National Audit Office

DEPARTMENT FOR TRANSPORT

Estimating and monitoring the costs of building roads in England

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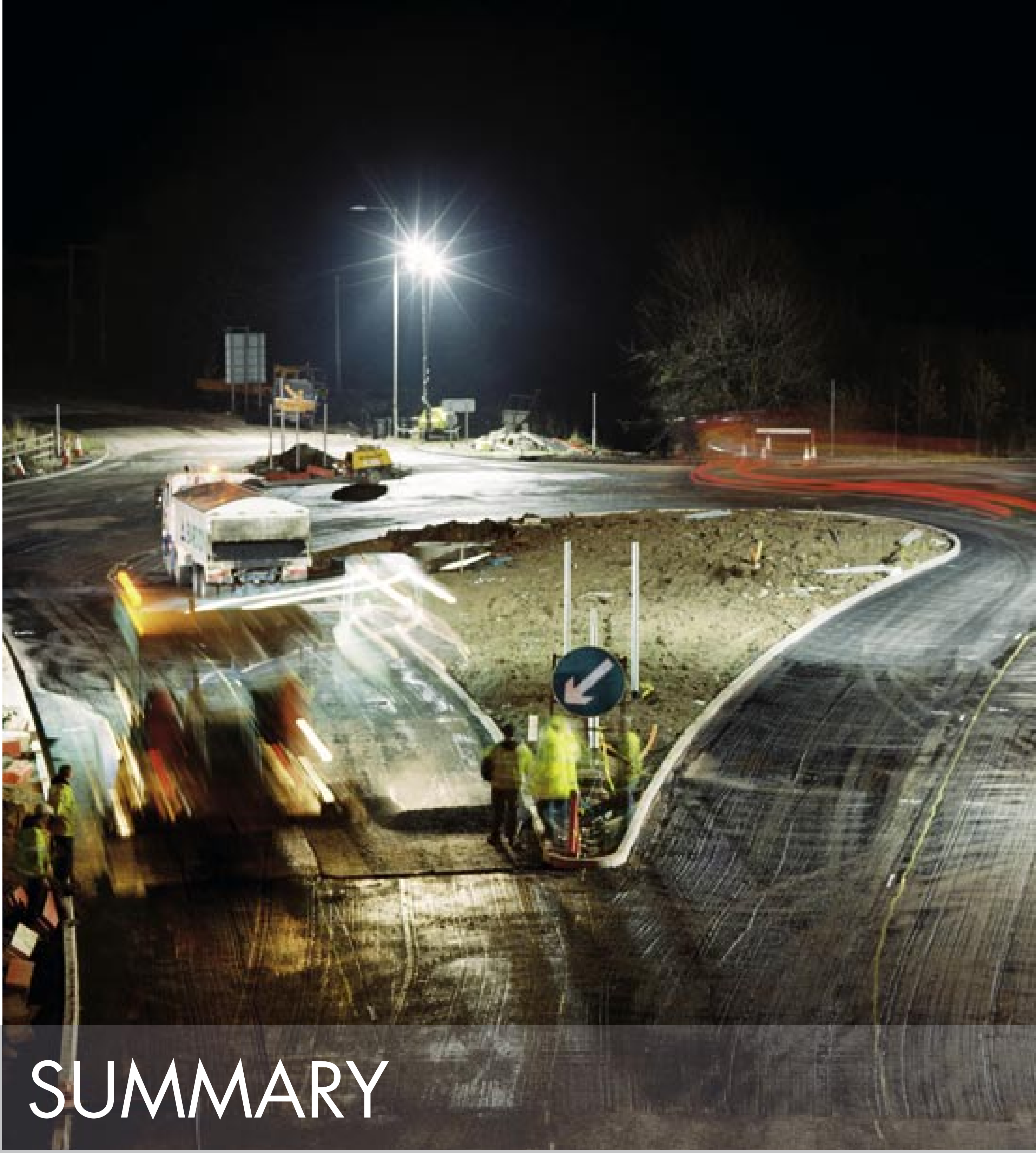


SUMMARY

1 This report examines how the costs of building and improving roads are estimated and monitored from early forecasts through to the final cost of schemes. The Department for Transport (the Department) has approved expenditure of over £11 billion between 1998 and 2021 for the development of new and existing trunk roads and motorways by the Highways Agency (the Agency) **(Figure 1 on page 8)**, and just under £1.7 billion on major road schemes which are proposed and developed by local authorities in five year Local Transport Plans **(Figure 2 on page 9)**.[1] This expenditure contributes to the Department's Public Service Agreement Target to make journeys more reliable.

