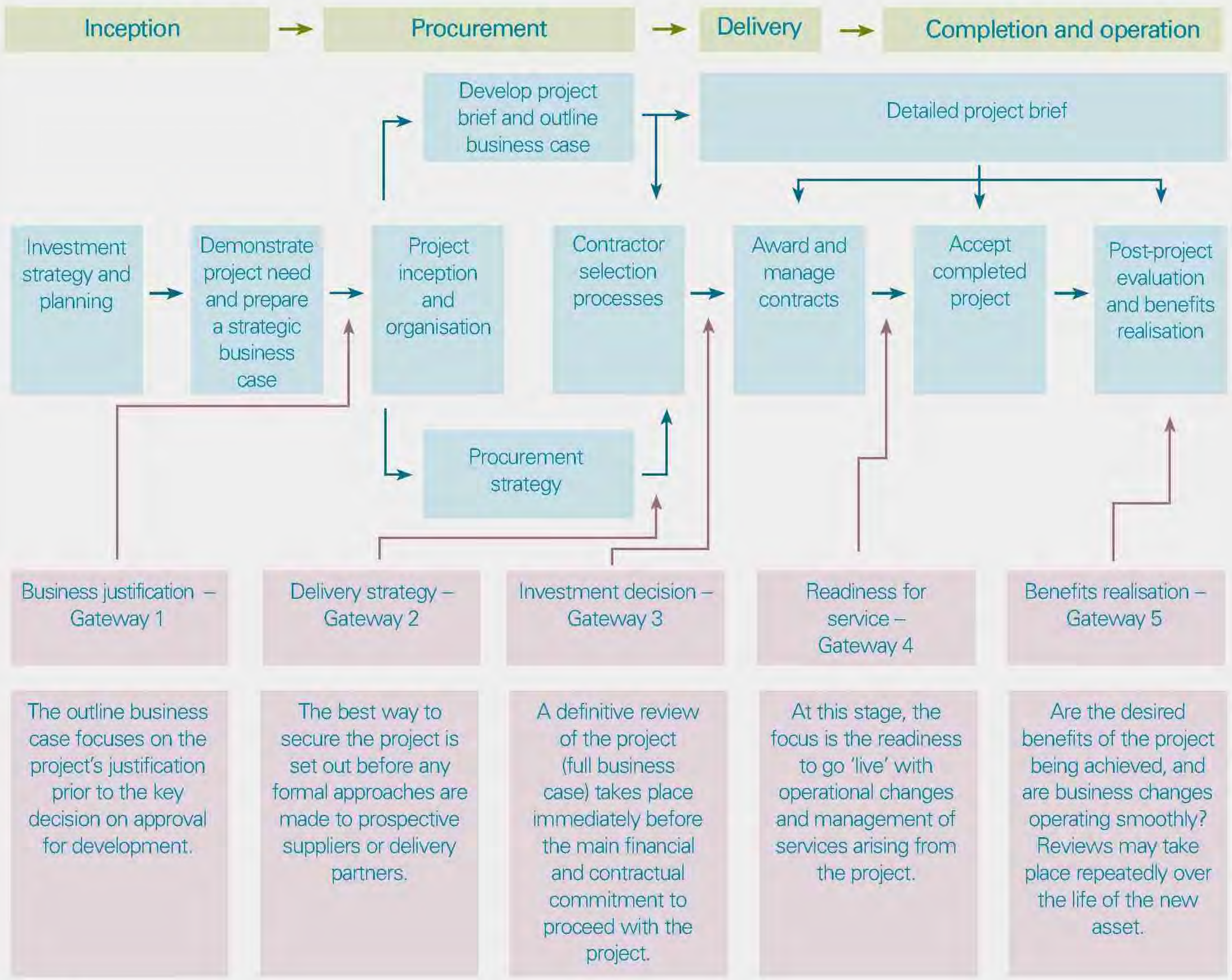
Good project management is essential to deliver major capital projects to cost, time and quality

9. Exhibit 2 summarises the main stages and five decision points in the life cycle of major projects from inception to completion, and explains why these are important. These key stages provide a framework for evaluating project progress.

10. Good project management and governance do not guarantee that a project will deliver its required outputs to cost, time and quality. Well managed projects may fall short in some way due to factors beyond their control. However, good management and governance increase the likelihood that projects will deliver to cost, time and quality, and help managers to respond effectively if problems arise.

3 *Infrastructure Investment Plan 2008*, Scottish Government, March 2008.
4 *The New Scottish Parliament Building: an examination of the management of the Holyrood project*, Audit Scotland, 2000 and *Management of the Holyrood Building Project*, Audit Scotland, 2004.
5 *Scottish Executive: an overview of the performance of transport in Scotland*, Audit Scotland, September 2006.
6 *Edinburgh Transport Projects Review*, Audit Scotland, June 2007.
7 The 2005 Infrastructure Investment Plan was published by the Scottish Executive.

Exhibit 2
The key stages in major projects



Source: Audit Scotland

11. Key features of good practice include:

- Prior to projects being approved for construction, they should be soundly researched, planned, and fit well with the Scottish Government's strategic objectives and policy priorities.
- Projects should be well organised, with clear aims, objectives and delivery arrangements.
- Competent, experienced teams should be appointed to deliver projects, with good leadership and properly defined roles and responsibilities. There should be a sound appreciation of risk and an effective strategy to manage and mitigate it.
- An effective partnership with suppliers, with their appointment based on a well-designed and well-executed competition.
- Accountability and transparency with regard to the progress of the project.
- At all stages of a project, there should be a clear focus on outcomes and how it will support and improve business performance.

Exhibit 3
Good practice in major project management

Good practice area	What this covers
Vision and direction	Strategic alignment, business case and sponsor commitment
Planning	Governance, risk management and procurement strategy
Execution	Project management, resources, people and procurement
Measuring and monitoring	Benefits management and reporting
Business acceptance	Change management and stakeholder management

Note: Appendix 3 details the model of good project management.

Source: Audit Scotland

12. Exhibit 3 summarises the main features of good project management practice, with further detail given in Appendix 3. We developed these good practice statements with Ernst & Young, which worked with us on this project. We took into account other published sources of advice, guidance and good practice on major project management, including: the Office of Government Commerce Programmes and Projects Guidance; the HM Treasury Green Book guidance on investment appraisal; and the Scottish Government's Construction Works Procurement Guidance.[8,9,10]

About this report

13. The Scottish Parliament needs assurance on the progress of capital investment and an understanding of what is happening at individual project level. Audit Scotland has therefore prepared this report to provide the Parliament with a position statement on how recently completed projects and a sample of current major capital projects performed against cost, time and quality targets. This is the first report of its kind and may form the basis of a series of regular updates on major capital projects.

14. Our methodology is outlined in Appendix 4. In summary, we:

- surveyed all 43 projects that the Scottish Executive and its agencies, NDPBs and the NHS completed between April 2002 and March 2007, to obtain a comprehensive picture of completion to cost, time and quality. In addition, we reviewed five completed projects in more depth to help understand performance better

- reviewed 15 current projects to examine progress against cost, time and quality

- conducted case study reviews for all 20 projects reviewed (5 completed and 15 current) covering each current government portfolio and £2 billion in value (36 per cent by value of recent and current projects). We assessed each case study project against good project management practice. We report the performance of the case study projects to cost, time and quality using a traffic light system (Exhibit 4). We completed our case study reviews between October 2007 and February 2008, and, inevitably, projects will have moved on since we completed our examination.

15. Our review did not cover local authorities, further and higher education institutions or Scottish Water. These sectors are at arm's length from the Scottish Government, have separate accountability and governance structures, and different funding systems for capital investment. Audit Scotland may examine major capital projects in these sectors in the future.

16. We did not examine the progress of projects funded through Private Finance Initiative (PFI) contracts (14 projects completed and in progress valued at £902 million). The Scottish Government will not use standard PFIs for new projects and is developing an alternative method to help fund major capital projects. The Parliament's Finance Committee is conducting an investigation into the funding of capital projects.

8 Available from http://www.ogc.gov.uk/programmes_and_projects.asp
9 The Scottish Government has adopted the Green Book and it applies to all parts of the Scottish administration. Available from: http://www.hm-treasury.gov.uk/economic_data_and_tools/greenbook/data_greenbook_index.cfm
10 Available from http://www.scotland.gov.uk/Publications/2005/11/28100404/04042

Exhibit 4
Assessment criteria for cost, time and quality

	Significant changes and/ or uncertainty R	Relatively minor changes and/or uncertainty A	On target G
Cost	• Actual or forecast cost materially over initial approval or contract value • Cost estimates currently materially uncertain	• Delivered just over cost • Currently forecasting a small cost overrun	• Completion within initial approval and contract value (or forecasting with reasonable certainty)
Time	• Actual or forecast delivery well outside timescale	• Actual or forecast delivery with a small overrun in time	• Actual or forecast delivery to time or ahead of time
Quality	• Did not deliver to the required scope • Scope has increased or decreased significantly	• Delivered to the original scope or with minor loss of function • Currently minor changes forecast in scope during project	• Delivered to scope in the business case • No residual issues • Forecasting to deliver to business case

Source: Audit Scotland

17. This report is organised into three further parts:

- Performance of all completed projects against cost, time and quality targets (Part 2).
- Progress of a sample of current projects towards cost, time and quality targets (Part 3).
- Lessons for the future (Part 4).

18. In addition to this report, we have also published a high-level summary of the 20 projects we reviewed and a good practice checklist for public bodies on our website: www.audit-scotland.gov.uk

Part 2. Projects completed between 2002 and 2007

There is a general picture of improvement in both time and cost estimating after contracts are awarded.

Key messages

- In general, the achievement of cost and time targets improved significantly as projects progressed.
- Around two-fifths of projects were completed within the cost estimated when they were first approved.
- Three-quarters of projects were completed within the forecast cost before awarding the main construction contract; and a fifth experienced an increase of less than five per cent compared to the contract estimate.
- For most completed projects, the forecast delivery date at initial approval was overly optimistic. Only around half of projects were completed within or close to the initial forecast date.
- Most completed projects successfully delivered the required roads, hospitals and other assets. However, one in five completed projects reported significant defects in the first year after completion. In all cases, project teams were pursuing remedies for identified defects.
- Few projects have been evaluated to demonstrate that they have delivered the expected benefits, which originally justified the investment, and there is no consistent approach to public performance reporting.

Overall, the achievement of cost and time targets improved as projects progressed

19. Capital spending must be used efficiently to deliver projects to budget and on time. There are two key decision points for any project: the initial decision to proceed with its development (business justification – Gateway 1 in Exhibit 2, page 7); and the major decision immediately prior to awarding the main contract (investment decision – Gateway 3).

- Any weakness in the analysis at the initial decision could later undermine the development and overall success of the project. There needs to be clarity about the overall value and purpose of the project, its contribution to business goals and the optimum balance of cost, benefit and risk for its effective delivery. Inaccurate cost and time estimates at this stage undermine effective appraisal and value for money.
- The estimate immediately prior to awarding the contract is vital because it provides a basis for confirming value for money before the main financial commitment (the construction contract) is accepted. Once a contract price is agreed, significant changes to a project are likely to be costly, disruptive and lessen value for money.

20. We examined the final costs of completed projects and the actual completion time compared to the estimates made at these two key stages.

21. The completed projects we examined were developed over different periods, including some that were started before devolution. Most projects took more than two years to go from initial approval to completion; in some cases they took longer, over six years in one case. Consequently, the guidance on project management and cost estimating that applied to the development of each project has changed in some cases.[11]

22. Fourteen of 43 completed projects did not estimate a completion date at the point of initial approval. Information about other contract time and cost estimates was better but incomplete.[12]

23. Exhibit 5, overleaf presents a high-level summary of our findings on the performance of the completed projects against cost and time targets, and illustrates the following major points:

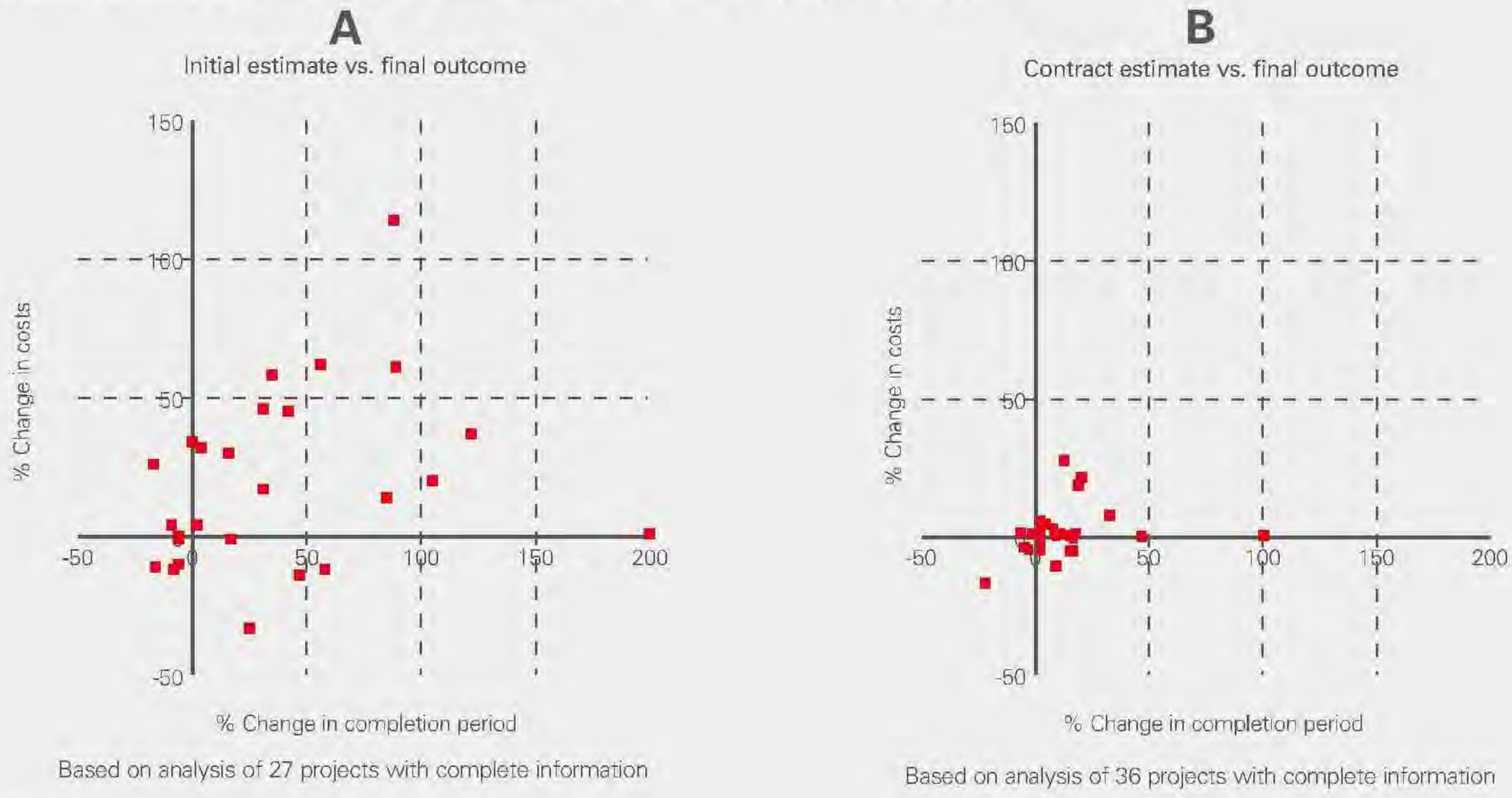
- Initial estimates of time and cost (Exhibit 5A) were often too optimistic.
- Cost and time overruns are often interrelated. However, there is no statistically significant relationship linking the achievement of cost and time targets.
- There is a general picture of improvement in both time and cost estimating after contracts are awarded (Exhibit 5B), as plans are more certain and risks clearer. At this stage, although some projects do not achieve cost and time targets, the degree of variation is significantly smaller. Four-fifths of projects completed within five per cent of the contract costs. Two-thirds of projects completed within ten per cent of the forecast contract duration.

