GEOSYNTHETICS & STEEL MESHES FOR LONGER LASTING ROADS

SCI HQ, London
Thursday, 12 May 2011

USER'S VIEW POINT: WHY WE USED THESE PRODUCTS

John Howe
Lincs Laboratory
Highways & Transportation
www.lincolnshire.gov.uk/lincslab

Contents

- About us – Lincolnshire
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- Case Study; A1073 Crowland “Meshtrack” Trial (April 1997)
- Case Study; C627 Fodderdyke (August 2004)
- Case Study; A17 Winglands Marsh (March/April 2009)
- Lincolnshire’s documents
- Installation & repair

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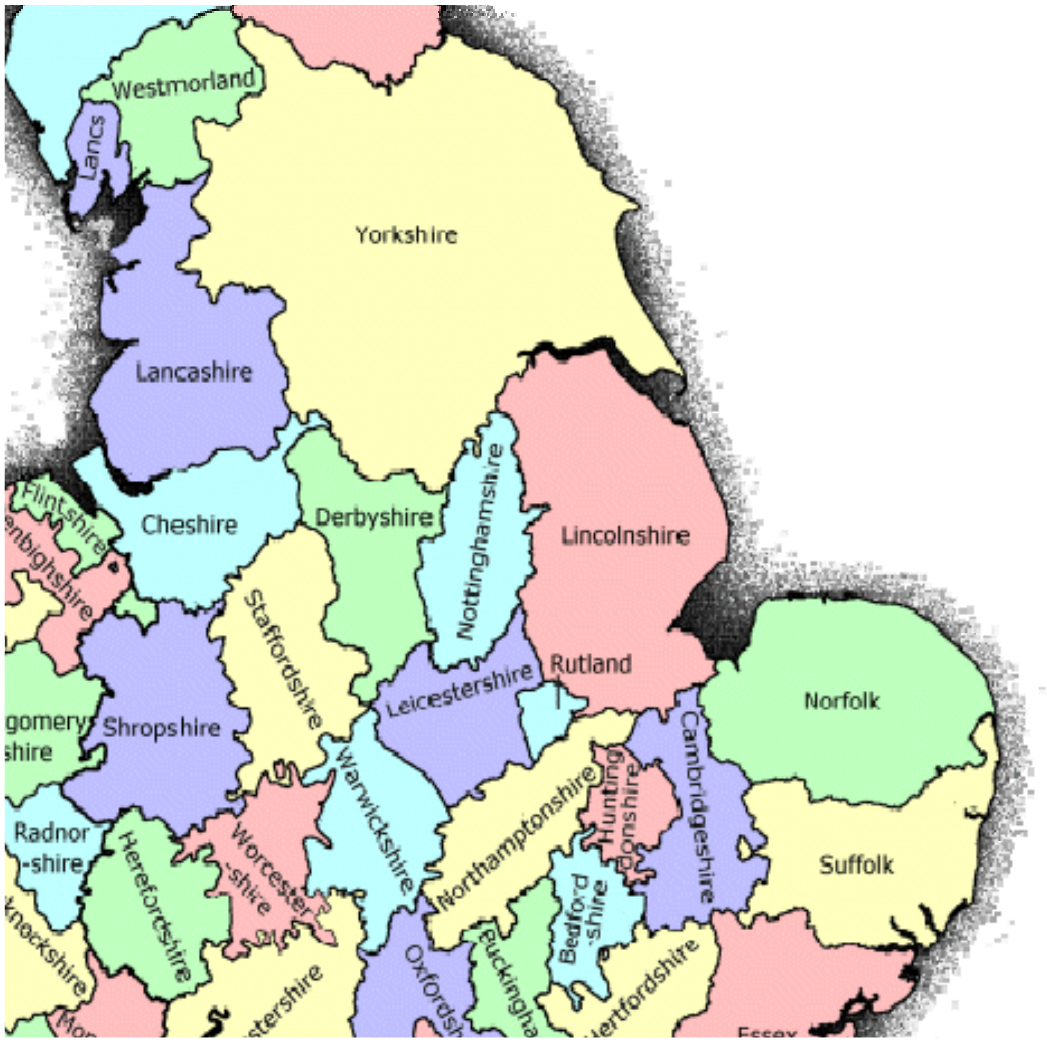
About Us - Lincolnshire

Size of highway network

- It is the 5th longest network of any English highway authority

- 80% being C class or unclassified roads



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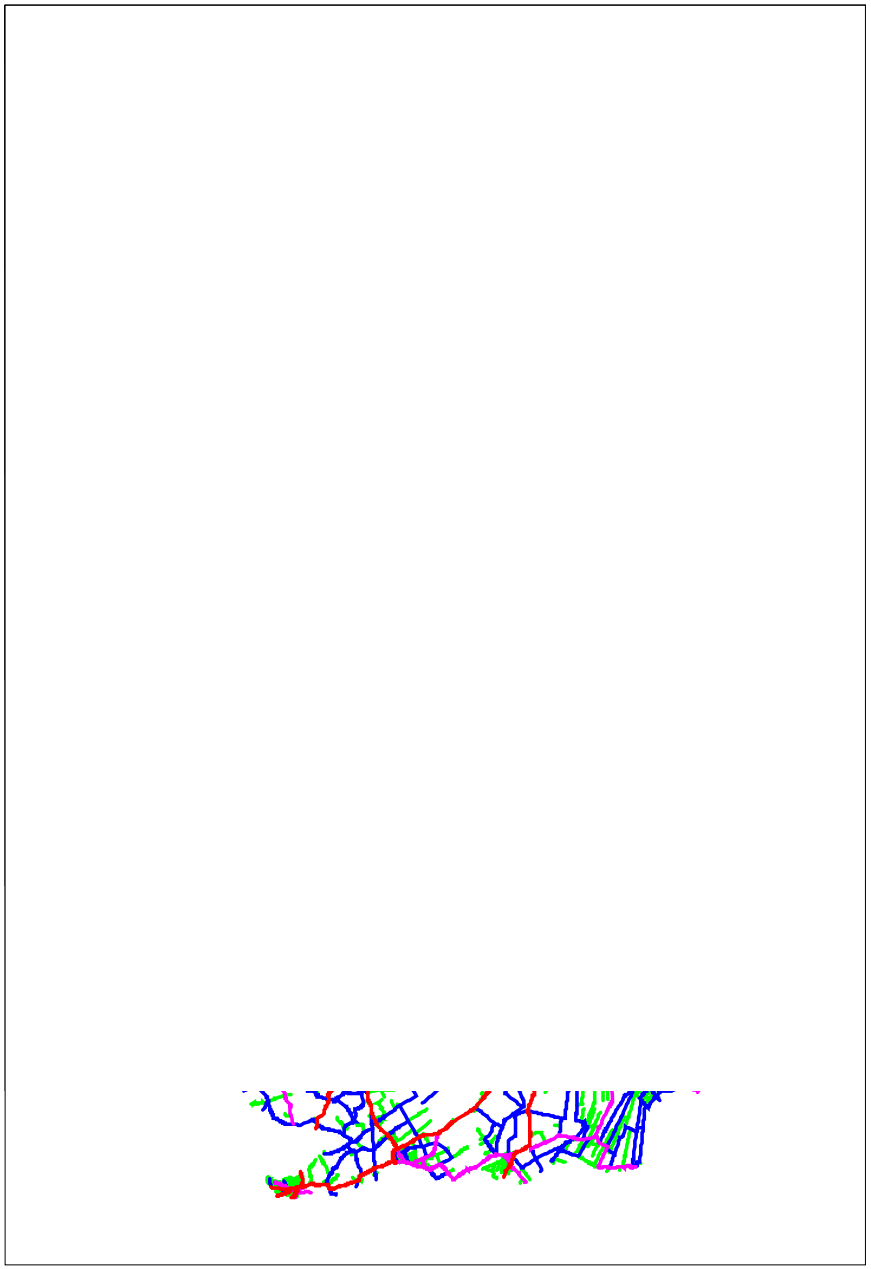
Lincolnshire's Highway Network