1 There are 103 schemes in the Highways Agency's programme, seven of which are PFI projects let as Design, Build, Finance and Operate contracts. The Programme contained 113 schemes: six schemes have been dropped, one has been transferred to Transport for London and in our analysis we have counted the three A43 Silverstone schemes as one scheme and the two A1 Dishforth to Barton schemes as one scheme. There are 81 Local Transport Plan schemes two of which are planned to be PFI contracts.

2 Schemes have cost more than initial estimates indicated. For the Targeted Programme of Improvement:

- By September 2006, 36 schemes had been completed and, after adjustments for changes in estimating methodology, had cost six per cent more than estimated;[2]
- The Department's latest approved estimates of the current Agency schemes are five per cent more than estimated and the latest forecast for the final programme indicates a 27 per cent increase above the initial estimates.

For the Local Transport Plan:

- By July 2006 the 20 schemes completed had cost 18 per cent more than initially estimated and the Department's funding contribution had increased by 14 per cent.
- The Department's latest approved estimates of the 61 schemes currently in the plan show an overall increase of 11 per cent above the initial estimates. The Department's funding contribution has also increased by 11 per cent. The latest local authority forecasts indicate that costs will increase further with the final cost likely to be 31 per cent more than the initial estimates.
- Unlike the Agency's schemes local authority estimates were not adjusted to compensate for the tendency to underestimate costs. The Department considers that if such adjustments had been made the increases above would be substantially reduced.

Overall Conclusion

3 Robust estimating is a key factor in delivering value for money from road schemes but represents a difficult and challenging task given the timescale of major road projects and the number of potential variables, some of which are outside of the Agency's and local authorities' direct control such as Public Inquiry outcomes. The Agency is taking action to improve its estimating processes, and the Department to improve its review of proposals put forward by local authorities. There is scope to further tighten procedures by improving 'intelligent buyer' skills through better evaluation of time and cost variances on completed schemes and dissemination of lessons learned; development and utilisation by the Agency of more unit cost data for components of schemes, labour and materials; and by managing prudent contingency provisions so as not to disincentivise project managers from preparing realistic estimates and managing against them. Additionally the Department and Agency could improve programme monitoring by measuring progress on the Agency's programme on a project by project basis rather than an overall target for all schemes and by comparing costs incurred not only to the overall project budget but also against those expected for the stage of completion.

Key findings

1 Most schemes enter the roads programme at an early stage of their development and only have an indicative estimate of likely cost. Final costs were 17 per cent more than initial estimates for the Agency's schemes entered as outline business cases, compared to seven per cent for schemes where the preferred route had been identified and three per cent for cases approved before the main works contract is let.

2 The Public Inquiry stage for a road scheme may require significant additional design work and major changes to design which make it difficult to produce accurate cost estimates before a Public Inquiry.

3 The biggest increases occur in the construction costs due to:

- inflation in construction costs which is higher than general inflation across the economy;
- design changes (for example where additional junctions are added to plans);
- costs of structures such as bridges and tunnels being underestimated;
- changes in interconnecting roads;
- meeting stakeholder requirements such as those of adjoining landowners;
- insufficient allowance being made for third party and other regulatory costs such as changes in safety standards;

2 Estimates for 35 of the 36 completed Targeted Programme of Improvement Schemes were prepared before 2003 and included a ten per cent contingency for risk but excluded non recoverable value added tax and inflation. From this base line, the actual costs were 40 per cent higher than these initial estimates. Since 2003 the Agency's estimates have included both value added tax and inflation and in accordance with Treasury guidance issued in 2003 in "The Green Book", have also been increased by between 3 and 45 per cent to compensate for the tendency to underestimate costs (known as 'optimism bias'). The original estimates have been adjusted retrospectively, giving the increase of six per cent rather than 40 per cent.

- complexity of the scheme being underestimated such as where surveys carried out after preparation of initial estimates show ground conditions to be worse than expected; and
- unforeseen work such as discovery of archaeological remains.

4 There are other major factors behind differences between roads costs estimates and outturn including:

- costs of preparatory work for construction (site set up, erection of temporary offices, site transport etc) have been underestimated;
- the costs of land and liabilities for compensation have been underestimated, for example because more land is required than originally anticipated, there is greater than anticipated land and property value inflation, and delays in scheme progress can add to inflationary pressures; and
- costs of re-routing utilities (gas, water and electricity) have been significantly underestimated.

5 The Department and the Agency are taking steps to improve estimating, for example of inflation and land costs but it is too early to judge the success of such measures. Steps are also being taken to improve the understanding and accuracy of cost estimates.[3] Additionally, the Department commissioned the Nichols Group to review the Agency's approach to cost estimating and project management.