24. In the rest of Part 2, we analyse in more detail the performance of all completed projects against cost, time and quality targets.

11 In particular, HM Treasury introduced new guidance on costing in 2003 – paragraph 71 below refers
12 Projects with incomplete information about time and cost estimates are identified in Appendix 1.

Exhibit 5

Achievement of cost and time estimates improves as projects progress



Source: Audit Scotland

Most projects were delivered within or close to, contract price, despite early estimates being too low

25. Exhibit 6 summarises the results of our more detailed analysis of final costs compared to initial and contract cost estimates.

Only two-fifths of completed projects met the initial cost estimate

26. The combined final cost of 41 projects completed between 2002 and 2007 was £730 million.[13] This was £84 million (13 per cent) higher than the combined initial estimated cost of £646 million.

27. Sixteen projects were successfully completed within initial cost estimates. Four of these were roads projects managed by Transport Scotland and its predecessors, while seven were prisons projects managed by the Scottish Prison Service. The five other projects completed within the initial cost estimates were: two NHS projects and three enterprise projects.[14]

28. Twenty-five projects had initial cost estimates that were too low, in most cases by a significant margin. The final cost of these projects shows an average overrun of 39 per cent against the initial cost estimate:

- Eight projects had cost increases of between one and 17 per cent.
- Seventeen projects had final costs of 20 per cent or more above the initial forecast, with one small project (the Aberdeen Sheriff Court Annex) overrunning by 149 per cent.

The final cost of most completed projects was within or close to the contract price

29. The combined final cost for 38 projects was £754 million.[15] This was £8 million (one per cent) more than the combined approved contract price of £746 million. This shows that contract cost estimates are more reliable than estimates made at the initial approval stage. For these 38 projects:

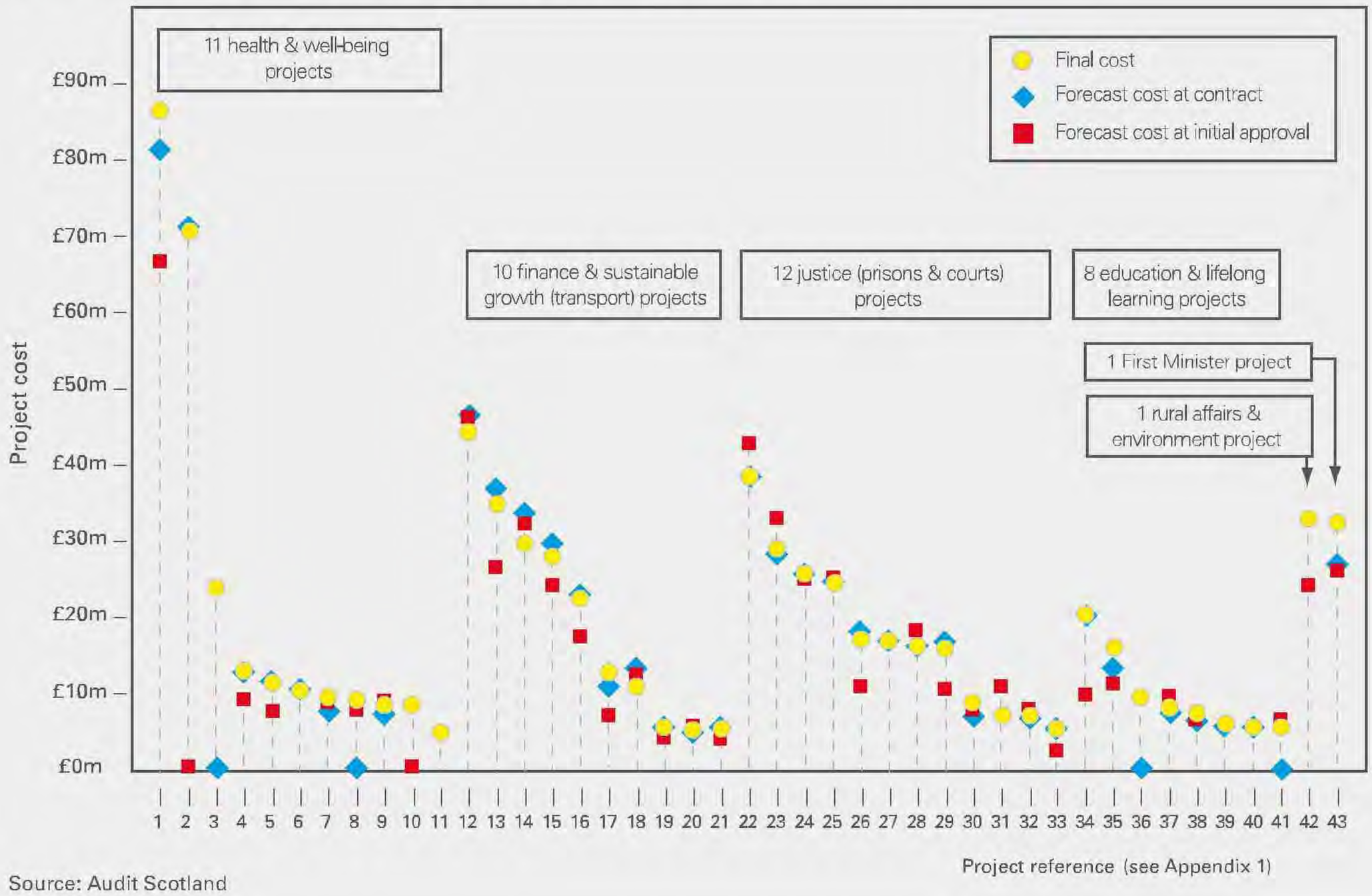
- Twenty-two were delivered within the contract price.
- Nine projects experienced an increase of less than five per cent and one an increase of seven per cent.
- Six projects experienced larger cost increases, between 11 and 28 per cent.

30. As part of our review, we also examined five out of the 43 completed projects as case studies, allowing us to assess performance against cost, time and quality targets. Exhibit 7 provides a summary of the outcomes of these five projects.

31. Three of the case study projects experienced significant cost increases compared to initial estimates (highlighted by the red traffic-lights for

13 We do not have forecast costs for two NHS projects, the Glasgow Royal Infirmary redevelopment and the Gyle Square property fit-out.
14 Transport Scotland was set up as a new agency of the Scottish Executive on 1 January 2006. At that time, it assumed responsibility for overseeing delivery of the Scottish Government's major transport commitments. Its responsibilities include delivering major road and rail projects.
15 Information about contract cost estimates was not available for five projects – New Royal Aberdeen Children's Hospital, Factory for Vestas, PBWAS, Gyle Square property fit-out, European Marine Energy Centre.

Exhibit 6
Completed projects – final cost compared to initial and contract estimates



Source: Audit Scotland

Exhibit 7
Summary of five completed projects against cost, time and quality targets

Project	Final cost £m	Completed	Procured by	Description	Outcome compared to plan		
					Cost	Time	Quality
Beatson Oncology Unit	87	2007	NHS Greater Glasgow & Clyde	New-build regional centre of excellence for oncology services for the West of Scotland.	R	R	A
Upgrade to Polmont Prison – Phase 2	39	2007	Scottish Prison Service	Provision of new cell block and regimes accommodation.	G	G	G
New SASA HQ at Gogarbank	33	2006	Scottish Agricultural Science Agency	New headquarters building and facilities for specialist scientific, technical and support services.	R	A	G
Playfair Project Phases 1 & 2	32	2004	National Galleries of Scotland	Refurbishment of the Royal Scottish Academy building and provision of a new underground link to the National Gallery of Scotland with education facilities and visitor services.	R	G	A
A80 – Auchenkilns	22	2006	Scottish Executive Transport Group	Upgrade of the existing road in preparation for future M80 motorway works and the removal of an existing junction.	G	A	G

Note: See Exhibit 4 for definitions of R-A-G and Exhibit 10 for explanation of Transport Scotland.

Source: Audit Scotland

cost in Exhibit 7). The reasons for cost increases in these cases mainly related to errors in the initial estimate, although external factors also contributed:

- The £87 million Beatson Oncology Centre experienced a £22 million (30 per cent) increase in cost from the initial estimate and a further £5 million (7 per cent) increase against the £82 million contract cost estimate. The original estimates in 2001 did not include a provision for inflation, which subsequently added £8 million to costs. Revised guidelines which added a further £8 million, and changes in guideline costs for patient areas added a further £6 million to the initial cost estimate. The Greater Glasgow NHS Board approved the increased cost in 2003 before the contract was awarded. However, further changes to meet new external requirements for the storage and containment of radioactive materials and consequential delays and disruption added £5 million to costs. These changes were approved under the project's formal change control system.

- The £33 million final cost of the new HQ for the Scottish Agricultural Science Agency (SASA) at Gogarbank was £9 million (37 per cent) higher than the initial estimate of £24 million, but marginally (one per cent) below the £33 million contract cost estimate. The initial estimates were prepared in 2000 and 2002 before any design had been completed. They were provisional estimates and did not contain allowances for risk and uncertainty. Revised estimates and the final design were included in a business case costed at £33 million, which was accepted in 2003. Higher proceeds from the agency's sale of surplus land at its former HQ (£23 million compared to an initial estimate of £15 million) helped to offset the higher project costs.

- The £32 million final cost of the Playfair project for the National Galleries of Scotland was £6 million (26 per cent) higher than the initial estimate, and £5 million (21 per cent) higher than the contract cost estimate. The increase in costs during the contract stage was due to higher than anticipated construction cost inflation; changing the scope of the project; a longer than anticipated parliamentary bill process (which delayed some construction work); and additional fundraising costs not being included in the original estimate.[16] The National Galleries met the majority (87 per cent) of the cost increase from fundraising.

Most projects experienced delays, particularly compared with initial forecasts

32. We also examined the actual completion time of projects compared to estimates made at the two key stages – initial approval and immediately prior to contract.

Compared with the initial time estimate, most projects were significantly delayed

33. Exhibit 8 summarises project completion times compared with initial estimates.

34. As with cost estimates, for most completed projects the forecast delivery date at initial approval was too optimistic. Our analysis of 29 projects with complete performance data shows that:

- ten projects were delivered within the initial time forecast

- nineteen projects took longer than initially forecast. Of these, two were delivered within ten per cent of the initial time forecast and the other 17 overran by between 16 and 200 per cent.

Most projects experienced some slippage compared with the contract estimate

35. Exhibit 9 summarises project completion times compared to contract estimates.

36. Of the 39 projects with complete performance data:

- Six projects were completed ahead of schedule. For example, the Playfair project was completed seven months earlier than planned after the National Galleries for Scotland took the opportunity to run two elements of the project in parallel, rather than consecutively as initially planned. This was not at any additional cost to the project.

- Ten projects were completed on time.

- Nine projects were completed with a ten per cent time overrun or less.

- Thirteen projects slipped between 11 per cent and 45 per cent of the contract time estimate.