Carriageway Lengths

- A roads = 1,076km (12%)
- B roads = 788km (9%)
- C roads = 2,900km (34%)
- UC roads = 3,880km (45%)

Total = 8,644km

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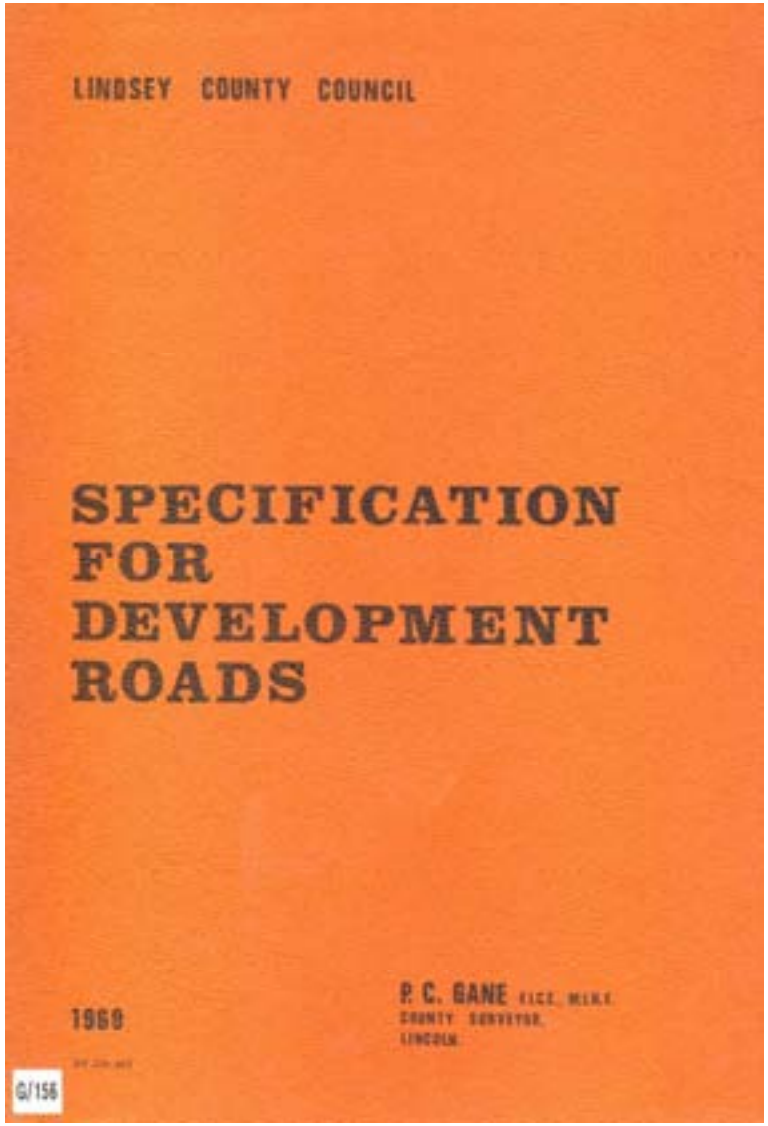
Geosynthetics in Lincolnshire (1)



Specification for Development Roads (1969)

No reference to geosynthetics

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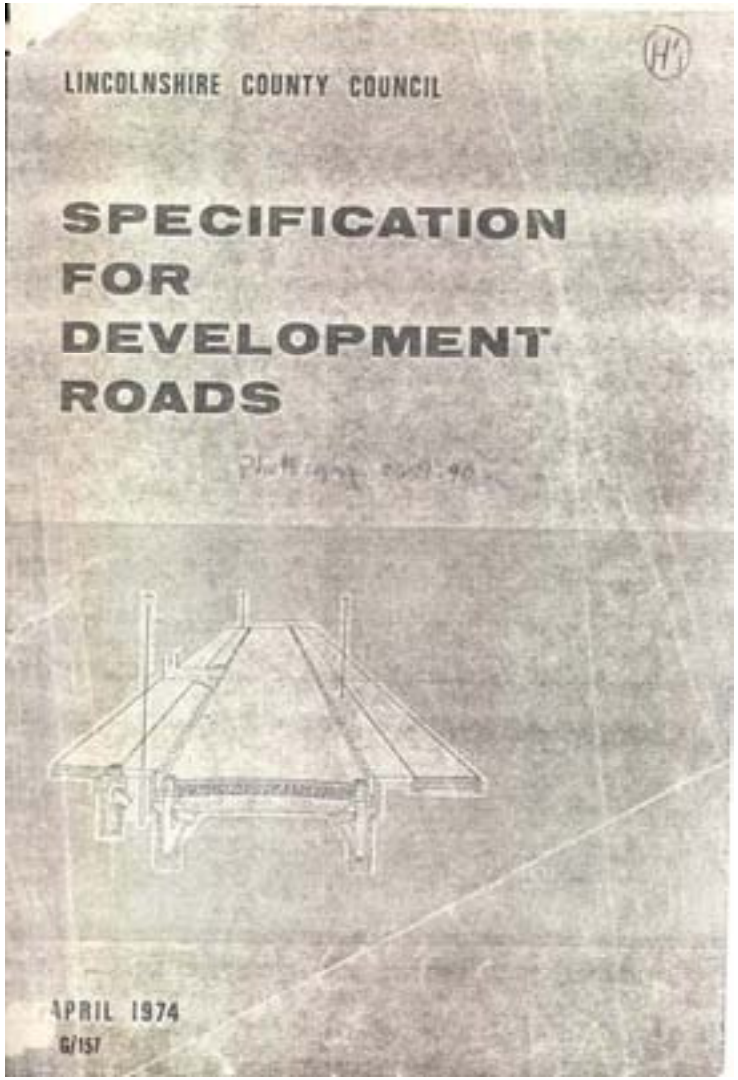
Geosynthetics in Lincolnshire (2)