6 Estimating could be further enhanced by:

- **Better evaluation of completed schemes.** Until recently the Agency's evaluations of roads after they open did not examine costs against budget or the scheme's progress against timetable. The Agency introduced new procedures in December 2006. The Department has required evaluations by local authorities on schemes approved since early 2006 and has recently issued guidance on evaluating major local authority transport schemes. Neither the Agency nor the Department formally disseminates the lessons learned from scheme evaluations with each other or with local authorities. The Department has supported the establishment of an internet based network for sharing good practice between local authorities.
- **Further work to develop and utilise unit costs for schemes.** The Agency has made some progress on identifying the unit costs of the main components of schemes and the costs of labour and materials so that it can manage estimates and contracts more effectively. The Department has not undertaken any work to identify the unit costs of Local Transport plan schemes as it does not have access to the detailed breakdown of costs from contracts let by local authorities. Instead it now ensures that cost estimates are externally reviewed by technical experts.
- **Reviewing the way provisions for contingencies are made.** The Agency includes a contingency to compensate for underestimates in its budgets for individual schemes which whilst prudent may reduce the incentive for project leaders to provide realistic estimates. The Department seeks to mitigate this risk for local authority schemes by sharing any costs incurred above budget with the Local Authority.

7 The Department and the Agency have been able to absorb the increases in costs to date because of delays on some schemes and changes to the roads programmes but this may change.[4]

8 Monitoring of road schemes requires more rigour:

- The Department has monitored its and the Agency's spending against annual expenditure limits within three year Government expenditure review periods. The Agency is responsible for developing and delivering schemes in accordance with budgets and the scope approved by Ministers.
- Improved processes have been put in place by the Agency since 2004, whereby expenditure is monitored monthly against budget on individual schemes and since August 2006, it has started to discuss this with the Department. The Agency is not required, however, to report on what proportion of a scheme has been delivered for the expenditure incurred.
- The Department has reviewed the progress of individual Local Transport Plan schemes at least annually and reviews scheme costs at each key decision stage. It is now introducing improved monitoring arrangements for local authority schemes as part of the process of introducing the regional funding allocations for transport schemes.

3 For example, the Department now requires a more comprehensive business case from local authorities, employs consultants to review cost estimates in new business cases, has introduced another approval stage for all projects to control costs during procurement and has introduced greater sharing of cost risks with local authorities. The Agency has introduced contracts which allow contractors to become involved earlier in schemes with the aim of reducing cost, promoting innovation and speeding up delivery.

4 For example of the 58 Targeted Programme of Improvement schemes forecast to have started construction before the end of 2005-06, 15 had not done so.

Recommendations

To build on recent improvements to the estimating and management of scheme costs

1 The Department should consider defining more clearly the time at which schemes are formally regarded as in its roads programmes which should reflect a time when the scheme development is sufficiently far advanced to allow costs to be estimated with reasonable certainty.

2 The Agency and the Department should examine critically scheme outturn costs against estimates to establish the reasons for the differences and use this information to produce a more informed range of contingency factors to compensate for under estimates and use the data in future appraisals. The contingency factors should be reviewed and updated as and when a significant number of new projects are completed to keep them timely.

3 To emphasise to project managers the importance of realistic and robust cost estimating, the Agency should retain centrally the contingency for underestimates and only allocate funds from this source to individual projects for project accountability purposes where they are satisfied cost variances could not have been foreseen.

4 The Agency should complete its work on establishing unit costs for all key schemes by the end of 2007, so that the Agency can set more realistic initial cost estimates and benchmark its performance against that of other organisations.

5 The Agency should monitor the market rates for key materials and pay rates used in roads construction to enable it to negotiate more competitive contracts with contractors or directly with suppliers.

To build on recent improvements in the monitoring and management of road schemes

6 From 2007-08 onwards, the Agency should publish an annual analysis of initial and updated cost estimates, outturn costs, and progress against target dates, for all road schemes within the Targeted Programme of Improvement.

7 The Agency's post road opening evaluations should by June 2007, incorporate reviews of the scheme's costs and progress against timetable compared to plans, identifying the reasons for variances, to ensure lessons are learnt to inform the planning, management and delivery of future schemes.

To enhance capability

8 By the end of 2007, the Agency should conduct a skills audit of its staff and based on the results take action to improve project and contract management skills.

9 The Department and the Agency should share more information between themselves and with local authorities to encourage best practice. This information should include identifying the factors that contribute to the successful delivery of schemes and improve the management of costs.