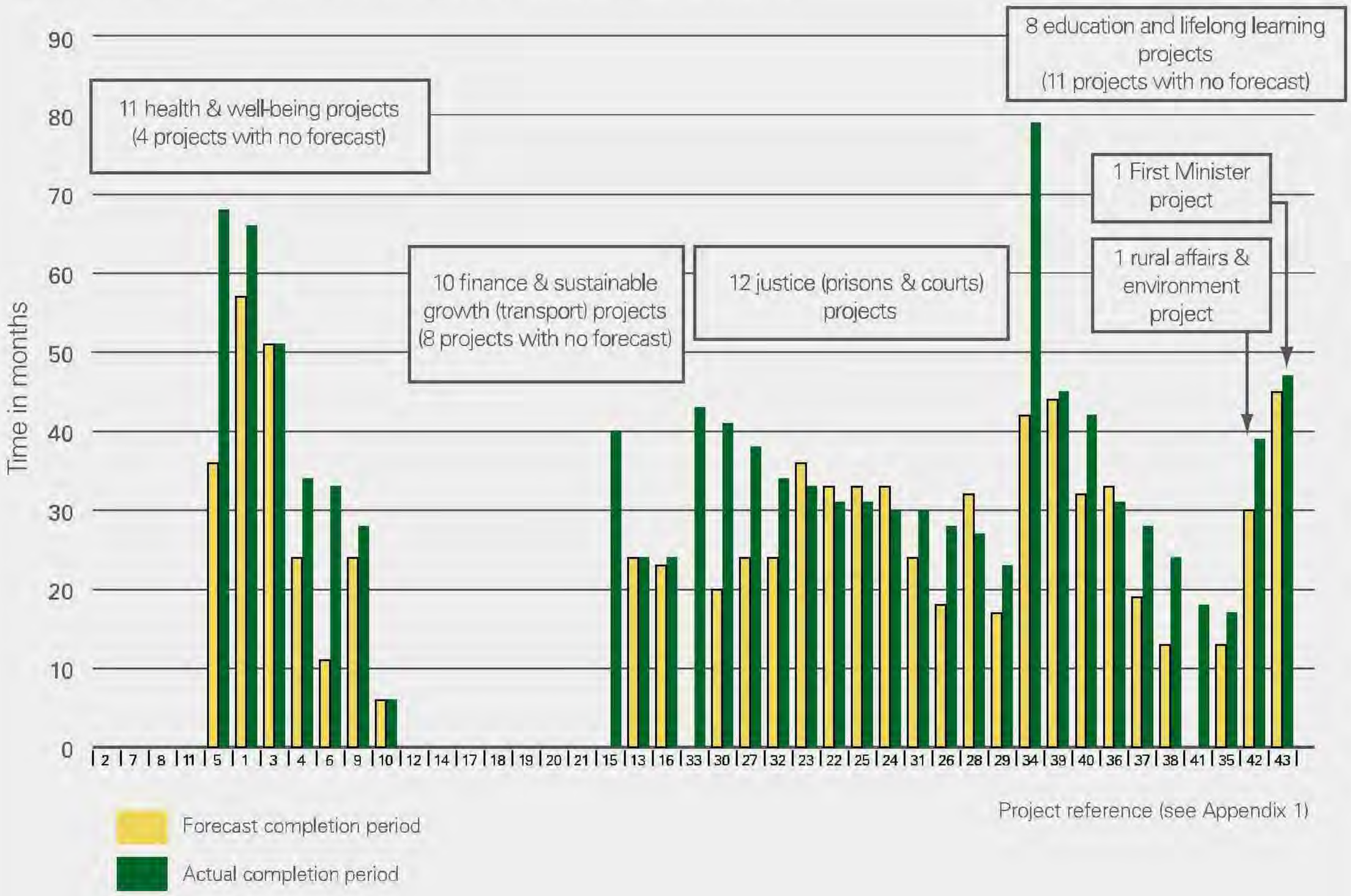
- The Dykebar Acute Mental Health Admissions unit slipped by 100 per cent, completing in ten months compared with a forecast of five months.

37. Two of the completed projects in our case study reviews experienced significant delays. During the construction contract, the Beatson Oncology Unit was delayed by around six months due to design changes after the contract was awarded. These changes were to meet new external requirements for the storage and containment of radioactive materials.

16 Construction inflation measures the change in the underlying costs of labour, raw materials etc, required in construction and it often rises faster than general inflation.

Exhibit 8

Completed projects – completion time compared with initial estimates



Source: Audit Scotland

Most completed projects have delivered the expected assets

38. Project quality may be defined as fitness for purpose, ie the project will satisfy the needs for which it was intended. Because projects vary significantly, there are no simple and universal measures of the achievement of quality which can be applied to all projects.

39. In our survey of completed projects we looked at whether the required project outputs were delivered without significant defects and what wider assessments of quality, if any, had taken place.[17] Eight of the 43 completed projects (almost one in five) reported significant defects in the first year after completion, five of these were NHS projects. Examples of defects reported included:

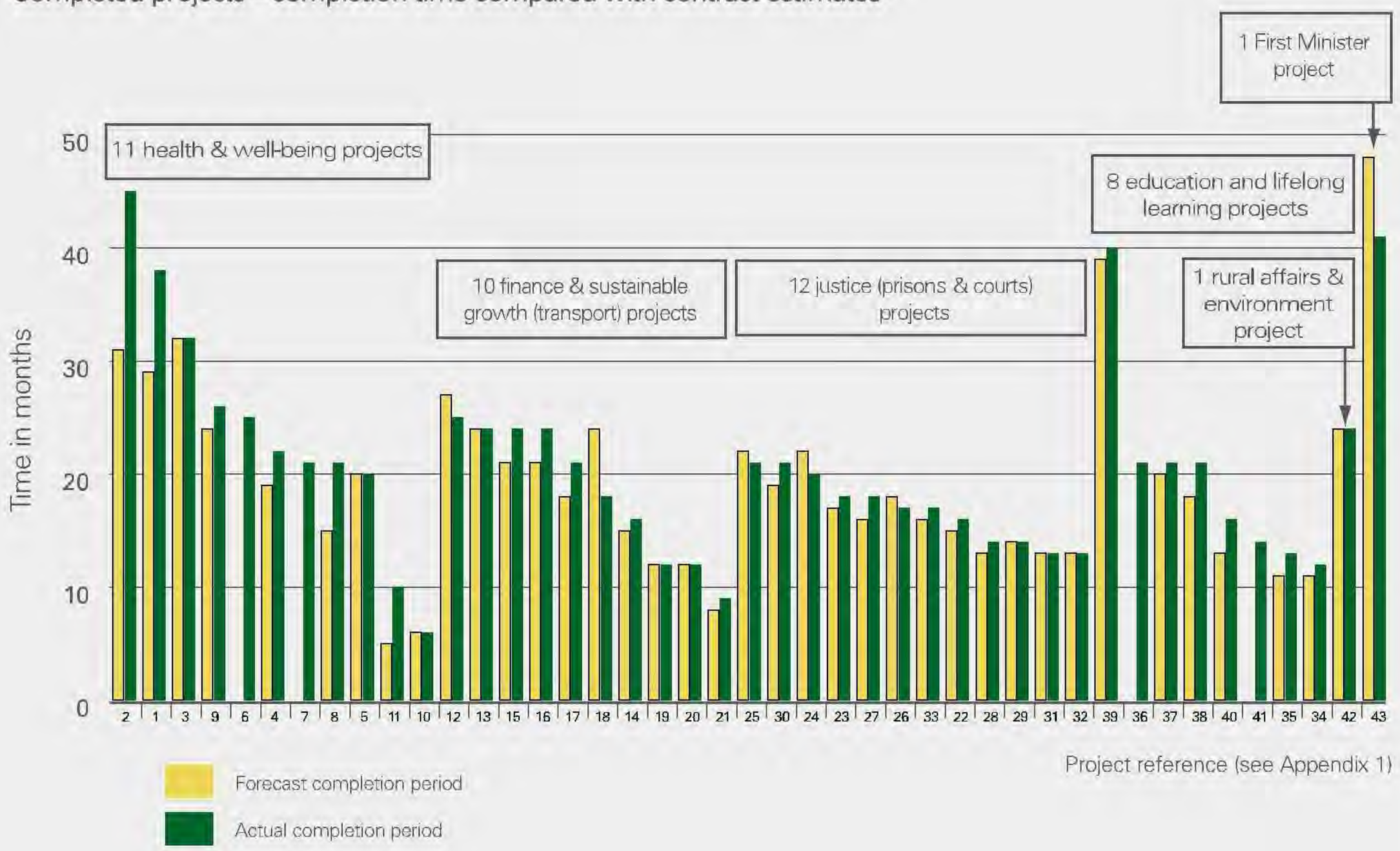
- The Glasgow Royal Infirmary redevelopment project had heating and ventilation problems. Five years after completing the project, the problems have still not been fully resolved, but the contractor is rectifying the problems at its own expense. The NHS board has identified the underlying cause of the problems as a lack of detail in the tender specification at the outset of the design and build contract.
- The Beatson Oncology Unit has experienced some leaks which have resulted in some areas needing to be replastered.
- A new network IT system for HIE needed significant software bug-fixing after it was implemented in March 2007.
- HIE's European Marine Energy Centre in Orkney experienced various cabling and leakage problems.

40. In addition, recent problems have emerged with the Clyde Arc Bridge. The bridge was closed to traffic in January 2008, 16 months after it had first opened, when one of its cable connections failed.

41. With the exception of the problem with the Clyde Arc Bridge, which is now resolved, none of the defects

17 We defined significant defect to be anything that adversely affected the client's use of the project building or output, ie any loss of functionality compared with that expected.

Exhibit 9
Completed projects – completion time compared with contract estimates



Source: Audit Scotland

represent a fundamental failure. In all cases, project teams have pursued or are pursuing remedies for defects. The project costs have been protected by the retention of some contract payments pending resolution of the defects.

Few completed projects have been evaluated to demonstrate benefits

42. Technical quality control, such as defects reporting, is important but is not sufficient to address all stakeholders' expectations and requirements of the project. It is important that there is clarity from the outset about the expected benefits and how these will be achieved. It is good practice to set out specific benefits in the business case, with measures identified and responsibility assigned to track, monitor and measure the delivery of benefits. The finished project can then be assessed to ensure that it meets the business requirements and provides good-quality design and functionality.

43. However, few projects have been evaluated to determine whether they have delivered the benefits intended. In most cases, evaluation concerned the quality of design and functionality rather than a more fundamental review of the achievement of the service and business benefits:

- Only seven of 43 completed projects had done a formal assessment of the project design using design quality measures; and only two of the seven could provide documents to evidence this.[18]
- Only four completed projects reported any formal assessment of the project against environmental (BREEAM) criteria.[19] All four projects reported good or very good performance. No projects reported other assessments against environmental criteria.
- Sixteen projects reported other forms of quality assessment, such as user surveys or other forms of acceptance testing. But only three could provide documents to evidence this.

18 The indicators are for: functionality; build quality; impact; and, diversity and inclusion. The Strategic Forum for Construction has stated that: *"Greater use of design quality indicators should be one of six headline targets to help judge the industry's ongoing performance"*. It suggested that, by the end of 2007, 60 per cent of all publicly-funded/PFI projects costing in excess of £1 million should use these indicators.

19 In the UK, BREEAM (the Building Research Establishment Environmental Assessment Method) is the most widely-used system for rating buildings in accordance with environmental credentials. Until June 2008, the NHS in Scotland has used the National Environmental Assessment Toolkit (NEAT).

44. The Scottish Public Finance Manual requires project teams to complete post-project evaluations but there is no requirement to report the results. We found:

- Thirteen projects reported doing a post-project evaluation. Only four could provide a copy of this report, although nine provided comments on the three main lessons learned from the evaluation.
- Nine roads projects completed by Transport Scotland and its predecessors were subject to standard quality control procedures for roads. These procedures do not include a formal post-project evaluation but do measure the residual life of the road five years after opening. Any shortfall compared with the remaining life specified in the contract is classified as a defect and must be remedied at the contractor's expense.
- The remaining 21 completed projects reported they had not done a post-project evaluation. However, this included four projects which have deferred evaluation.

Recommendations

The Scottish Government should:

- collect information on all projects including explanations for cost, time and quality changes, and lessons learned. It should report this information publicly.

Public bodies should:

- improve early-stage estimating of the cost and time of projects and ensure better assessment and quantification of risk and uncertainty
- make more use of the tools available to assess and confirm both the quality of design and environmental sustainability to get the best benefits from the available funding
- ensure project budgets are sufficient to allow for post-project evaluation in all projects
- carry out post-project evaluations within a reasonable timescale to determine whether projects have delivered the benefits intended (benefits include satisfying the business requirements as well as providing good-quality design and functionality). Evaluations should consider performance against cost, time and quality targets
- ensure cost, time and quality targets are clear from the outset, and properly recorded.

Part 3. Projects currently in progress

Most current projects at the delivery stage are not experiencing increases in cost and are on track to meet timescale.

Key messages

- Four of the 15 current projects had significant increases in estimated cost before approval of the main construction contract. In particular, the estimated costs of two transport projects – the £692 million M74 completion project and the £85 million Stirling-Alloa-Kincardine Rail Link – have more than doubled since they were first approved, and both have experienced delay.
- Nine current projects had awarded the main construction contract, which should increase cost certainty. Most of these have experienced little or no increase in contract costs so far, and three more projects have since reached the contract stage.
- Thirteen current projects are on schedule to achieve the initial completion date but two transport projects are not.
- It is too early to assess the quality of projects in progress. Four are at a relatively early stage of development, which increases the possibility of changes in scope. Two other projects have experienced significant changes in scope since inception.

45. We assessed the progress of 15 current projects against cost, time and quality targets. Exhibit 10 (overleaf) provides a summary of each project we examined and our assessment of its progress towards cost, time and quality targets at the time of our review. We examined projects between October 2007 and February 2008, and, inevitably, projects will have moved on since we completed our examination of them.

46. The 15 projects reviewed have an estimated cost of £1.8 billion (38 per cent of the £4.7 billion value of current projects – Appendix 2). They cover each of the Scottish Government's portfolios and include projects at each of the key stages in a project life cycle prior to completion. Nevertheless, because we have reviewed only a small sample of projects, and our findings are based on their status at a snapshot in time, our results cannot provide assurance on the performance of all 104 current projects.

The costs of some current projects have increased since initial approval

47. Four of the current projects we examined have, so far, experienced significant cost increases compared with the initial forecasts. Exhibit 11 (page 21) summarises the main reasons for cost increases.

Two large transport projects have experienced large cost increases and slippage compared with the initial forecasts

48. Transport Scotland inherited responsibility for the two projects affected by the largest cost increases: the M74 completion and the Stirling-Alloa-Kincardine Rail Link. In each case, the estimated cost of these two projects had more than doubled and both had been significantly delayed.

49. Case study 1 (page 22) provides an overview of the changes in time and cost estimates affecting the M74 completion project. At the time of our initial review (Autumn 2007), the £510-593 million estimated project cost was more than double the £245 million estimate in 2001 when the Scottish Executive first accepted responsibility for the project. The project had also been delayed by about three years. Total project costs were uncertain at the time of our review because the tendering for the main construction contract was still in process and had resulted in only one bid being received. The contract was awarded in March 2008 and the estimated project cost is now £692 million.

50. Case study 2 (page 24) provides an overview of the changes in time and cost estimates affecting the Stirling-Alloa-Kincardine Rail Link project. At the time of our review (Autumn 2007), Transport Scotland had recently taken direct control of this project, and project management and governance had improved. The project was completed in May 2008, within the revised timetable approved by Transport Scotland when it took over the project.