Specification for Development Roads (1974)

No reference to geosynthetics

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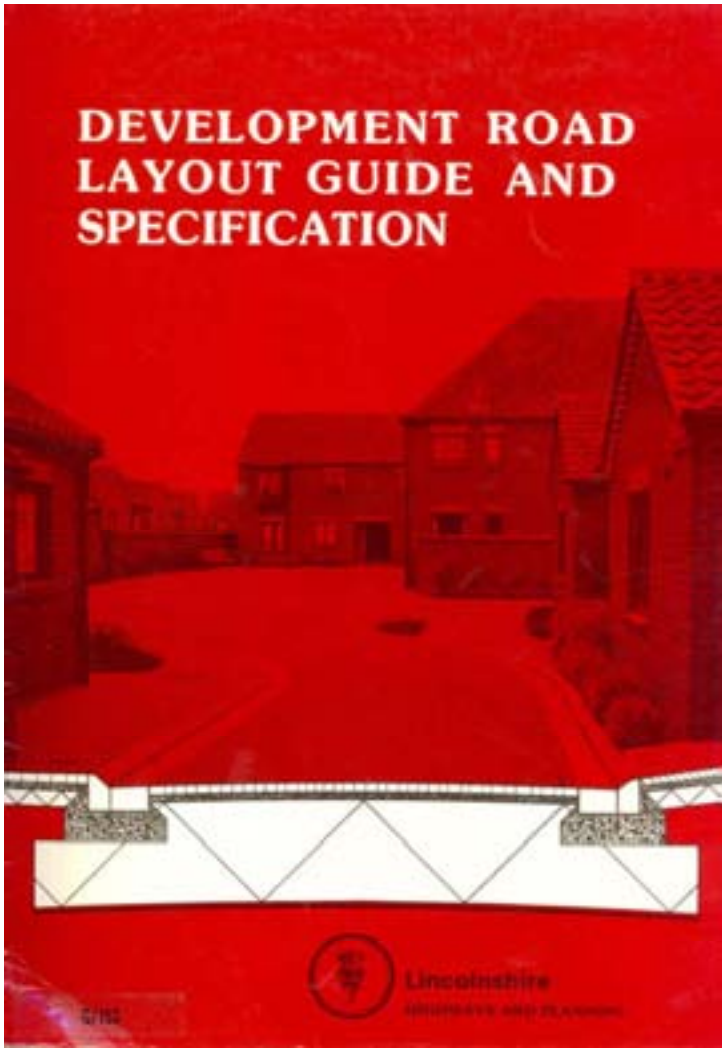
Geosynthetics in Lincolnshire (3)



Development Road Layout Guide & Specification (1985)

"the use of an approved geotextile may enable economies to be made & these are indicated in Charts 1 - 4"

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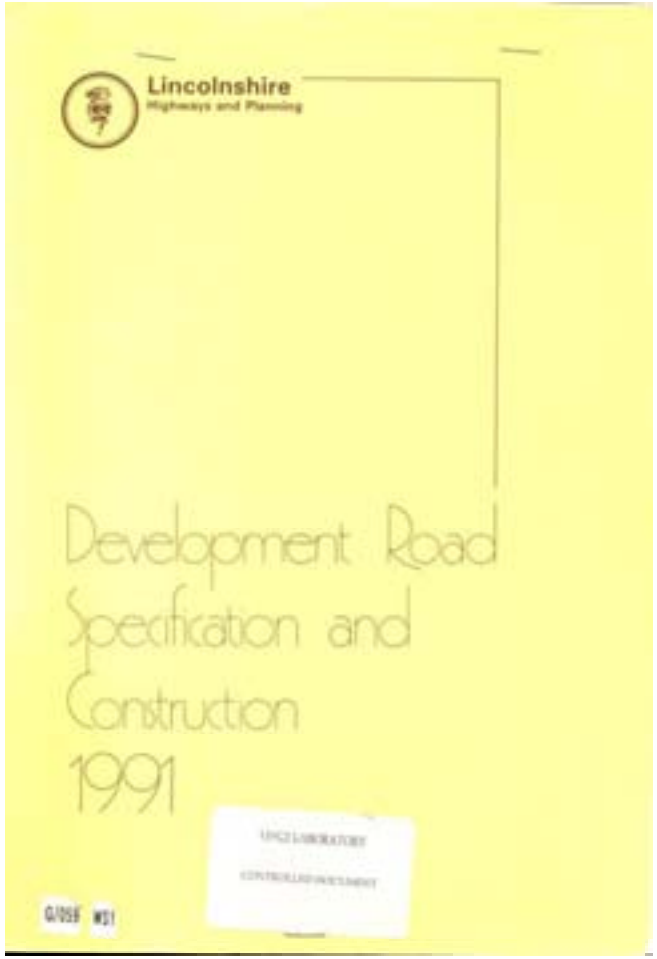
Geosynthetics in Lincolnshire (4)



Development Road Specification & Construction (1991)

"The charts permit the use of approved geotextiles with consequential economies in construction. The type of geotextile to be used & the proposed reduction must be agreed before construction commences."

"Geotextiles when used as a separation layer between sub-base & sub-grade shall be handled & laid as described in this clause"

"When soils are very weak, it may be necessary to incorporate a geogrid & specialist advice should be sought."

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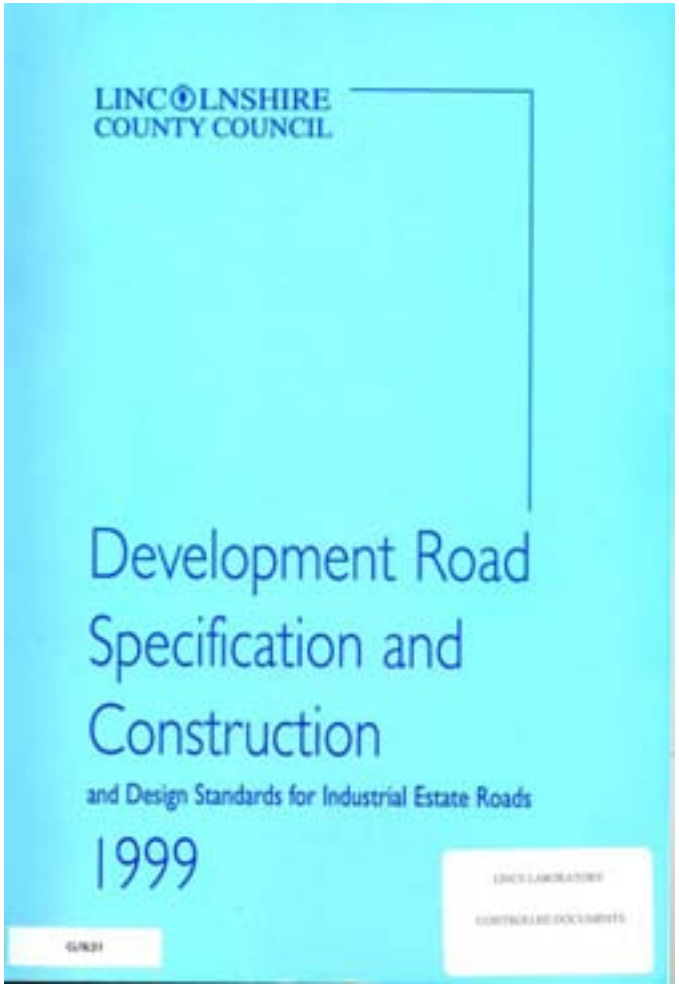
Geosynthetics in Lincolnshire (5)



"Two principal uses in a pavement foundation:

1. As a separator between sub-base & subgrade
2. As a foundation reinforcing agent which can reduce the sub-base thickness."