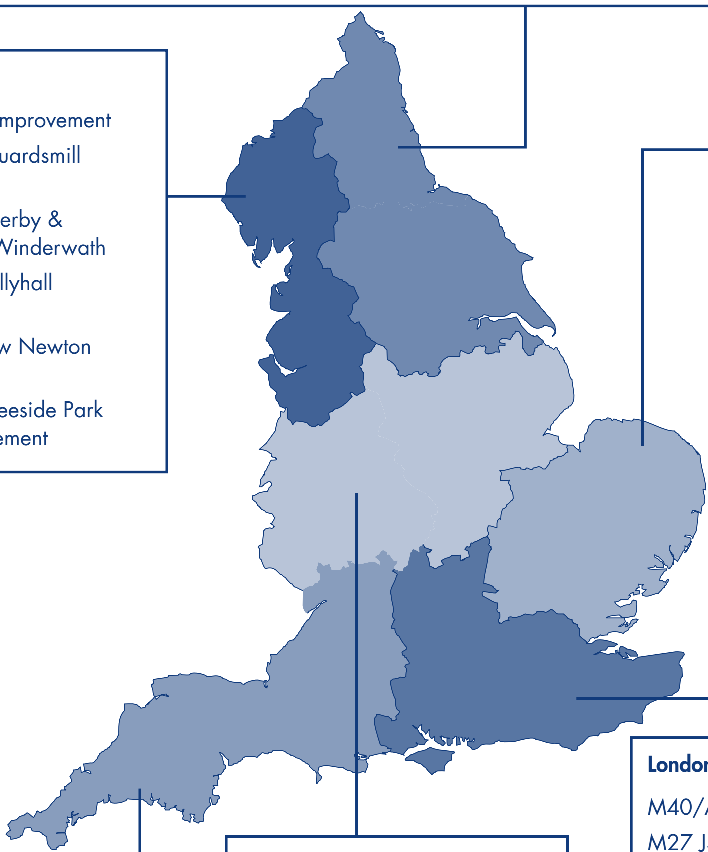
1 Location of current schemes in the Targeted Programme of Improvement as at July 2006

North East & Yorkshire

M1 J39 to J42 Widening
M1 J37 to J39 Widening
M1 J34N to J37 Widening
M1 J32 to J34S Widening
M1 J31 to J32 Widening
M1 J31 to J32 Northbound Collector/Distributor
M1 J30 to J31 Widening
M62 J27 to J28 Widening
M62 J25 to J27 Widening
A63 Melton Grade Separated Junction
A57/A628 Mottram – Tintwistle Bypass
A1 Bramham – Wetherby (Including Wetherby Bypass)
A69 Haydon Bridge Bypass
A66 Long Newton Junction
A66 Greta Bridge to Stephen Bank Improvement
A66 Carkin Moor to Scotch Corner Improvement
A19/A184 Testos Junction Improvement
A1/A19/A1068 Seaton Burn Junction Improvement
A1 Dishforth to Barton

North West

M62 Junction 6 Improvement
M6 Carlisle to Guardsmill Extension
A66 Temple Sowerby & Improvement at Winderwath
A595 Parton – Lillyhall Improvement
A590 High & Low Newton Bypass
A5117/A550 Deeside Park Junctions Improvement



East

M1 Junction 6a – 10 Widening
M1 Junction 10 – 13 Widening
A505 Dunstable Northern Bypass (A5 to M1 Link)
A47 Blofield to North Burlingham Dualling
A428 Caxton Common to Hardwick Improvement
A421 Great Barford Bypass
A421 Bedford to M1 Junction 13
A14 Haughley New St – Stowmarket Improvement
A14 Ellington – Fen Ditton Improvement
A11 Fiveways – Thetford Improvement
A11 Attleborough Bypass

South West

A419 Blunsdon Bypass
A38 Dobwalls Bypass
A303 Stonehenge
A30/A382 Merrymeet Junction
A30 Bodmin Indian Queens
A419 Commonhead Junction

Midlands

M40 Junction 15 (Longbridge)
M1 J21-30
M1 J19 Improvement
A500 City Road & Stoke
A46 Newark – Widmerpool Improvement
A453 Widening (M1 J24 to A52 Nottingham)
A45/A46 Tollbar End Improvement
A1 Peterborough – Blyth Grade Separated Junctions

London & South East

M40/A404 Handy Cross Junction Improvement
M27 J3 to J4 Widening
M27 J11 to J12 Climbing Lanes
M25 Junction 28/A12 Brook Street Interchange
M25 J5-7 Widening
M25 J27-30 Widening
M25 J23-27 Widening
M25 J16-23
M25 J1b-3 Widening
M20 Junction 10A
A3 Hindhead Improvement
A27 Southerham to Beddingham Improvement
A23 Handcross to Warninglid Widening
A21 Tonbridge to Pembury
A21 Kippings Cross to Lamberhurst Bypass
A2/A282 Dartford Improvement
A2 Bean – Cobham Phase 2