Three other projects are subject to significant uncertainty

51. In addition to the four projects outlined in Exhibit 11, which have experienced significant increases in estimated costs, three other current projects were subject to significant uncertainty about their estimated costs at the time of our review (red in Exhibit 10, page 20):

- The scope of the Glasgow Airport Rail Link project had, at the time of our review, been subject to significant change. This followed a decision by Transport Scotland to combine it with a previously separate rail improvement project, the Paisley Corridor Route. The intention was to reduce overall disruption to the network by combining the necessary construction works, and therefore produce better value for money overall. However, at the time of our examination, a new cost for the combined projects had not been agreed.
- At the time of our examination, the Scottish Crime Campus project was at the inception stage and the level of funding had not been finally approved. The current cost estimate of £63 million is based on feasibility study work undertaken in 2005, and further appraisals need to be conducted before a realistic cost of the project can be confirmed.
- The Erskine Bridge strengthening and maintenance programme is unusual because it constitutes a number of phased programmes of work rather than one individual project. At the time of our review, £17 million of works had been

(text continued on page 25)

Exhibit 10

Summary of 15 current projects' progress towards cost, time and quality targets

Project	Latest cost £m	Stage at review	For delivery in	Procured by	Description	Progress compared to plan Cost	Time	Quality
M74 completion	692	Procurement (now at delivery)	2011	Transport Scotland* *(Glasgow City Council)*	New-build, six-lane urban motorway, extending the M74 west from the eastern edge of the Glasgow built-up area to the M8 near the south end of the Kingston Bridge.	R	R	G
Glasgow Airport Rail Link Project	300-400	Procurement	2011	Transport Scotland* *(Network Rail)*	A new rail link to Glasgow Airport, combined with upgrading of a section of the Network Rail Paisley Corridor Route.	R	A	A
Edinburgh Waverley Infrastructure Works	150	Delivery	2008	Transport Scotland* *(Network Rail)*	Rail capacity enhancements to provide four extra train paths an hour through Waverley Station and enable other projects, eg Airdrie-Bathgate and Stirling-Alloa-Kincardine.	G	G	G
A876 Upper Forth Crossing at Kincardine	120	Delivery	2008	Transport Scotland	A new bridge to reduce congestion at Kincardine and allow refurbishment, with minimal disruption, to existing bridge.	G	A	G
Stirling-Alloa-Kincardine Rail Link	85	Delivery	2008	Transport Scotland* *(Clackmannan-shire Council)*	Reopening of disused railway to provide passenger services from Stirling to Alloa and allow diversion of coal from the Forth Bridge to be replaced by commuter services.	R	R	R
A898 Erskine Bridge	29	Delivery	2010 & ongoing	Transport Scotland	Long-term strengthening and maintenance programme commenced in 1996.	R	A	G
Scottish Crime Campus	63	Inception	2011	Scottish Government	A new purpose-built crime campus facility at Gartcosh.	R	A	A
Edinburgh Prison Phase 3	25	Delivery	2008	Scottish Prison Service	A new gatehouse, games hall, stores and administration accommodation, and upgrade to the main link corridor for the prison.	R	A	A
Parliament House Master Plan	62	Procurement (now at delivery)	2012	Scottish Court Service	Major essential maintenance and some refurbishment within Parliament House, a complex of very important historic and grade A-listed buildings.	R	R	G
State Hospital re-development	85	Procurement (now at delivery)	2010	The State Hospitals Board for Scotland	Redevelopment of a high-security residential and patient treatment centre through new-build construction/adaptation on the existing hospital site near Carstairs.	G	G	G

Exhibit 10 (continued)

Summary of 15 current projects' progress towards cost, time and quality targets

Project	Latest cost £m	Stage at review	For delivery in	Procured by	Description	Progress compared to plan Cost	Time	Quality
Golden Jubilee Heart & Lung Centre	14	Delivery	2007	National Waiting Times Centre Board	Fitting out and reconfiguring the shell of an empty floor and providing and equipping new medical facilities within an existing hospital.	A	A	G
Royal Museum Masterplan	46	Procurement	2011	National Museums Scotland	Complete refurbishment of the Royal Museum in Edinburgh.	G	G	G
National Intranet	38	Delivery	2010	Scottish Government	The national schools intranet for Scotland's 800,000 teachers and pupils.	G	A	G
eCare	33	Delivery	2009 & ongoing	Scottish Government	IT project to enable information sharing and collaboration between health boards and councils (to support single shared assessments and child protection messaging).	A	A	G
Royal Botanic Garden Visitor Centre	16	Delivery	2009	Royal Botanic Garden Edinburgh	A new purpose-built visitor centre at the west gate entrance to the existing site.	G	A	G

Note: See Exhibit 2 for definitions of stages and Exhibit 4 for definitions of R-A-G.

* Transport Scotland became the principal funder and decision maker for transport projects on its creation in 2006. In most cases, it has delegated contracting authority and delivery to third parties, as indicated in the table.

Source: Audit Scotland

Exhibit 11

Reasons for increases in the estimated costs of four current projects

Project	Forecast cost at initial approval £m	Forecast cost pre-contract £m	Latest forecast cost £m	Main reasons for increase in costs
M74 completion	245	692	692	Significant underestimate of land acquisition costs, construction costs and construction inflation, exacerbated by external factors causing delay. See Case study 1 page 22.
Stirling-Alloa-Kincardine Rail Link	35	58-62	85	Increase in the scope of the project and underestimating of costs at appraisal and outline design. Weak project governance and mis-aligned roles and responsibilities (see Case study 2 page 24).
Parliament House Master Plan	52	62	62	The initial business case did not set out the likely costs of inflation. Underestimating of costs at outline design stage.
Edinburgh Prison Phase 3	18	25	25	Increase in the scope of the project and underestimating of costs at appraisal and outline design.

Note: In each case the forecast cost at initial approval was the sum reported as the basis for the decision to allow the project to proceed to development. In most cases, as shown in the table, the initial estimates made no specific allowance for inflation.

Source: Audit Scotland

Case study 1

The M74 completion project

Inception and procurement

The project was adopted as a trunk road scheme in 2001, after a development process going back to the 1960s. In 2003, Scottish ministers approved road orders which proposed the line of the road and allowed land to be acquired. By that time estimated costs had increased significantly. The higher costs were attributed to the earlier exclusion of inflation and underestimates of the scope and complexity of the work, and the associated land purchasing and compensation (around 110 business properties had to be purchased to allow construction).

In response to objections to the road orders, a public local inquiry took place in 2003 and 2004. In 2005, Scottish ministers overruled the public local inquiry report (which had recommended against proceeding), which resulted in a legal challenge. While the objectors later dropped their challenge, their action delayed procurement by more than a year, until August 2006. By this time, estimated costs had increased further. In particular, higher land costs were forecast reflecting higher than anticipated compensation payments in some cases.

Transport Scotland invited tenders in August 2006 but received only one bid, from a consortium of those invited to bid (the M74 Interlink Joint Venture comprising Balfour Beatty, Morrison, Morgon Est and Sir Robert MacAlpine). After considering carefully the implications of this unforeseen action, Transport Scotland continued the tender process with the consortium. It commissioned consultants to develop a 'shadow bid' as a benchmark to help understand what the project should reasonably cost and assess value for money.

Transport Scotland recommended that Scottish ministers should proceed with the project in March 2008 on the following grounds:

- It had benchmarked the tendered contract cost against a cost comparator prepared by independent advisers. The results of this independently prepared benchmark suggested the realistic cost of the contract was in the range of £434 to £478 million. The tendered £457 million construction contract cost was within this range.
- Transport Scotland's economic analysis of the project, based on its standard methodology for such evaluations, showed the estimated benefits of the project were likely to exceed its £692 million total cost by a ratio of almost five-to-one.
- In Transport Scotland's judgement, there was a significant risk that delaying a contract decision would mean the total project cost could increase further and/or significantly delay the project. The benefits of the project would also be delayed.

Scottish ministers authorised Transport Scotland to proceed with a construction contract in March 2008.

Delivery to time and cost

The project's cost has more than doubled and its completion has been delayed by three years.

	Adopted as trunk road scheme (January 2001)	Draft road orders issued (2003)	Before procurement start August 2006	Current forecast (or actual achieved – A)
Estimated project cost	£m	Low – high estimates £m	Central – high estimates £m	£m
Main construction, including contingencies and advance works	165	183-236	246-321	483
Land costs*	80	122-149	209	181*
Professional services	Not included	23	27-29	28
Inflation	Not included	47-67	28-34	Included
Total costs	**245**	**375-475**	**510-593**	**692**
*Note: Land costs are net of £19 million estimated income from sales of surplus land				
Estimated/Actual timetable				
Contract award date	-	-	End April 2007	March 2008 (A)
Construction start date	2005	-	Spring/Summer 2007	May 2008 (A)
Construction finish date	2008	-	End 2011	End 2011

Case study 1 (continued)

The M74 completion project

Reasons for cost increases

At the time of Audit Scotland's review there was no definitive analysis of the reasons for the significant increase in cost estimates for the M74 completion project. A range of factors appears to have contributed to increased costs between 2001 and 2008.

High construction inflation and the longer than expected duration of the project account for about half of the increased construction costs of some £250 million between 2003 and 2008. Another significant factor appears to be the combination of very significant construction risks (arising from the scale, location and nature of the project), the form of contract adopted for the project and an increasing sellers' market in this section of the construction industry.

The M74 Interlink Joint Venture's approach to pricing this contract is likely to have been conservative since no other competitor proved to be available and willing to provide a competing bid for this contract. Transport Scotland mitigated this factor to some degree by the use of a carefully researched 'shadow bid'. But, in the absence of any competition for the work, its commercial position in the tender process with the joint venture was fundamentally weak.

It is not clear that the construction cost estimates prior to tendering took these commercial factors sufficiently into account, although the shadow bid the Executive commissioned in 2006 may now recognise them.

Other factors contributing to increased costs were:

- When the Scottish Executive accepted responsibility for progressing the project in 2001, there was a lack of clarity about the initial cost estimates. There was no clear plan at that time for managing and controlling the project's total cost. In particular, the only allowance for risk was implicit within the range of cost estimates for the project – but there was no explicit allowance for risk or bias. There was consequently no agreed basis for accounting, controlling and managing the significant risk element within the estimate, nor any explicit strategy for doing so.
- The route of the road and the design solution to be adopted were not settled at the outset, so there was, inevitably, a high degree of uncertainty in the initial estimates for both construction cost and land assembly.
- The initial project cost estimates in 2001 were expressed in constant May 2000 prices and did not make any specific provision for future inflation. They also excluded foreseeable costs, such as professional fees.

Project management and governance

Our review of the project management arrangements highlighted a mixture of strengths and weaknesses:

- The project team has significant experience.
- The project was subject to the standard economic, transport, and environmental and community impact appraisals. However, there was no single business case drawing these appraisals together.
- There is strong commitment from the partner councils and Transport Scotland to the project.
- There was a formal risk management plan, although this was not fully embedded in the project and there were weaknesses in accounting for risk in cost estimates.

Source: Audit Scotland

Case study 2

The Stirling-Alloa-Kincardine Rail Link project

Inception and procurement

Clackmannanshire Council promoted the private parliamentary Bill required for the project (the Stirling-Alloa-Kincardine Railway and Linked Improvements Act 2004). The Scottish Executive and later Transport Scotland were the principal funders of the project. Tendering of the main design-and-build contract took place in 2003 and 2004. The council awarded a Phase 1 contract (preliminary design and target cost preparation) to First Nuttall Joint Venture in July 2004; it awarded a Phase 2 contract (detailed design and implementation) in September 2005. The council led the project until 2007 but problems resulted in Transport Scotland taking direct responsibility from August 2007.

Other key parties involved in the project include: Network Rail (which owns and operates the new railway); Jacobs Babtie (a contract management consultant the council retained to oversee construction work, later the nominated project manager for the contract); and tie Ltd (which provided project management services to the council, overseeing the contracts with Jacobs Babtie and First Nuttall as the council's agent, and managing contacts with Network Rail and others).

Delivery to time and cost

The project's cost has more than doubled and its completion has been delayed by two-and-a-half years.

	Estimate for Parliamentary Bill (2003)	Estimate at phase 2 contract award (2005)	Current forecast
Estimated/Actual project cost	**£m**	**£m**	**£m**
Parliamentary preparation	1.1	2.6	2.5
Construction	26.2	49.6	75.7
Land acquisition	0.7	4.2	6.8
Contingency (maximum)	9.2	9.4	Included
Total costs	**37.2**	**65.8**	**85.0**
Estimated/Actual timetable			
Project completion	Winter 2005	June 2007	28 March 2008

Reasons for cost increases

Estimated costs increased by 67 per cent between the Bill estimate and the contract stage. The main factors were:

- Higher land costs (up by £6 million), mine working remediation (up £4 million), earthworks (up £1 million), changes in contract method (up £2 million), and scope changes on a station and level crossing (up £2 million).
- Inflation not allowed for at the Bill stage (£5 million).
- After the contract was awarded, costs increased by a further £25 million, principally on construction costs (up £21 million), land costs (up £3 million) and an additional £1 million for Network Rail costs.

Project management and governance

In June 2007, because of a range of concerns about the project, Transport Scotland took a direct role in the project management on behalf of the council and commissioned a technical audit. The resulting audit report revealed project liabilities significantly greater than previously reported.

Scottish ministers announced, in June 2007, that an improved project governance structure would be put in place to take the project through to completion in March 2008 and to contain costs within £85 million. The new arrangement removed tie Ltd from the project. Transport Scotland took over day-to-day project management in August 2007 and put in place a range of measures to improve control.

Our review of the project confirmed significant shortcomings before Transport Scotland took control of the project:

- Project requirement specifications were not formalised and there was no clear baseline for planning. Costs and programme timescales were based on a preliminary design which was untested against requirements.
- Control and challenge were weak in the project governance. Reporting was ineffective and there was a poor level of challenge and poor management of cost by key stakeholders.
- Not all of the right skills and experience were available.
- Risk management was not embedded and not all significant risks were identified.
- Project management and governance significantly improved after Transport Scotland's direct involvement. Construction was complete by 28 March 2008 and services commenced in May 2008. Final costs for the project are dependent upon negotiations with contractors on any outstanding claims.