"The type of geosynthetic product to be used, its purpose and any proposed reduction in sub-base thickness must be agreed before construction commences."

"Geotextiles, when used as a separation layer between sub-base & subgrade, shall be handled & laid in accordance with this clause."

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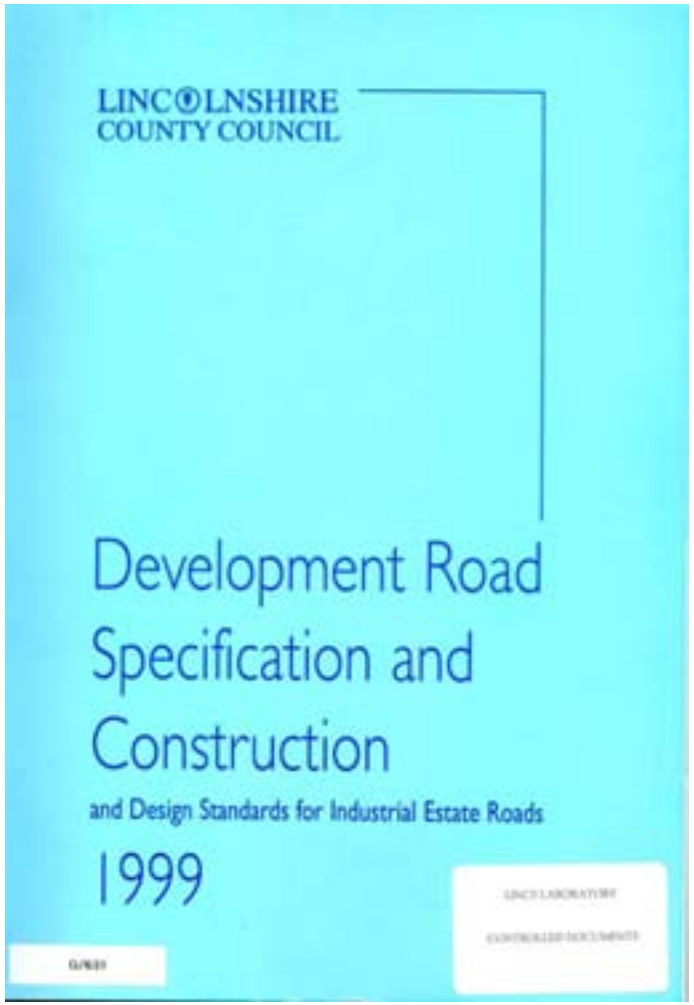
Geosynthetics in Lincolnshire (6)



"When soils are very weak, it may be necessary to incorporate a geogrid as an alternative to the geotextile, and specialist advice should be sought."

"Any proposal to reduce the sub-base thickness must be supported by a specialist report taking into consideration the site investigation findings, the properties of the proposed product and the following design parameters for the sub-base:

Traffic loading = 1,000 standard axles

Maximum permitted rut depth = 40mm"

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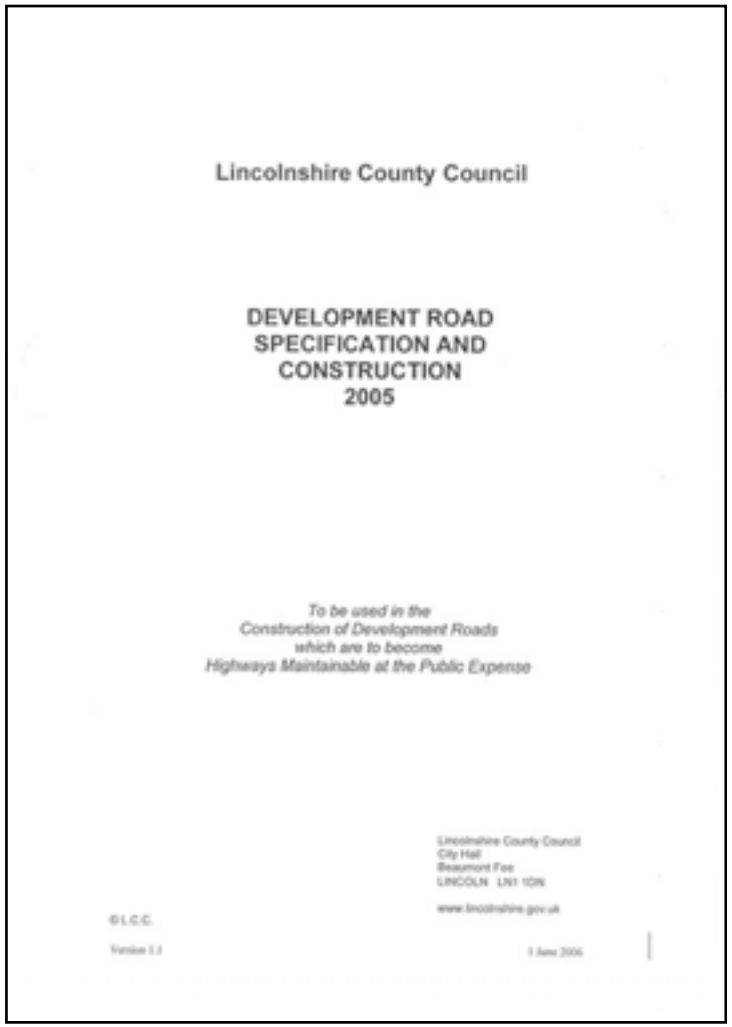
Geosynthetics in Lincolnshire (7)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DEVELOPMENT ROAD
SPECIFICATION AND
CONSTRUCTION
2005

To be used in the
Construction of Development Roads
which are to become
Highways Maintainable at the Public Expense

Lincolnshire County Council
City Hall
Beaumont Fee
LINCOLN LN1 1DN

www.lincolnshire.gov.uk

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Version 1.1

1 June 2006

<u>Development Road Specification & Construction (2005)</u>

Clauses as 1999 edition

PLUS additional guidance on the compliance of geogrids used for reinforcement.