Source: National Audit Office

2 Location of current Local Transport Plan major road schemes as at July 2006

Yorkshire & Humberside

Sheffield Northern Inner Relief Road
East Leeds Link Road
Leeds Inner Ring Road – Stage 7
A165 – Reighton Bypass
A631 – West Bawtry Road Improvements
A628 – Cudworth and West Green Link Road
A57 – M1 to Todwick Crossroads
Hemsworth to A1 Link
Glasshoughton Coalfields Link Road
Waverley Link Road
Beverley Integrated Transport Scheme

North West

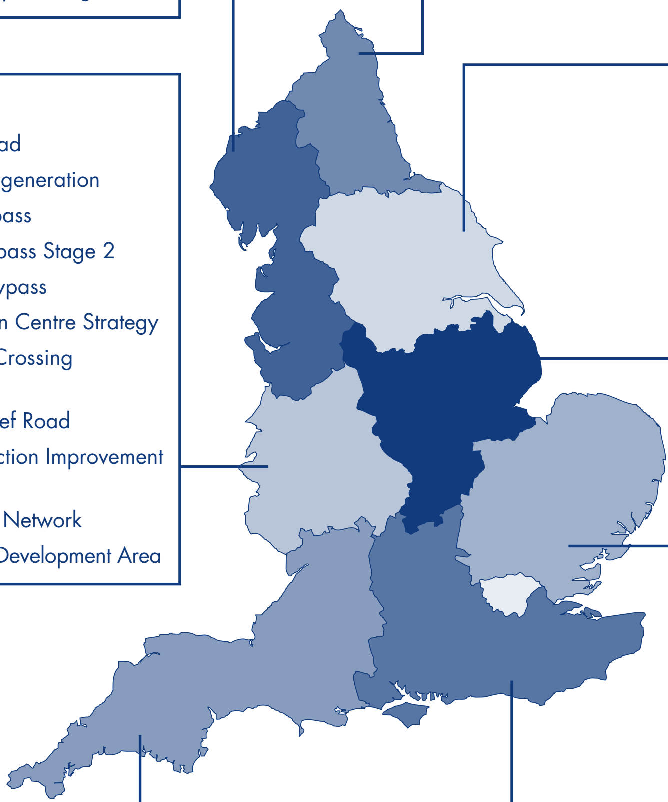
A58 – Blackbrook Diversion
A34 – Alderley Edge Bypass
A57 – Glossop Spur
Hall Lane Area Improvement Scheme
Carlisle Northern Development Route
New Mersey Gateway
Liverpool Edge Lane West
Ashton Northern Bypass Stage 2

North East

Pegswood Bypass
Sunderland Southern Radial Route
Darlington Eastern Transport Corridor
A688 – Weatley Hill to Bowburn Link
A1056 – Northern Gateway Stage 2
North Middlesborough Accessibility Improvements

West Midlands

Selly Oak Relief Road
A38 - Northfield Regeneration
A429 - Barford Bypass
Rugeley Eastern Bypass Stage 2
Tunstall Northern Bypass
Cradley Heath Town Centre Strategy
Owen Street Level Crossing Relief Road
Rugby Western Relief Road
A 4123/A641 Junction Improvement Burnt Tree
Brierley Hill Access Network
Darlaston Strategic Development Area



East Midlands

A6096 Ilkeston-Awsworth Link
A612 – Gedling Integrated Transport Scheme
Oakham Bypass
Markham Employment Growth Zone
A47 Earl Shilton Bypass
A509 – Isham Bypass
A1073 Spalding to Eye
A43 Corby Link Road

East

A1198 – Papworth Bypass
B1115 – Stowmarket Relief Road
A127/A1159 Priory Crescent, Southend on Sea
Ridgmont Bypass and Woburn Link Road
A6 – Bedford Western Bypass

South West

Barnstaple Western Bypass
Poole Bridge Regeneration Initiative Scheme
Taunton Third Way and Northern Inner and Distributor Road
A353/A354 – Weymouth Relief Road

South East

A228 Leybourne & West Malling Corridor Improvement Scheme
A4146 – Stoke Hammond/Linslade Western Bypass
East Kent Access – Phase 1
East Kent Access Phase 2
M4 Junction 11 (Green Park Improvements) and Mereoak Roundabout
Thames Gateway A13/A130
Bexhill to Hastings Link Road
Sittingbourne Northern Relief Road

Source: National Audit Office