Source: Audit Scotland

tendered and £10 million had been spent on maintenance. The current cost estimate of £29 million is an indication of the possible cost of the project, and there is no definitive lifetime budget or end date target for the programme of works.

Most projects at the delivery stage are not experiencing increases in cost

52. As noted in Exhibit 10 (page 20), nine current projects had progressed to the delivery (ie, post-contract) stage at the time of our review (and three more projects have now reached that stage). Based on the experience of completed projects (Part 2), the cost of a project is likely to be more certain once it has reached the delivery stage.

53. Our review showed that of these nine projects:

- six were experiencing no increase in the expected contract price[20]
- the Golden Jubilee Heart & Lung Centre was experiencing a forecast increase of £1 million (14 per cent) in the construction contract price, but this increase was wholly offset by savings in equipment costs that form part of the project
- two projects are experiencing significant cost variances: the Stirling-Alloa-Kincardine Rail Link project is forecasting a £19 million (29 per cent) cost overrun on the contract; while the Erskine Bridge has a £4 million overrun (representing a 70 per cent increase on individual contracts included within this project).

Most current projects are on track to meet contract timescales

54. Most current projects are expected to be completed with little or no delay compared with the forecast made when the contract was awarded. However, three current projects have suffered significant delays:

- The Parliament House Master Plan project has been delayed because initial tendering for the project in 2005 and 2006 did not result in any bids. In January 2008, the Scottish Court Service awarded a contract for the first of three phases of the necessary works, and there is no indication of further delays.
- The M74 completion and the Stirling-Alloa-Kincardine Rail Link projects are discussed in Case studies 1 and 2.

It is too early to assess the quality of current projects

55. Assessing the quality of current projects is difficult while they are incomplete. We have limited our assessment of quality to identify whether any changes in scope have occurred during the life of each of the projects reviewed.

56. Three projects are at a relatively early stage of development, with no approved design for some or all of the project, or no contract awarded. Inevitably, the scope and cost of these projects are subject to greater uncertainty. These projects are the Scottish Crime Campus (at inception stage); and two other projects at various stages of procurement: the Glasgow Airport Rail Link Project and the Royal Museum Masterplan.

57. For nine other current projects we reviewed, the scope had not changed significantly at the time of our review and there appeared to be no over-riding risk to overall delivery. For two remaining projects, however, there had been some changes in scope.

58. The Edinburgh Prison Phase 3 project has experienced some moderate changes in scope, compared to that at inception. All changes were approved under the project's formal change control system and have resulted in the project cost increasing by £2 million. Examples of changes include: use of a key management system (which will offer increased staff efficiency) and work to comply with the Disability Discrimination Act.

59. The Stirling-Alloa-Kincardine rail project is discussed in Case study 2.

20 Edinburgh Waverley Infrastructure Works, A876 Upper Forth Crossing at Kincardine, Edinburgh Prison Phase 3 (although this project had suffered cost increases at earlier stages), Royal Botanic Garden Edinburgh Visitor Centre, eCare and National Intranet.

Part 4. Lessons for the future

There is a case for additional leadership and better coordination and management of the investment programme across government to ensure that it matches market capacity and capability.

Key messages

- Project management and governance arrangements within individual projects are broadly effective.
- In most cases, projects are addressing the strategic aims of the Scottish Government and demonstrated this in their business cases. However, four projects had no authoritative business case. There is scope to improve the quality of project appraisals more generally.
- The overall approach to estimating costs, including the treatment of risk and uncertainty and consideration of whole-life costs at the project appraisal stage, could be improved.
- There is evidence of a sound approach to competition in most cases, but not all projects achieved a sufficient degree of competition from the outset.
- Project managers with specialist knowledge and significant practical experience can better deliver projects.
- The Scottish Government has a strategic group with a remit to improve project delivery. However, there is a case for additional leadership and better coordination and management of the investment programme across government, to ensure that it matches market capacity and capability. This would promote good competition and value for money in the medium and long term.

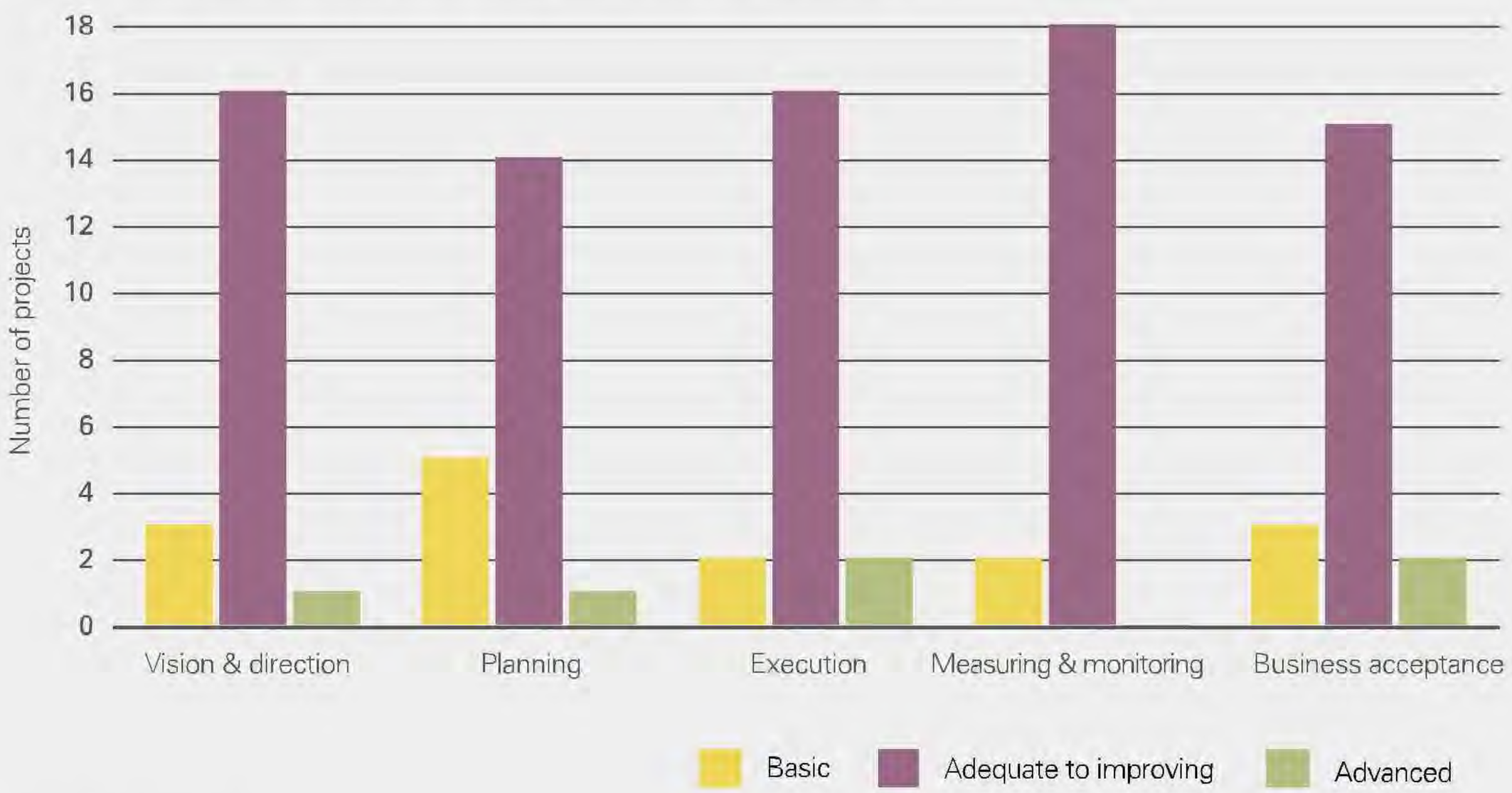
60. In this part of the report, we review lessons for the future management of major projects. Good project management and governance are important to help ensure the success of projects. They should provide evidence of robust cost estimating to support investment decision-making and help deliver value for money.

Management and governance within individual projects are broadly effective

61. Using our model of good practice (Exhibit 3 and Appendix 3), we assessed project management capability under five areas of project management and governance in five completed and 15 current projects. Exhibit 12 shows that for each of these areas at least three-quarters of the projects were assessed as adequate to improving or better.

62. For seven out of 19 projects, that had advanced to procurement stage or beyond, capability was mostly adequate to improving. However, seven projects were assessed as having only basic capability in only one or more good practice areas: the M74 completion, Playfair Project, Royal Botanic Garden Visitor Centre, Erskine Bridge, Glasgow Airport Rail Link, Golden Jubilee Heart & Lung Centre and the eCare project. For these projects, the most common gap in capability related to planning.

Exhibit 12
Assessment of project management and governance for 20 projects



Source: Audit Scotland

63. Only one project, the Scottish Crime Campus, had basic capability in all five areas of governance and project management. The project was at inception stage at the time of our review in late 2007, no outline business case had been approved and capability was expected to improve. In early 2008, major developments in the project were highlighted, which should improve its project management and governance.

64. The remainder of this part of the report highlights achievements and lessons learned in the following areas of project management:

- project set-up and planning (including business cases and cost estimating)
- procurement
- project delivery
- wider programme management.

Project set-up and planning are key to the successful delivery of projects

65. Good practice in setting up and planning projects requires:

- clear vision and direction from the outset
- a well thought through business case, which defines the outputs and outcomes from a project, to help determine its value for money. Business cases should also set out a clear plan for delivery. This should be used throughout the project to help manage changes affecting it during implementation and to help realise the intended benefits
- support for and commitment to the project from top management and major stakeholders
- a good and clear decision-making structure with proper, well-defined roles and responsibilities for all involved in the project.

Business cases are needed to set out a clear plan for delivery

66. Business cases for most projects demonstrated clear links between the stated aims of the project and wider strategic goals.

67. However, our work identified gaps in some projects. In four projects (Erskine Bridge maintenance, M74 completion, eCare, Scottish Crime Campus) no authoritative business case was available. Although each of these projects had passed through several decision points, the absence of a business case created a number of risks:

- There may be confusion and a potential lack of ownership in relation to the key parameters of project aims, scope, cost, time and risk, which may compromise the success of the project.
- Accountability is weakened because the basis for reporting, reviewing and assessing progress on benefits, costs, risks and timescales is not as clear as it could be.

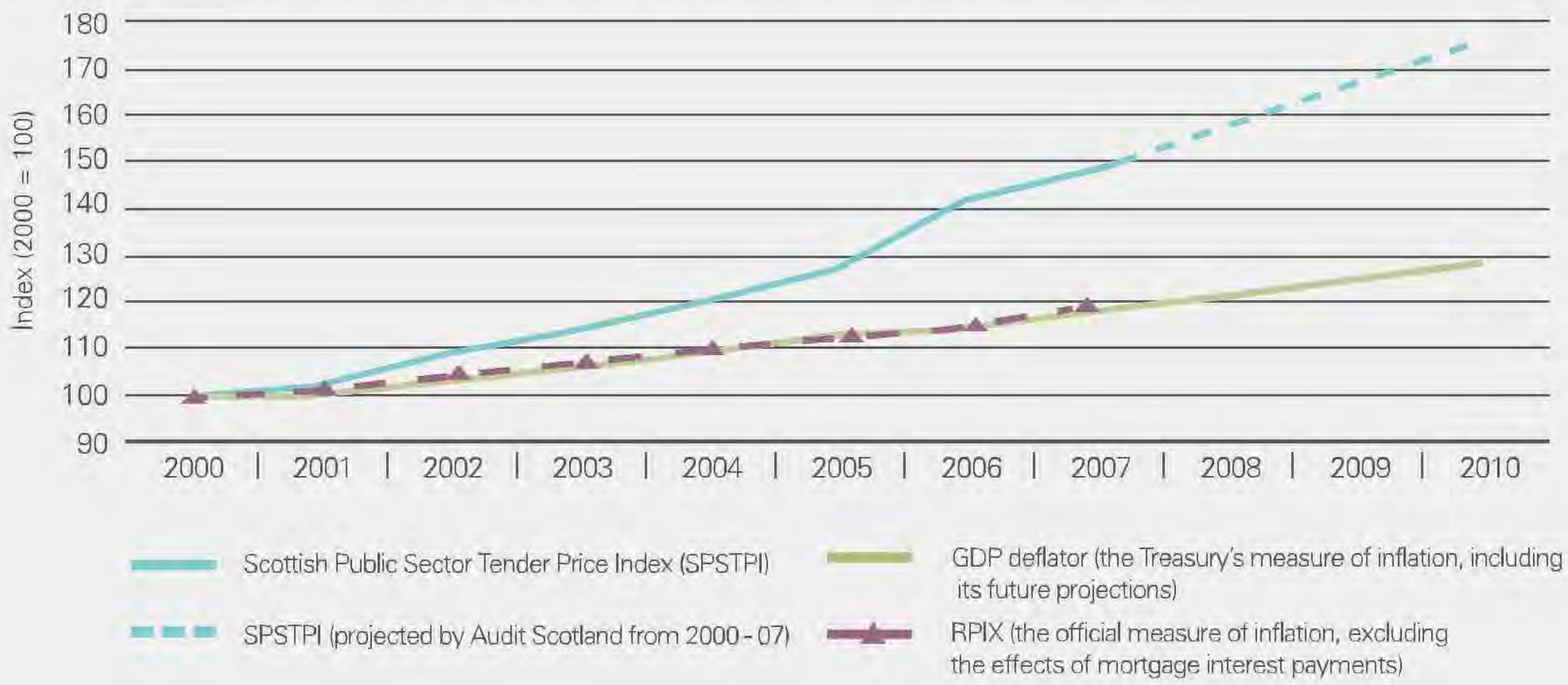
68. In a few other projects, while satisfactory business cases were available, there was scope for improvement. For example, the business case for the National Intranet had not been reviewed to reflect changes in the project that had been introduced in the previous two years. Similarly, the business case for the Edinburgh Waverley Infrastructure Works had not been revisited since December 2005.