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An early experience – Tensar AR Reinforcement
Canwick Road Tidal Flow , Lincoln (October 1985)

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An early Experience – Tensar AR Reinforcement
Canwick Road Tidal Flow , Lincoln

October 1985

23 years later - June 2008

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An early Experience – Tensar AR Reinforcement
Canwick Road Tidal Flow , Lincoln

23 years later - June 2008

26 years later - May 2011

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An early experience – Tensar AR Reinforcement
Canwick Road Tidal Flow , Lincoln

October 1985

23 years later - June 2008

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An early experience – Tensar AR Reinforcement
Canwick Road Tidal Flow , Lincoln

23 years later - June 2008

26 years later - May 2011

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Tensar AR Reinforcement
A1 North Witham (south bound)
May 1986

Transverse/Reflective Cracking associated with Concrete Edge Beam

Repair - Preparation

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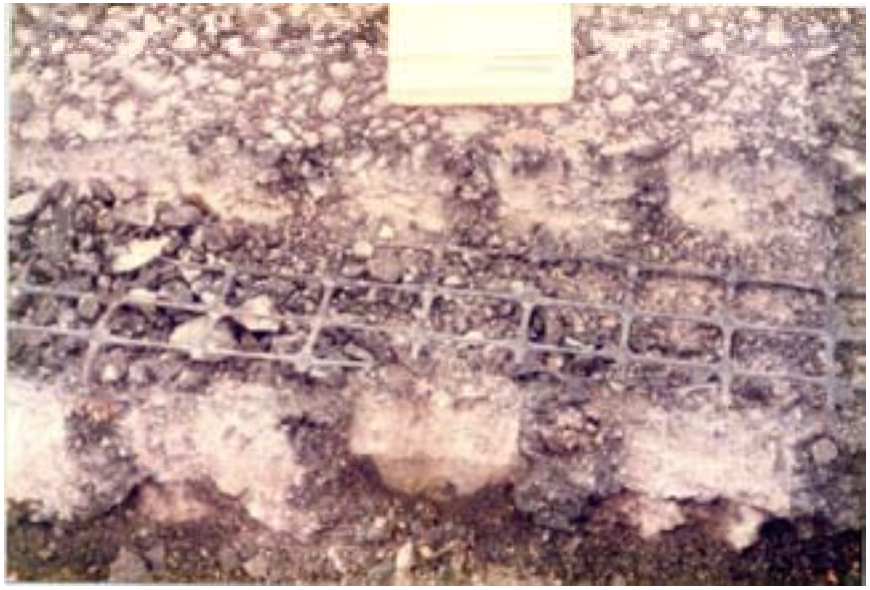
Tensar AR Reinforcement
A1 North Witham (south bound)
May 1986



Repair – AR Reinforcement sandwiched between two layers of 20mm dense binder course

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Transverse/Reflective Cracking
Concrete Edge Beams

To provide:

- Edge Restraint
- Vertical Level Control

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Tensar AR Reinforcement
B1226 Riseholme Road, Lincoln

April 1988

20 years later - June 2008

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Tensar AR Reinforcement
B1226 Riseholme Road, Lincoln

20 years later - June 2008

23 years later – May 2011

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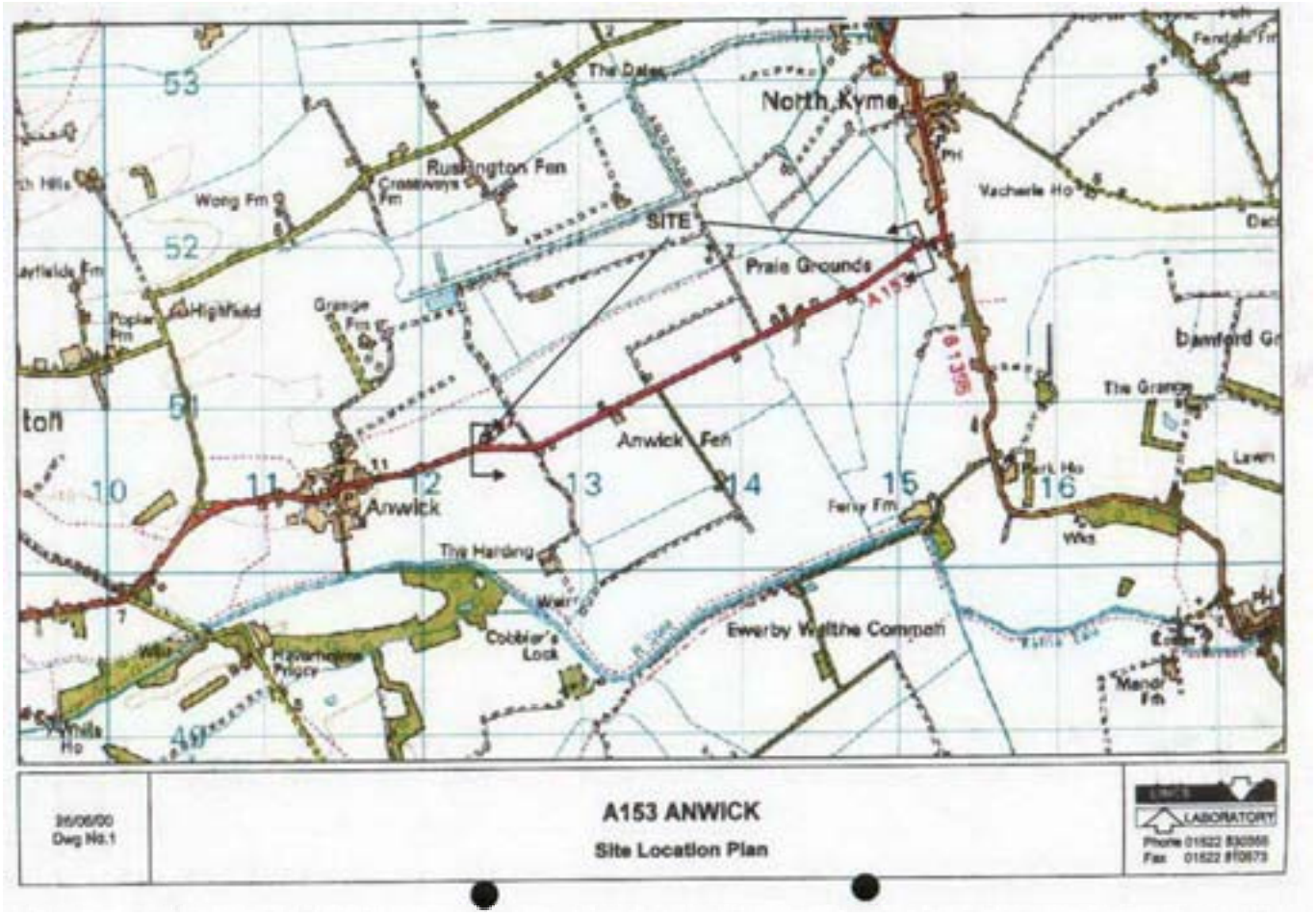
A153 Anwick to North Kyme (Summer 1993)



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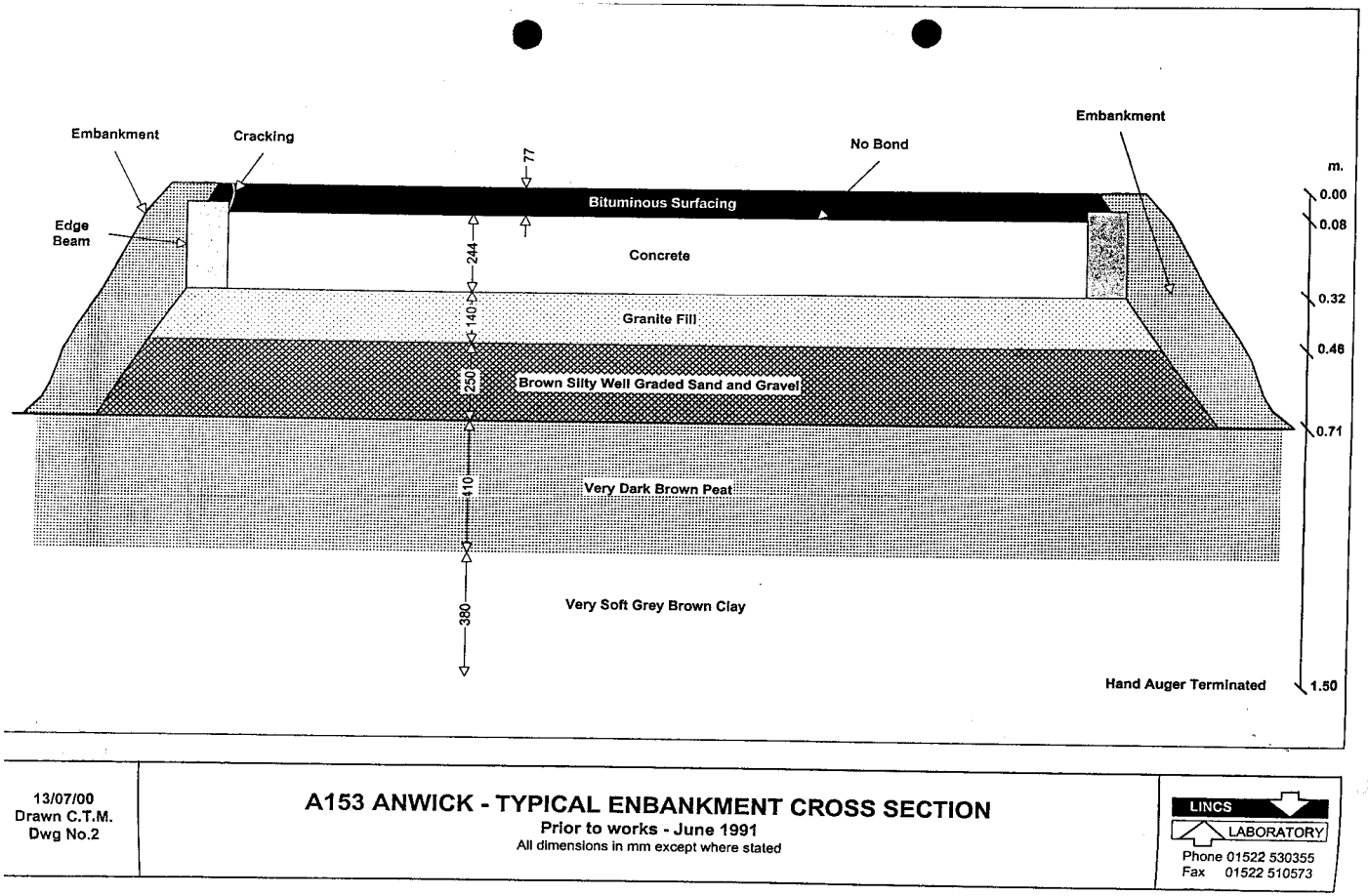
A153 Anwick to North Kyme (Summer 1993)



13/07/00 Drawn C.T.M. Dwg No.2	**A153 ANWICK - TYPICAL ENBANKMENT CROSS SECTION** Prior to works - June 1991 All dimensions in mm except where stated	LINCS LABORATORY Phone 01522 530355 Fax 01522 510573

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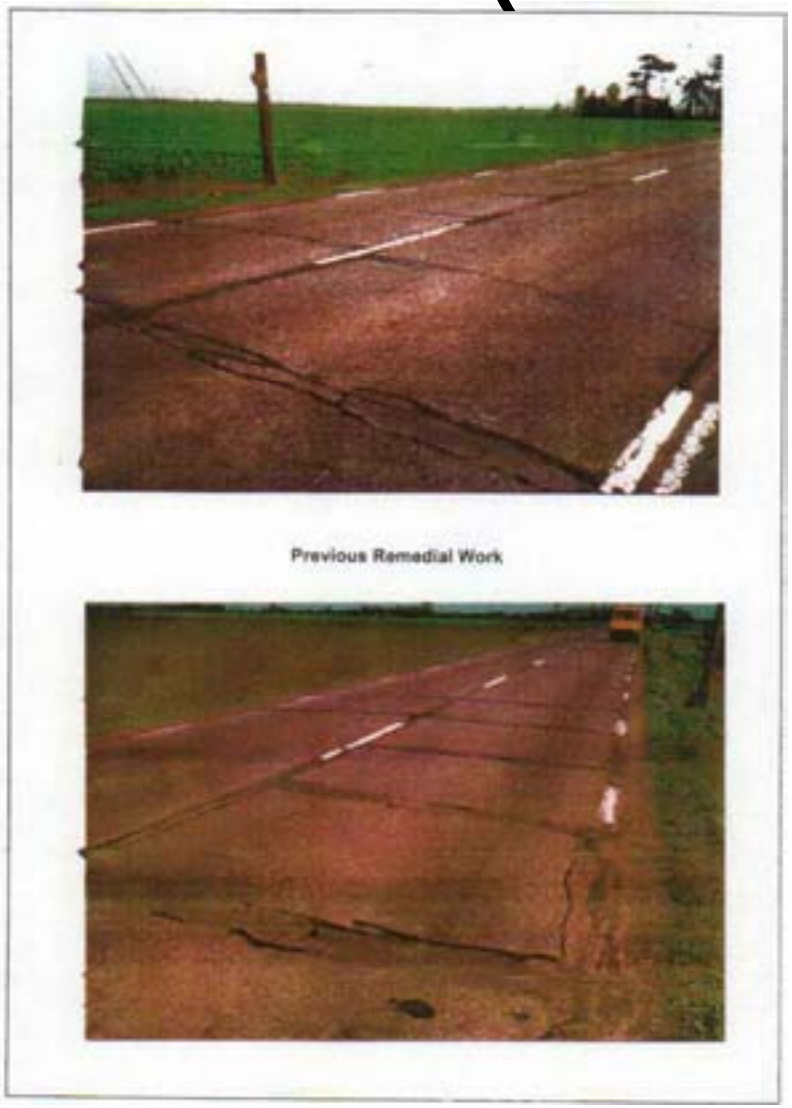
A153 Anwick to North Kyme (Summer 1993)