69. As part of our review, we commissioned an expert assessment of a sample of six business cases to assess quality and completeness.[21] The purpose of the assessment was not to question the merit of any project, but to examine the quality of the underlying project appraisal process. This highlighted a number of areas where the quality of project appraisals could be improved:

- In most projects, the overall aims were set down, but these could have been improved by having more clearly-defined and specific objectives. In particular, the inclusion of specific targets to demonstrate the change brought about by the investment would have enhanced the understanding of the need and purpose of the projects.
- In most cases, a reasonable range of options was identified. However, the list of options considered in detail in some appraisals was limited. There is a risk that rather than a rational examination of a wide range of alternatives that ultimately highlights the best option, business cases become a process to justify a pre-existing preferred option.
- In three cases, the initial appraisal excluded consideration of how to procure the project. Although better analysis in this area was completed immediately prior to awarding the contract, ideally an assessment of risks to delivery of a project should influence the choice of procurement method from the outset.

21 The six projects selected for the assessment were: the Beatson Oncology Unit, Edinburgh Waverley Infrastructure Works, M74 completion, National Intranet, State Hospital redevelopment and the Royal Botanic Garden Visitor Centre.

Exhibit 13
Construction inflation 2000-07 compared with general inflation and projected to 2010



Source: Audit Scotland using data supplied by Scottish Government and published by HM Treasury

The approach to estimating costs needs to improve

Early cost estimates should include appropriate allowances for risk and cost inflation

70. Parts 2 and 3 of this report show that, in many cases, project time and cost estimates supporting the initial decision to proceed were too optimistic. Only two-fifths of projects were completed within the cost estimated at initial approval, and the costs of some current projects have also increased significantly.

71. Research for HM Treasury in 2002 provided evidence of systematic errors in estimating cost and time in the early stages of major projects across the UK.[22] This identified regular underestimates because project managers did not make sufficient allowance for the unforeseen problems that increase costs and time, this is known as 'optimism bias'. HM Treasury issued guidance in 2003 to counteract this. The guidance requires projects' cost estimates to include an allowance for optimism bias. The allowance has to be based on empirical evidence of cost overruns experienced by similar or comparable projects.[23] The allowance for optimism bias is over and above allowances for specifically identified risks but may be expected to gradually reduce as the project progresses and knowledge of risks (and how to control them) improves. As well as improving the accuracy of cost estimates, allowing for optimism bias also reduces the risk of committing to more projects than can be afforded in the overall investment programme.

72. In the cases we examined, project teams had attempted to improve cost estimating and project control by recognising optimism bias. In most cases, potential risks and their associated costs had been identified.

73. Due to the long gestation periods of projects, some projects had not built in allowances for risk or optimism bias in early estimates. For example, project cost estimates made before the HM Treasury guidance in 2003 included no optimism bias allowance. After this date, there were significant differences among projects on how estimates accounted for risk and uncertainty in project. Some projects introduced large contingency allowances to reflect estimating uncertainty, but these were not always linked to any specific empirical evidence about optimism bias. In other cases, risk registers and risk management systems were introduced to assist project management, but the results were not directly linked to project budgets and estimates.

74. Another problem in forecasting costs is accounting for construction costs inflation. Some projects we reviewed either did not include a specific inflation estimate or assumed that construction inflation would be the same as general inflation. However, recent history and longer trend analysis show periods when construction inflation varied significantly from general inflation. Since 2000, the Scottish Public Sector Tender Price Index (SPSTI) has risen by an annual average rate of 5.8 per cent (49 per cent in total), while general inflation has recorded a 2.5 per cent annual average (19 per cent in total) (Exhibit 13). Current independent forecasts suggest that, for the next few years, construction inflation will continue to outstrip general inflation. Projects therefore need to consider a range of

22 *Review of Large Public Procurement in the UK*, Mott MacDonald for HM Treasury, July 2002.
23 HM Treasury Supplementary Green Book Guidance – Optimism bias is a systematic tendency to underestimate the cost of a project by ignoring the likelihood of unforeseen costs.

Exhibit 14
Procurement routes – advantages and disadvantages

Procurement route	Advantages	Disadvantages
Design and build (client engages contractor who then employs designers)	• Single point of responsibility • Early contractor involvement • Relative cost certainty, if there is a straightforward design and specification (and if the client does not introduce changes to requirements post-contract)	• Less control over quality of specification and works – especially limiting if a one-off, design-intensive project • Client has less direct involvement of the design – risk therefore to fitness of purpose • Late changes by the client result in heavy penalties • Contractor builds in risk premium • Complex legal issues with novation of design teams (novation is the transfer of the contract between the client and the design team to the contractor)
Prime contracts or framework agreements (template contract agreed for series of projects)	• Only need to negotiate once for a series of projects • Prospect of repeat business attractive to consultants and contractors	• May not always be best value for money • Public procurement regulations may impact
Two-stage tender (contractor selected for first stage on basis of limited scope, eg preliminaries, overhead and profit. In second stage, full price is negotiated through open book tendering of sub-contracts)	• Early contractor involvement in design and building issues, allowing for increased scope for innovation from tenderers • Can start on site earlier • Design team can develop the design in more detail prior to going to tender for second stage	• Level of detail available for first-stage tender may be limited, with large percentage of provisional sums – reducing cost certainty • Once the contractor is selected, competition is lost and this may impact on the cost • Client must take steps to strengthen its commercial position for second-stage tender
Management contracting (contractor appointed to employ and manage works' contractors, which carry out the works)	• Management contractor involved early and manages works' contractors • Can appoint early	• No single point responsibility for design and construction • Management contractor only held responsible for workmanship to extent that works' contractor is responsible and able to pay
Construction management (construction manager appointed to arrange and monitor trade contracts but client employs all contractors)	• Can help accelerate timetable • Construction manager can exercise cost and quality control	• No direct contract between construction manager and the trade contractors • Difficult to control cost increases and therefore little cost certainty • Should not be attempted without good previous experience of the method
Traditional procurement (client engages design team and contractor direct)	• Control over design process • Direct reporting of design team ensuring quality of specification • Relative cost certainty if well controlled as a detailed Bill of Quantities is required	• No one person is responsible for design and construction • Design needs to be developed as fully as possible prior to tendering • Longer timescale for delivery required • Can be less attractive to contractors when there is high market demand

Source: Audit Scotland

inflation scenarios if cost estimates are to be reliable.[24]

Other project cost estimates could be improved

75. There is scope to improve other aspects of estimating cost. The choice of construction method, fixtures, fittings and services may significantly affect the costs and they require careful assessment during project appraisal. Explicit consideration of the effect of whole-life costs was relatively scarce within the project appraisals we examined.[25]

76. Comparative costs from similar completed projects provide a useful benchmark for establishing likely costs at the early appraisal and planning stages, but we found the use of benchmarking and cost comparisons varied among projects. Transport Scotland, because it is

24 http://www.davislangdon.com/upload/StaticFiles/EME%20Publications/Market%20Forecasts/MarketForecast_May2008.pdf

running a programme, can and do compare the costs of its major road schemes to help gauge the likely cost of any new project.

A sound approach to procurement is vital

The choice of procurement strategy can affect project costs

77. Choosing the correct procurement strategy for a project is essential for good competition, minimising costs and maximising quality and value for money. The aim is to get the optimum balance of risk between client and contractor, in accordance with the principle that each risk should be assigned to whichever party is best placed to manage it. There is no single right answer when deciding how to procure a project due to the individual nature and requirements of projects. Exhibit 14 illustrates the potential advantages and disadvantages of different procurement routes, for projects which are publicly funded.

78. Our work shows that project teams were mostly making sound procurement decisions. For example, because of the importance of integration and cost certainty within projects, HM Treasury guidance states that design and build contracts should be considered for every project, along with other integrated procurement methods such as Prime Contracting. Design and build was the most commonly adopted procurement route among projects completed between 2002 and 2007 (Exhibit 15).

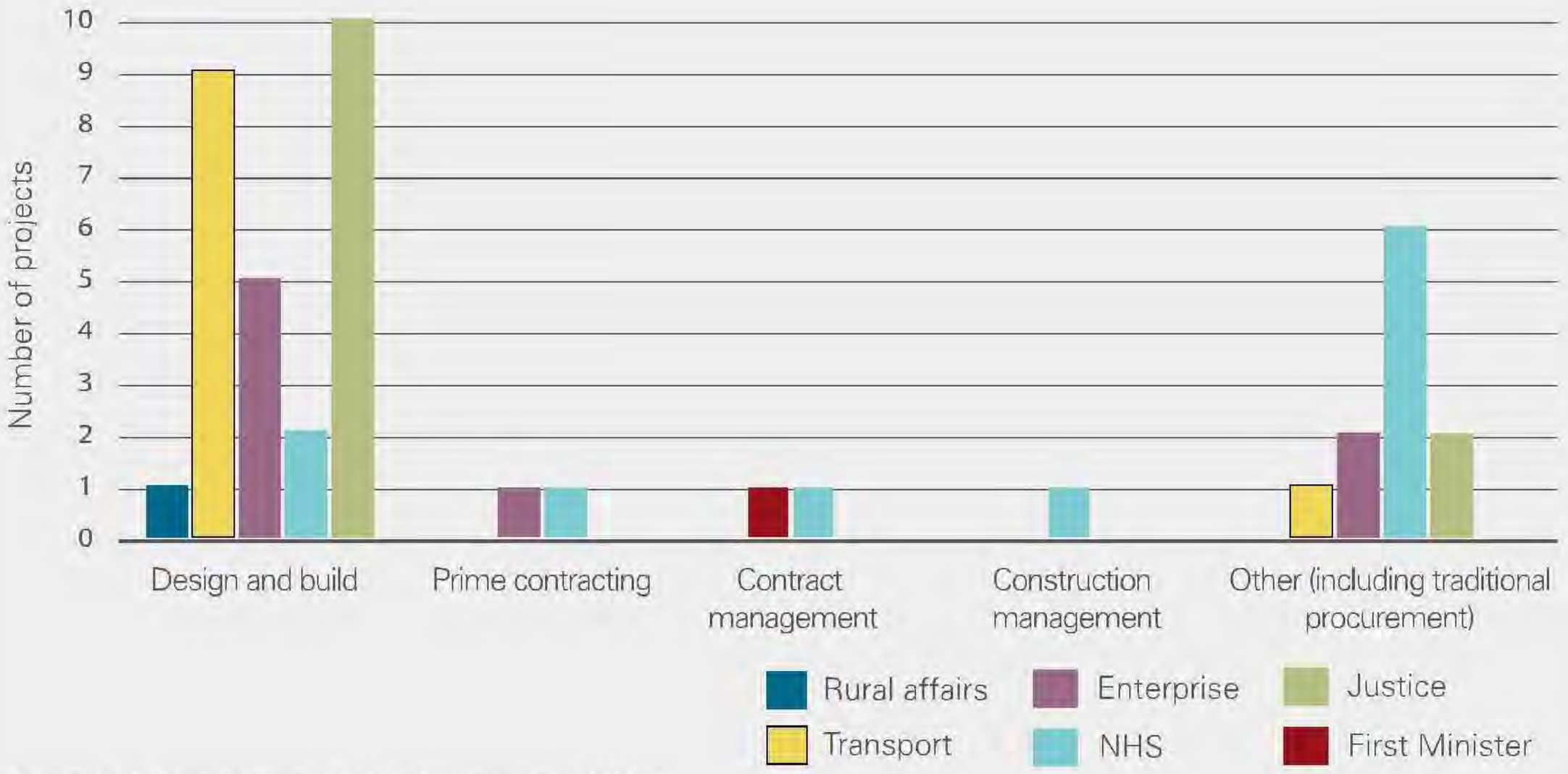
79. Our case study reviews showed that in most cases, project teams had prepared formal procurement strategies based on an assessment of risks and risk allocation strategies for each procurement route. Tender competitions for projects were also generally well handled, with a good level of competition in most cases. The projects we reviewed typically received between three and five bids each before the main construction contract was awarded.

80. In particular, for roads projects, Transport Scotland and its predecessors developed a robust lump-sum design and build contracting strategy, which has resulted in a high degree of cost certainty for many projects in recent years. Between 1993 and 2005 it completed 25 design and build projects costing £390 million, with an average contract cost variance of +4 per cent.

81. However, three projects – M74 completion, Playfair project and Parliament House – experienced difficulties with their procurement:

- In two cases, M74 completion and Parliament House, the fixed price design and build contracts (which should provide cost certainty for the client but involve a high degree of risk transfer to suppliers) did not prove attractive to the market. This in turn created delays and other

Exhibit 15
The most common type of procurement for completed projects (2002 - 2007) was design and build



Source: Audit Scotland survey of 43 projects completed 2002-07

25 The whole-life costs of a facility are the costs of constructing, operating and maintaining it over its whole life through to its disposal. Whole-life costs of an asset are more reliable indicators of value for money than the initial construction costs, since money spent on a good design can be saved many times over in (lower) construction and maintenance costs. A well-built project can also achieve significant savings in running costs.

problems for the projects. Case study 1 in Part 3 discusses the M74 completion project.

- The National Galleries for Scotland initially tendered for a management contractor for the Playfair project. This procurement route was selected after professional advice from the externally-appointed project manager, but it received only one bid in response. In 2001, after further advice and discussion of the procurement strategy with the Scottish Executive, it tendered for a construction management contract. Six competitive bids were received and a construction manager was appointed in June 2001.

- In 2005, the Scottish Court Service attempted to procure the works for the Parliament House project on a fixed price design and build contract. This resulted in no bids being received. A revised tender in summer 2006 (again based on fixed price design and build contract) also resulted in no bids, despite contractor interest and confirmation from some that bids would be submitted. After a review of the contract strategy, the Scottish Court Service approved a procurement approach for Phase 1 of the project based on two-stage tendering, with the Scottish Court Service retaining responsibility (and risk) for design and coordinating the works. In spring 2007, three bids were received in response to the first-stage tender and the Scottish Court Service appointed a main contractor for its Phase 1 works in June 2007.

82. For three projects, the chosen contract type proved to be poorly matched to some risks arising later in the project. Specifically, the risk of changes in scope after the construction contract was awarded had not been fully considered, resulting in costs being higher than the contract price:

- The Stirling-Alloa-Kincardine Rail Link project is discussed in Case study 2 in Part 3.

- The Golden Jubilee Heart & Lung Centre had a design and build lump-sum fixed price contract. The client made changes to the scope after it was awarded, with inadequate assessment of potential risks. The changes resulted in a 14 per cent increase in the contract cost.

- After it awarded the design and build contract for the Beatson Oncology Unit project, NHS Greater Glasgow and Clyde made changes to the scope to meet newly issued regulations for the safe treatment radioactive materials and safe containment of x-rays. These changes were necessary to ensure adequate security and compliance, but introducing them at this stage contributed to a seven per cent increase in the contract cost.

Wider market conditions may also affect costs

83. Public sector capital projects compete in an open market along with the private sector and are subject to the volatility of the market. The market is affected by domestic demand and, increasingly, by global demands for raw materials, knowledge and expertise, which has forced up prices. Consequently, in periods of high demand, market competition may weaken and project costs increase beyond original plans and forecasts. In particular, there is a risk that increasing national and international demand may reduce the number of suppliers bidding for contracts.

84. Market conditions present strategic risks to individual projects and to the Scottish Government's investment programme as a whole. The current market means that there may be fewer potential suppliers for capital projects, or their willingness to compete for work may be reduced. This increases the risk of poorer value for money for public bodies from weak competition. The Scottish Government needs to consider carefully the extent to which poorly coordinated approaches by the public sector could put value for money at risk and how to manage that risk.

Good governance and experienced teams have contributed to successful project delivery

Project managers with specialist knowledge and significant practical experience can more effectively deliver projects

85. Overall, projects appear reasonably well executed. For all projects, there was generally a culture of positive project management and recognition of the importance of a systematic approach. In general, for most projects:

- Good governance structures were in place. The right people were involved and committed to the project.

- Project reporting showed evidence of clear leadership, accountability and openness to support decision-making.

- Business cases and project plans clearly allocated responsibilities for delivery.

86. In particular, Transport Scotland and the Scottish Prison Service (responsible for investment programmes comprising many similar, rather than one-off projects) have well-established, systematic procedures.

87. Both Transport Scotland and the Scottish Prison Service have delivered a programme of projects within ten per cent of the overall estimated cost. The Prison Service completed ten prison projects between 2002 and 2007 at a total cost of £198 million. This was less than both the initial estimated cost of £201 million and the combined contract cost of £199 million. Similarly, Transport Scotland completed nine roads projects costing £164 million. This was nine per cent more than the initial estimated cost of £150 million but £8 million (five per

cent) less than the combined contract cost of £172 million.

88. Transport Scotland's road investment programme in 2007-08 comprises ten medium and large projects, each exceeding £20 million in value. Similarly, there are three medium and large rail projects in progress. Major roads projects are managed by small but experienced teams within Transport Scotland, with strong communication and well-understood roles. Similarly, Transport Scotland has significantly increased the number and skills of project managers with experience in delivering rail projects.

89. Other public bodies with limited experience of major projects, such as in the case of the Scottish Agricultural Science Agency's new HQ at Gogarbank, employed individuals and project management companies to bring the skills needed to help deliver their projects.

Independent gateway reviews are not always done

90. A gateway review is a short, focused review of a project carried out at key decision points in its life cycle by a team of independent, experienced practitioners. Exhibit 2 in Part 1 highlights the five project gateways. Gateway reviews provide an independent stock-take at key points in a project, with an opportunity to identify and correct any deficiencies. The Scottish Government sponsors and provides resources centrally to enable independent gateway reviews to take place.

91. The Scottish Executive introduced gateway reviews in 2001, but they were not mandatory until 2005. Since 2005, 44 gateway and similar reviews for 20 major construction projects have been completed.[26]

92. Of the 15 current projects we examined, nine had carried out gateway reviews or another form of review with some degree of independence from the project team. Project teams that have carried out gateway and similar reviews confirm the process is valued and useful. Six other current and five completed projects we examined had not completed gateway reviews because they had started (or in some cases finished) prior to this becoming mandatory.[27]

Better coordination and challenge across the Scottish Government may improve investment planning and control

93. The Scottish Executive's 2005 *Infrastructure Investment Plan* recommended improvements in how the public sector should manage the substantial increase in infrastructure spending, to promote value for money and effective delivery. The plan aimed to:

- sustain healthy interest from suppliers in the larger volume of future projects
- improve in areas, such as procurement, where the Holyrood project had highlighted risks
- secure high standards of governance and accountability
- build project management capability within public bodies.

94. Some improvements have been made in these areas.

- The Scottish Executive undertook a fundamental review and strengthening of central guidance on major project procurement and management during 2004 and 2005, and issued revised guidance in December 2005.
- In general terms, our review suggests this guidance is widely recognised and accepted by project managers.
- In 2006, the Scottish Executive improved strategic coordination by setting up a cross-government committee – the Infrastructure Investment Group.

95. However, it is not clear that action so far fully satisfies the improvement aims of the 2005 plan. For example, in 2007 the Scottish Government deferred a decision to introduce changes in corporate governance and reporting systems to strengthen central oversight and challenge.

96. The Scottish Government's 2008 *Infrastructure Investment Plan,* sets out its future investment plans and the broad delivery framework. However, it does not provide a plan for maintaining and strengthening capability in major project management.

97. The Infrastructure Investment Group oversaw the creation, in 2007, of a database of current and potential major projects across the Scottish Government. However, the database provides only a snapshot of each project, with no real-time information available on project status, progress against cost, time and quality targets or risks to their delivery.

98. The NHS, Transport Scotland and the Scottish Prison Service are responsible for large capital investment programmes and use their own systems for monitoring and overseeing projects. But there is no strong, central focus within government to foster consistent and constructive challenge of investment projects and their progress. The Scottish Government does not have standardised systems

26 Most of these projects have been reviewed more than once. The Scottish Government facilitated a further 95 gateway reviews of policy projects in the same period.

27 The six current projects are: Upper Forth Crossing, Golden Jubilee Heart & Lung Centre, Stirling-Alloa-Kincardine Rail Link, eCare, Erskine Bridge maintenance and strengthening, Edinburgh Prison Phase 3.

for reporting and appraising the current status of projects and how they are performing against cost, time and quality targets.

99. A completely new and centralised (ie, pan-Government) system of project management, monitoring and reporting is unlikely to be the best approach. It would be costly to implement and would cut across existing governance systems, which, our work shows, are in many respects effective. However, there are risks with the current approach, which devolves responsibility to individual government portfolios, making strong unified direction and leadership more difficult to achieve. There is scope for reinforcing strategic direction and investment planning, by establishing a senior, professionally-led, coordination and challenge function to champion best practice in investment planning and control across the whole Scottish Government and the wider public sector.

100. The key achievements and lessons our work has identified provide a useful starting point for reinforcing and spreading good practice. Key issues to maintain and strengthen capability in major project management are:

- The need for good leadership to promote and ensure consistently high standards of major project management and governance across government.
- Developing and sharing existing project management and expertise across government.
- Improving the rigour of project appraisals and the reliability of project cost forecasting.
- The opportunity to support accountability with better, more consistent and open reporting of project progress, outputs and achievements.
- Introducing a more strategic approach to major project procurement across government which responds to market conditions and appetite.
- Reinforcing constructive challenge to support effective delivery of projects and disseminating lessons learned.

101. In May 2008, the Scottish Government published its business case for the further development of the Scottish Futures Trust initiative. This includes the proposal for a small new public body, Scottish Futures Trust Ltd Delivery and Development, which is intended to provide a focal point for coordinated public sector infrastructure planning and investment. It will seek to introduce greater efficiency in major investment through greater scrutiny, oversight and coordination across the public sector. This coordination may help address our recommendations below.

Recommendations

The Scottish Government should:

- strengthen strategic direction and investment planning by establishing a senior, government-wide, investment coordination and challenge function
- ensure robust procurement strategies and cost estimates have been developed prior to awarding funding to projects
- take account of market conditions and construction inflation when developing its capital programme.

Public bodies should:

- ensure appropriate project management and governance arrangements are put in place for every project
- prepare robust business cases for every project. These should be clear about the project aims and benefits, and include assessment of: risks; the range of options to be considered; and a clear basis for assessing, reviewing and reporting
- include a specific risk allowance, optimism bias allowance and take account of construction cost inflation in early cost estimates
- build whole-life costs into business cases and subsequent project reporting
- develop an appropriate procurement strategy which considers all procurement routes, competitiveness and capacity within the construction industry. Ensure that risk management strategies explicitly consider and mitigate the risk of changes in scope after the contract has been awarded
- from the outset, ensure they have project managers with the appropriate experience and knowledge of effectively managing major projects
- set a clear plan with regard to the need for independent gateway or similar reviews at the key stages in projects.

Appendix 1.

43 completed major capital projects completed between 2002 and 2007

Projects reviewed as case studies are highlighted

	Portfolio and project	Final cost £m	Year completed
	Health and well-being		
1	Beatson Oncology Unit	87	2007
2	Glasgow Royal Infirmary redevelopment (maternity, plastics & additional floor)	71	2002
3	New Royal Aberdeen Children's Hospital	24	2003
4	Crosshouse west end development	13	2004
5	Galloway Community Hospital	12	2006
6	Stracathro Ambulatory Diagnostic & Treatment Centre	10	2006
7	Leith Community Treatment Centre	10	2004
8	PBWAS[1]	9	2003
9	Linear Accelerator – Edinburgh Cancer Centre Phase 4	9	2006
10	Gyle Square Property fit-out	8	2004
11	Dykebar Acute Mental Health Admissions Unit	5	2002
	Subtotal	**258**	**11 projects**
	Finance and sustainability		
12	A1 Haddington to Dunbar Expressway	44	2004
13	Larkhall to Milngavie rail link	35	2005
14	A78 Ardrossan to Saltcoats Bypass	30	2004
15	A8 Baillieston to Newhouse major maintenance	28	2004
16	A80 Auchenkilns Junction Improvement	22	2005
17	A985 Kincardine Eastern Link Road	13	2004
18	A830 Arisaig to Kinsadel	11	2003
19	A1 Howburn to Houndwood	5	2003
20	A96 Coachford Climbing Lane	5	2005
21	A1 Bowerhouse to Spott	5	2003
	Subtotal	**198**	**10 projects**
	Justice		
22	Upgrade to Polmont Prison Phase 2 – Monro Hall, Segregation Hall	39	2007
23	Glenochil Prison Phase 2– Abercrombie Hall & Health Centre	29	2007
24	Edinburgh Prison – Ingliston House	26	2005
25	Glenochil Prison Phase 1 – Harviestoun Hall	25	2005
26	Edinburgh Prison – Hermiston House	17	2003
27	Perth Prison Phase 1 – Regimes, energy centre, kitchen, laundry	17	2006
28	Edinburgh Prison – Phase 2	16	2006
29	Polmont Prison Houseblock 1 – Iona Hall	16	2002
30	Ballater Street refurbishment	9	2007
31	Edinburgh Prison – Phase 1	7	2005
32	Polmont Prison Phase 1 – Regimes	7	2005
33	Aberdeen Sheriff Court Annex	5	2005
	Subtotal	**213**	**12 projects**
	Education and lifelong learning		
34	Clyde Waterfront – New River Clyde Road Bridge	20	2006
35	Centre for Health Science Phase 1	16	2006
36	Factory for Vestas, Machrihanish	10	2002
37	Project Atlas	8	2007
38	EMEC Tidal Test facility	7	2007
39	Gartcosh Stage 3 site development	6	2007

1 Prosthetics Bioengineering Wheelchair and Associated Services.

Portfolio and project		Final cost £m	Year completed
40	Network Management System	5	2007
41	European Marine Energy Centre – Wave	5	2003
	Subtotal	**77**	**8 projects**
	Rural affairs		
42	Construction of new HQ at Gogarbank farm, near Ratho	33	2005
	First Minister		
43	The Playfair Project Phase 1 and Phase 2	32	2004
	Total	811	43

Projects with incomplete data

We could not get definitive estimates of cost or time for the following projects:

Portfolio and project		Project cost estimate available?		Project time estimate available?	
		Initial approval	Contract	Initial approval	Contract
	Health and well-being				
2	Glasgow Royal Infirmary redevelopment (maternity, plastics & additional floor)	No	Yes	No	Yes
3	New Royal Aberdeen Children's Hospital	Yes	No	Yes	Yes
6	Stracathro ADTC	Yes	Yes	Yes	No
7	Leith Community Treatment Centre	Yes	Yes	No	No
8	PBWAS	Yes	No	No	Yes
10	Gyle Square Property fit-out	No	No	Yes	Yes
11	Dykebar Acute MH Admissions Unit	Yes	Yes	No	Yes
	Finance and sustainability				
12	A1 Haddington to Dunbar Expressway	Yes	Yes	No	Yes
14	A78 Ardrossan to Saltcoats Bypass	Yes	Yes	No	Yes
15	A8 Baillieston to Newhouse major maintenance	Yes	Yes	No	Yes
17	A985 Kincardine Eastern Link Road	Yes	Yes	No	Yes
18	A830 Arisaig to Kinsadel	Yes	Yes	No	Yes
19	A1 Howburn to Houndwood	Yes	Yes	No	Yes
20	A96 Coachford Climbing Lane	Yes	Yes	No	Yes
21	A1 Bowerhouse to Spott	Yes	Yes	No	Yes
	Justice				
33	Aberdeen Sheriff Court Annex	Yes	Yes	No	Yes
	Education and lifelong learning				
36	Factory for Vestas, Machrihanish	Yes	No	Yes	No
41	European Marine Energy Centre – Wave	Yes	No	No	No

Appendix 2.