Previous Remedial Work

<u>Previous remedial Work</u>

Crack sealing
Flexible overbanding

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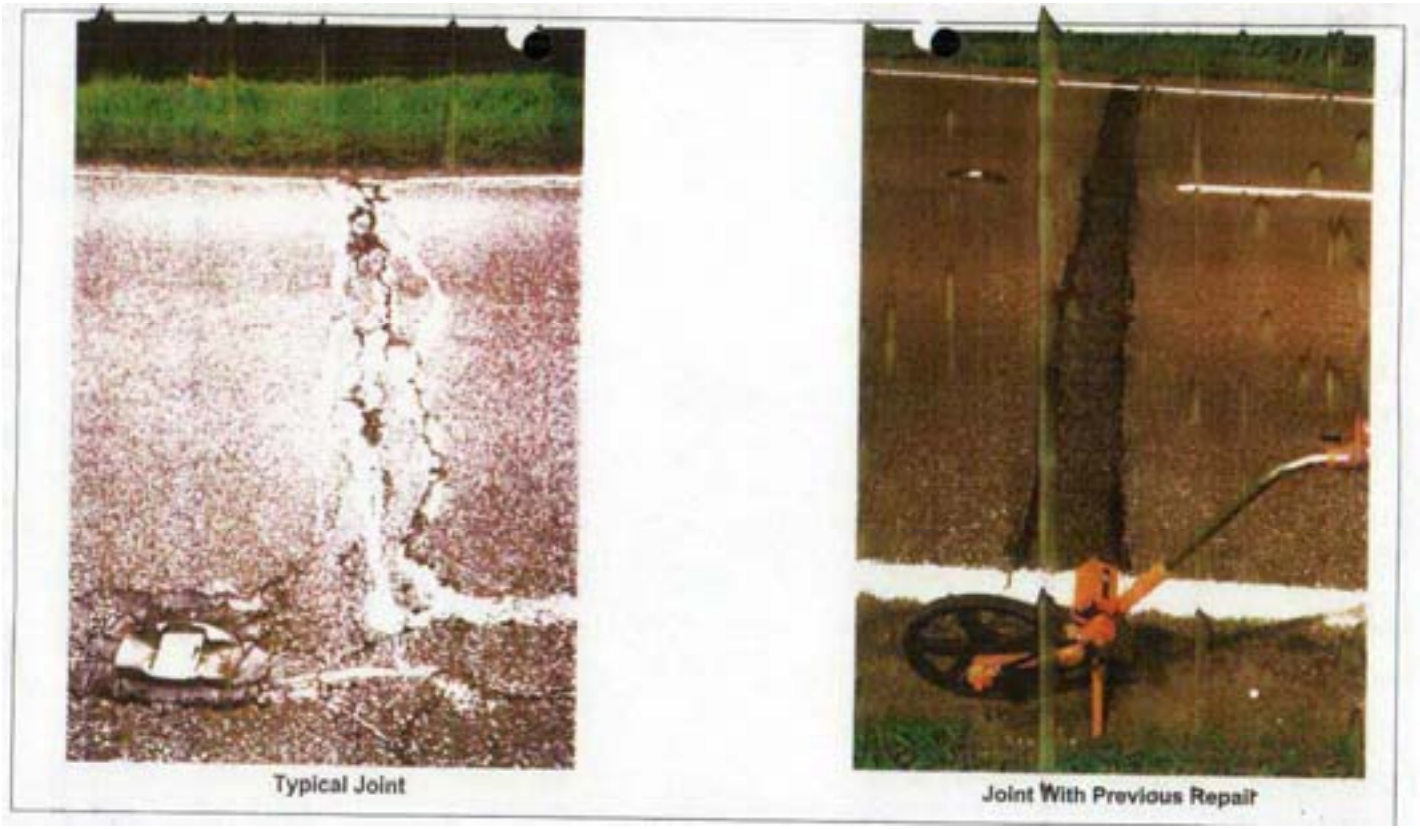
A153 Anwick to North Kyme (Summer 1993)



Typical distress at transverse joint

Flexible sealant

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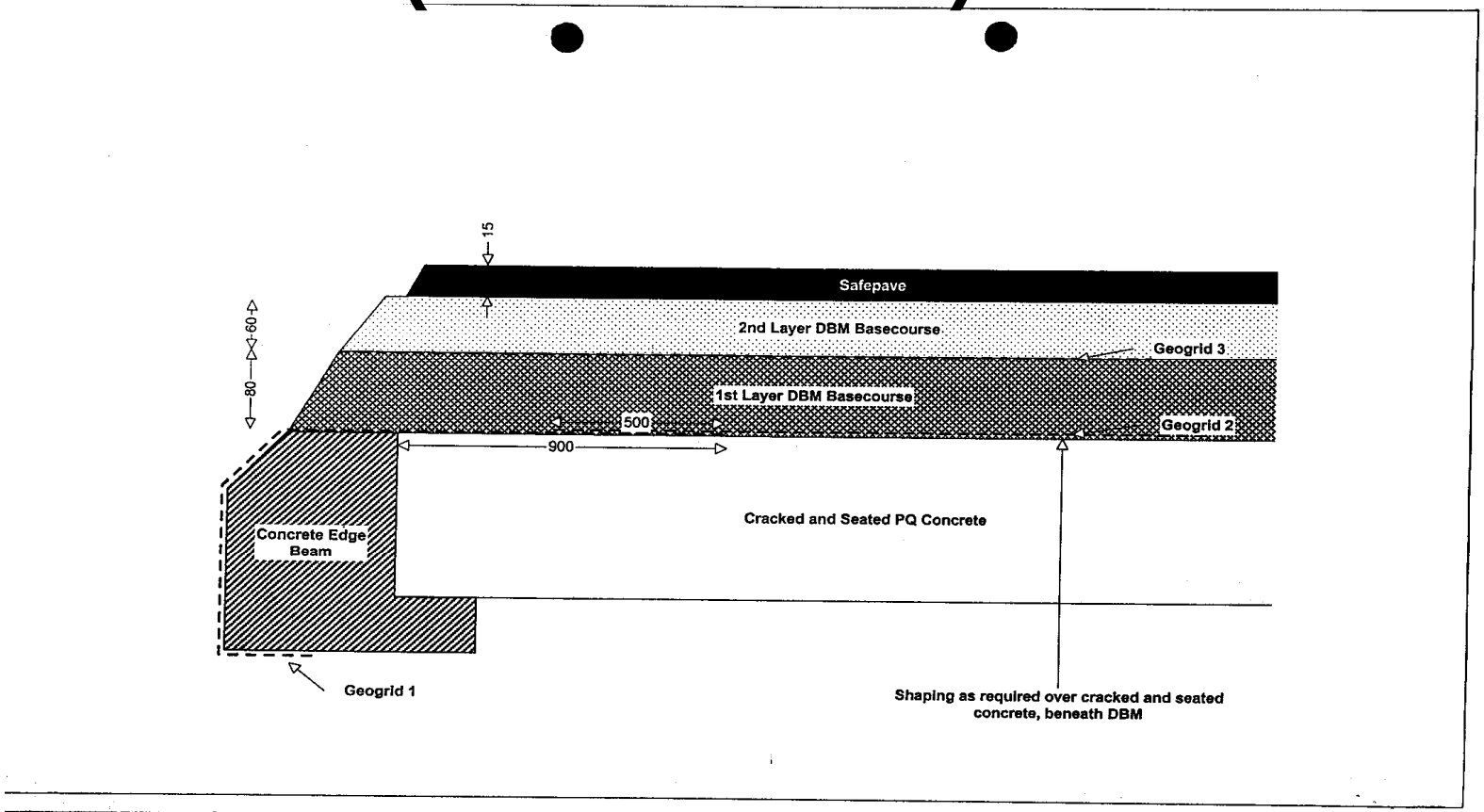
A153 Anwick to North Kyme (Summer 1993)