104 major capital projects currently in progress

Projects reviewed as case studies are highlighted

Portfolio and project	Estimated cost	Procured by
Finance and sustainable growth	**£m**	
M74 completion	692	Glasgow City Council
Edinburgh Tram Project	500	City of Edinburgh Council
Glasgow Airport Rail Link (GARL) Project, combined with upgrading of a section of the Network Rail 'Paisley Corridor' Route	300-400	Transport Scotland
Airdrie to Bathgate Rail Link Project	375	Transport Scotland
Borders Railway Project	295	Transport Scotland
Edinburgh Waverley Station Infrastructure Works	150	Transport Scotland
A876 Upper Forth Crossing at Kincardine Project	120	Transport Scotland
A90 Balmedie to Tipperty Dualling Project	50-100	Transport Scotland
Stirling-Alloa-Kincardine Rail Link	85	Clackmannanshire Council
Traffic Scotland Intelligent Transport System Action Plan 2007-12	80	Transport Scotland
White Cart Water flood prevention scheme – Glasgow City Council	53	Glasgow City Council
A876 Kincardine Bridge Refurbishment Project	20-50	Transport Scotland
A96 Fochabers and Mosstodloch Bypass Project	20-50	Transport Scotland
Water of Leith flood prevention scheme – City of Edinburgh Council	47	City of Edinburgh Council
A68 Dalkeith Northern Bypass Project	42	Transport Scotland
eCare	33	Scottish Government
A898 Erskine Bridge Maintenance, Strengthening and Refurbishment Project	29	Transport Scotland
Braid Burn scheme – City of Edinburgh Council	29	City of Edinburgh Council
M8 Kingston Bridge Complex – Parapet Upgrading included Bothwell Street	26	Transport Scotland
Central Scotland Motorway Network Upgrading	26	Transport Scotland
A830 Arisaig to Loch nan Uamh Project	25	Transport Scotland
A77 Glen App Improvement Project	24	Transport Scotland
A75 Dunragit Bypass Project	<20	Transport Scotland
A75 Hardgrove to Kinmount Project	<20	Transport Scotland
A77 Drummuckloch to Innermessan Improvement Project	<20	Transport Scotland
A77 Park End to Bennane Improvement Project	<20	Transport Scotland
A77 Symington and Bogend Toll Project	<20	Transport Scotland
A82 Crianlarich Bypass	<20	Transport Scotland
A82 Pulpit Rock	<20	Transport Scotland
A9 Crubenmore Dual Carriageway Northern Extension Project	<20	Transport Scotland
A75 Overtaking Opportunities	14	Transport Scotland
A9 Ballinluig Junction Improvements Project	14	Transport Scotland
Raasay Ferry Terminal	13	The Highland Council
Dunfermline flood prevention scheme – Fife Council	13	Fife Council
e-Planning Efficient Government Programme	11	Scottish Government
A9 Kincraig to Dalraddy Carriageway Project	11	Transport Scotland
Future Road improvements Programme	11	Transport Scotland
A7 Auchenrivock Improvement Project	10	Transport Scotland
Galston flood prevention scheme – East Ayrshire Council	10	East Ayrshire Council
A75 Cairntop to Barlae Project	9	Transport Scotland
New pensions IT system	8	SPPA
Residual Bridge Strengthening Programme	8	Transport Scotland
Bo'ness flood prevention scheme	8	Falkirk Council

Portfolio and project	Estimated cost	Procured by
A68 Pathhead to Tynehead Project	7	Transport Scotland
A9 Helmsdale to Ord of Caithness Improvements Phase 2 Project	7	Transport Scotland
A76 Glenairlie Improvement Scheme Project	7	Transport Scotland
A68 South Soutra to Oxton Project	7	Transport Scotland
A77 – Burnside Improvement – 06/SW/0901/009	7	Transport Scotland
M8 Harthill Footbridge Replacement	6	Transport Scotland
Broxburn flood prevention scheme	5	West Lothian Council
Total for finance and sustainable growth	**3,357**	**50 projects**
Justice	**£m**	
Court Unification and Fines	73	Scottish Court Service
Scottish Crime Campus (Gartcosh)	63	Scottish Government
Parliament House Master Plan	54	Scottish Court Service
Polmont Prison Phases 3 & 4	43	Scottish Prison Service
Edinburgh Prison Phase 3	25	Scottish Prison Service
Perth Prison Phase 3	21	Scottish Prison Service
Glenochil Prison Phase 3	21	Scottish Prison Service
Polmont Prison Phase 5	18	Scottish Prison Service
Edinburgh Prison Phase 4	14	Scottish Prison Service
Dumbarton Sheriff Court	10	Scottish Court Service
Police Performance Management Platform Project	8	Grampian Police Board on behalf of ACPOS
Total for Justice	**350**	**11 projects**
Rural affairs and the environment	**£m**	
Fisheries Protection Vessel Vigilant (replacement)	15	SFPA
Royal Botanic Garden Edinburgh – Visitor Centre	16	Royal Botanic Garden Edinburgh
Loch Lomond & The Trossachs HQ	9	Loch Lomond and The Trossachs National Park
Fisheries Protection Aircraft (replacement x 2)	7	SFPA
A replacement SAC education facility in Ayr	6	Scottish Agricultural College
Total for rural affairs and the environment	**53**	**5 projects**
Health and well-being	**£m**	
New Acute Hospital Residual Charge	139	NHS Forth Valley
Acute services review, Phase 2	130	NHS Greater Glasgow and Clyde
State Hospital redevelopment	85	The State Hospitals Board for Scotland
Victoria Hospital reconfiguration	51	NHS Fife
Picture archive & communication system (PACS)	32	National Services Scotland
Ravenscraig – North Lanarkshire Council	29	sportscotland
Chris Anderson Stadium – Aberdeen City Council	28	sportscotland
Airdrie Resource Centre	27	NHS Lanarkshire
Forthbank – Stirling Council	27	sportscotland
Borders General Hospital redesign projects	18	NHS Borders

Portfolio and project	Estimated cost	Procured by
Golden Jubilee Heart & Lung Centre	15	National Waiting Times Centre Board
Toryglen – Glasgow City Council	15	sportscotland
Scotstoun – Glasgow City Council	14	sportscotland
Day Surgery Centre Raigmore	14	NHS Highland
Carluke Resource Centre	12	NHS Lanarkshire
Coatbridge Dental & Integrated Resource Centre	12	NHS Lanarkshire
Mental Health Project	11	NHS Fife
Cupar Community Hospital	8	NHS Fife
Linear Accelerator Raigmore	8	NHS Highland
Main Block Development Project (ABC 20)	6	NHS Tayside
Wave 5 Linear Accelerator	6	NHS Tayside
Miscellaneous	6	Scottish Ambulance Service
Glasgow ambulance stations	5	Scottish Ambulance Service
Health Centre Programme	12	NHS Forth Valley
Royal Alexandra Hospital Maternity Phase 2	8	NHS Greater Glasgow and Clyde
Health Centre Programme	8	NHS Forth Valley
Laboratory review	6	NHS Greater Glasgow and Clyde
Dental access centres	5	NHS Fife
Total for health and well-being	**737**	**28 projects**
First Minister	**£m**	
Royal Museum Masterplan	46	National Museums Scotland
Burns International Museum	21	National Trust for Scotland
Royal Commission of Ancient and Historical Monuments in Scotland	17	RCAHMS
Eden Court Theatre	14	Eden Court
Stirling Castle Palace Project	11	Historic Scotland
Royal Museum Masterplan Enabling Phase	10	National Museums Scotland
Culloden Battlefield Memorial Centre	8	National Trust for Scotland
Total for First Minister	**127**	**7 projects**
Education and lifelong learning	**£m**	
National Intranet	38	Scottish Government
Jordanhill School Estate redevelopment	7	Scottish Government
Rossie Secure Services	7	Scottish Government
Total for education and lifelong learning	52	3 projects
Total	**4,676**	**104**

Appendix 3.

Model of good project management practice

Project area	Basic practices	Adequate – improving practices	Advanced practices
Vision & direction • Strategic alignment & business case • Sponsor commitment	• A simple business case exists with limited benefits appraisal • No clear linkage between the project and overall strategy of the business • There is an absence of sponsorship or no clear lead/ direction to the programme from senior management	• Business case exists – with a compelling vision for the programme • Objectives linked to strategy – and regularly updated • Sponsor of appropriate experience, seniority and influence in place to support the project	• A clear and compelling vision for the programme is defined and translated into statements of programme mission and objectives • There is a balanced scorecard of Critical Success Factors and Key Performance Indicators, reflecting the mission and objectives • There is strong top management support and commitment to sponsor
Planning • Governance • Risk management • Procurement strategy	• No clear organisational structure • Roles and responsibilities are not defined or are unclear • Basic risk assessments and treatment provision across businesses • Insufficient or weak procurement analysis, does not consider market interest or appetite for the project	• Organogram is in place, complete and complied with • Roles and responsibilities have been defined and documented • Risk management integrated into core processes – and with some modelling capability • Documented procurement strategy – awareness of market appetite for the project	• Dedicated roles allocated, including a board panel, steering/ working group and project management team linked to KPIs and scorecards • Clear linkage between financial performance and risk management performance • Overall risk and treatment portfolio approach • Procurement strategy well matched to project risk profile and market appetite
Execution • Project management • Resources & people • Procurement	• No project baseline, scope changes incorporated without review/control or amendments to budget and schedule • There is a lack of team spirit or staff in silos • Insufficient resources to deliver the project: quantity and capability • Weak supplier interest in the project	• Change control is present – and is dynamic and reviewed/linked to strategy, opportunities and risk appetite • Resources brought in to deliver programme – and based on an assessment of capability and skill mix • External resource used to backfill business as usual • Effective competition amongst capable suppliers	• There are effective controls over any proposed changes to the business requirements • The team possess complementary skills in order to support high performance • There is an open and constructive management culture • Strong constructive relationships with key suppliers
Measuring & monitoring • Benefits management • Reporting	• Projects have poorly defined deliverables • Benefits are qualitative or are based on spurious assessments • Reporting is viewed as an administrative activity that adds no value	• Statements of deliverables exist at project and work-stream level • Benefits are defined and quantified at least at a basic level • Reports to senior managers are available – and produced within days not weeks	• Benefits are clearly quantified in terms related to improved business performance • Benefits defined at workstream, project and business level • Performance information is highly accessible, available at any time and is easy to interpret via a 'dashboard'
Business acceptance • Change management • Stakeholder management	• There is no clear change management strategy or plan in place • The case for change is questionable and has not been clearly articulated • A rudimentary analysis and assessment of stakeholders' needs has been undertaken	• The consequences of basic resistance to change are exposed and understood – and plans exist to manage this risk • A stakeholder engagement plan is in place – and senior managers realistically estimate the necessary time commitment	• There is a clear change strategy and approach with sufficient involvement of stakeholders to make change happen • Change is seen as not imposed but an opportunity • All stakeholders are identified and expectations are classified and understood

Appendix 4.

Audit Scotland methodology

1. Our examination of major projects comprised the following main elements.

Survey of completed projects

Delivery to cost, time and quality

2. We surveyed the public bodies responsible for all 43 projects that were completed between April 2002 and March 2007 (Appendix 1), to obtain systematic information about completion to cost, time and quality objectives.

3. In examining delivery to cost, we compared the actual forecast cost of projects against two main benchmarks:

- the estimate of total costs at the point at which the project was first approved (initial estimate)
- the estimate at the point immediately before the main contract was awarded (contract estimate).

4. Similarly, in examining delivery to time we, compared the actual completion date against two key targets:

- the estimated completion date at the point the initial business case was approved (initial estimate)
- the estimated date before the main contract was awarded (contract estimate).

5. Project quality may be defined as fitness for purpose, ie the project will satisfy the needs for which it was intended. Because projects vary significantly, there are no simple and universal measures of the achievement of quality which can be applied to all projects. In our survey, we asked for information about whether the required project outputs were delivered without significant defects, and what wider assessments of quality, if any, had taken place. In particular, we asked:

- Was there a formal assessment of the project against design quality criteria (ie, functionality; build quality; impact; and diversity and inclusion)?
- Was there any formal assessment of the project against environmental (BREEAM) criteria?
- Did the project apply any other form of quality assessment against which the project deliverables were measured?
- Did the client complete a formal post-project evaluation? And, if so, what were the three main lessons from the evaluation?

Case study review of a sample of 20 projects

6. Using a competition, we appointed Ernst & Young to work jointly with us on individual project reviews and provide advice. Ernst & Young has significant experience in independently assessing major capital project performance.

7. Working with Ernst & Young, we conducted more detailed reviews of a sample of 20 projects:

- Five completed projects. Most of our evidence about the performance of completed projects came from our survey. We examined a small sample of completed projects as case studies to help provide a deeper understanding of performance.
- 15 current projects. We selected a relatively large number of current, high-value projects to maximise our coverage. There are currently 104 major investment projects in progress with a combined capital value of £4.7 billion (Appendix 2, page 37). We examined 15 of these projects, with a combined value of £1.8 billion (38 per cent of current projects by value).

8. Within our sample of 20 projects we included at least one project from every Scottish Government portfolio.

9. As part of each case study, we interviewed senior staff responsible for the project and some stakeholders, such as delivery partners. We also reviewed key documents.

Delivery to cost, time and quality

10. For our case study reviews, we assessed the performance of each project to cost, time and quality using a traffic light system (Exhibit 4, page 9).

Project management and governance

11. We assessed each project against good project management criteria. Specifically, we looked at five areas of project governance and management effectiveness (Exhibit 3) which we adapted from a model which Ernst & Young has applied elsewhere in assessing major capital project performance. We also took into account other sources of advice, guidance and good practice on major project management. For each project and for each good practice area, we assessed the project management capability on a scale which ranged from basic to advanced. Appendix 3 details the model of good practice criteria we applied.

12. In general terms, we sought assurance that the management and governance were adequate. Our reviews of individual projects were short and high level – designed to get positive evidence of effective management and governance rapidly.

13. As part of our assessment, we commissioned an expert assessment of a sample of six business cases to assess quality and completeness

(Beatson Oncology Unit, Edinburgh Waverley Improvement Works, M74 completion, National Intranet, State Hospital Redevelopment, Royal Botanic Garden Visitor Centre). The purpose of the assessment was not to question the merit of any project, but to examine the quality of the underlying project appraisal process.

Reporting

14. In addition to this report, we have also published a high-level summary of the 20 projects we reviewed and a good practice checklist for public bodies on our website: www.audit-scotland.gov.uk

Appendix 5.

Membership of the Project Advisory Group

Member	Organisation
Tim Banfield	Director, Defence & FCO VFM Audit, National Audit Office
Mike Baxter	Head of Private Finance and Capital Unit, Scottish Government Health Directorates
Riona Bell	Director of Funding, Scottish Funding Council
John Connolly	Facilities Management Consultant for Gardiner & Theobald LLp
Guy Houston	Director of Finance and Corporate Services, Transport Scotland
Professor Graeme Millar CBE	Forum Chair, Scottish Construction Forum
Hugh O'Farrell	Manager, Cross-Government and Efficiency Studies, National Audit Office

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How Government Works

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