13/07/00
Drawn C.T.M.
Dwg No.5

A153 ANWICK - THE FINAL SOLUTION
All dimensions in mm except where stated

LINCS LABORATORY
Phone 01522 530355
Fax 01522 510573

Geogrid = Glassgrid 8501

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A153 Anwick to North Kyme (Summer 1993)

Exposed concrete slab, transverse joint & surface condition of adjacent carriageway surface.

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A153 Anwick to North Kyme (Summer 1993)

"Crack & Seat" Technique

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A153 Anwick to North Kyme

<u>Condition 15 years later (June 2008)</u>

Maintenance since Summer 1993:

- Western half of site patched & surface dressed Summer 2003
- Eastern half of site patched & surface dressed Summer 2004.

<u>Condition 18 years later (May 2011)</u>

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A153 Anwick to North Kyme

<u>Condition 15 years later (June 2008)</u>

Maintenance since Summer 1993:

- Western half of site patched & surface dressed Summer 2003
- Eastern half of site patched & surface dressed Summer 2004.

<u>Condition 18 years later (May 2011)</u>

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A153 Anwick to North Kyme

Transverse cracking appearing at isolated locations (June 2008)

Condition 15 years later (June 2008)

Condition 18 years later (May 2011)

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A153 Anwick to North Kyme

Transverse cracks and longitudinal edge cracks are visible at intervals. The majority of the carriageway surface appears sound (May 2011).

Condition 15 years later (June 2008)

Condition 18 years later (May 2011)

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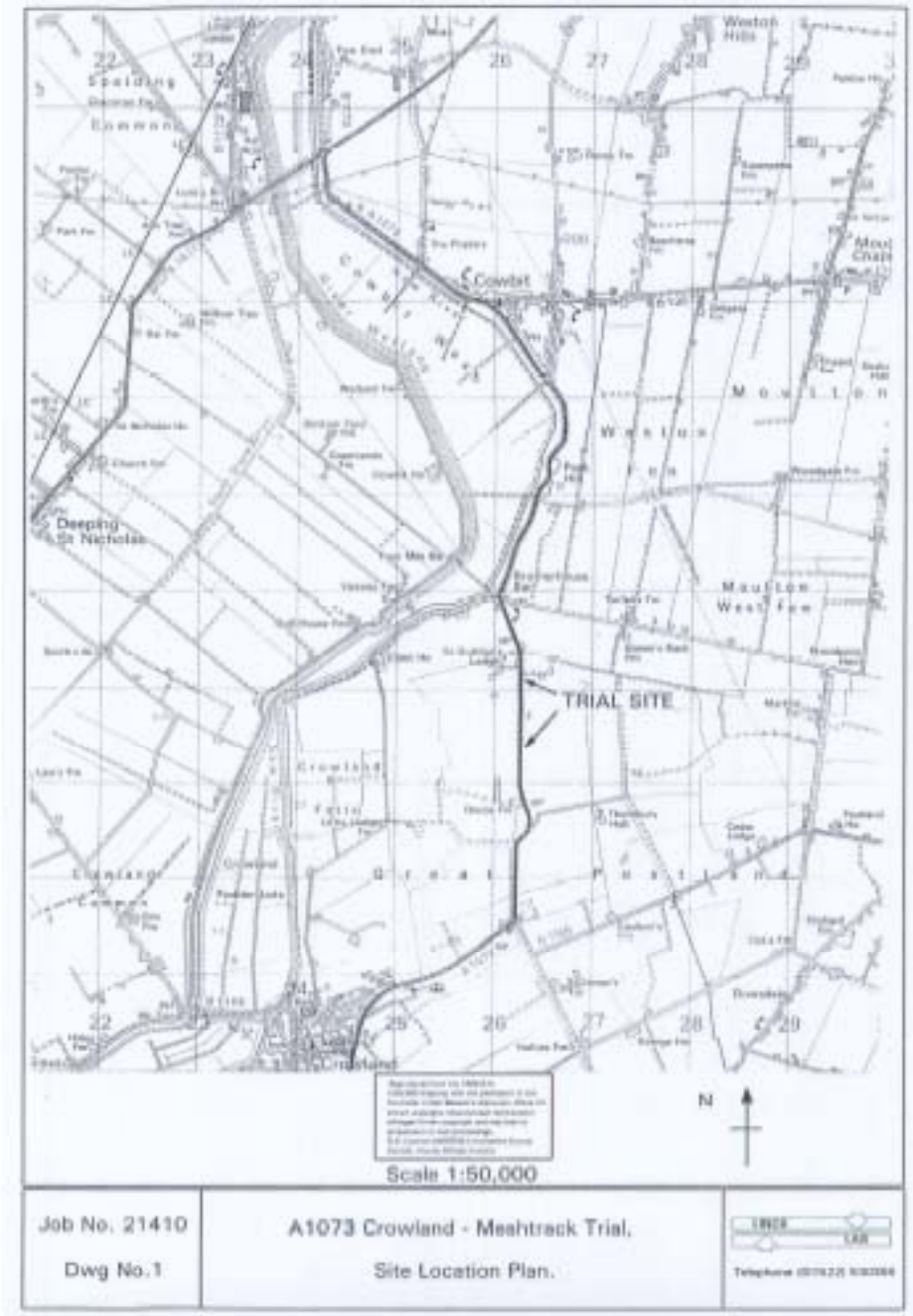

A1073 Crowland "Meshtrack" Trial (April 1997)

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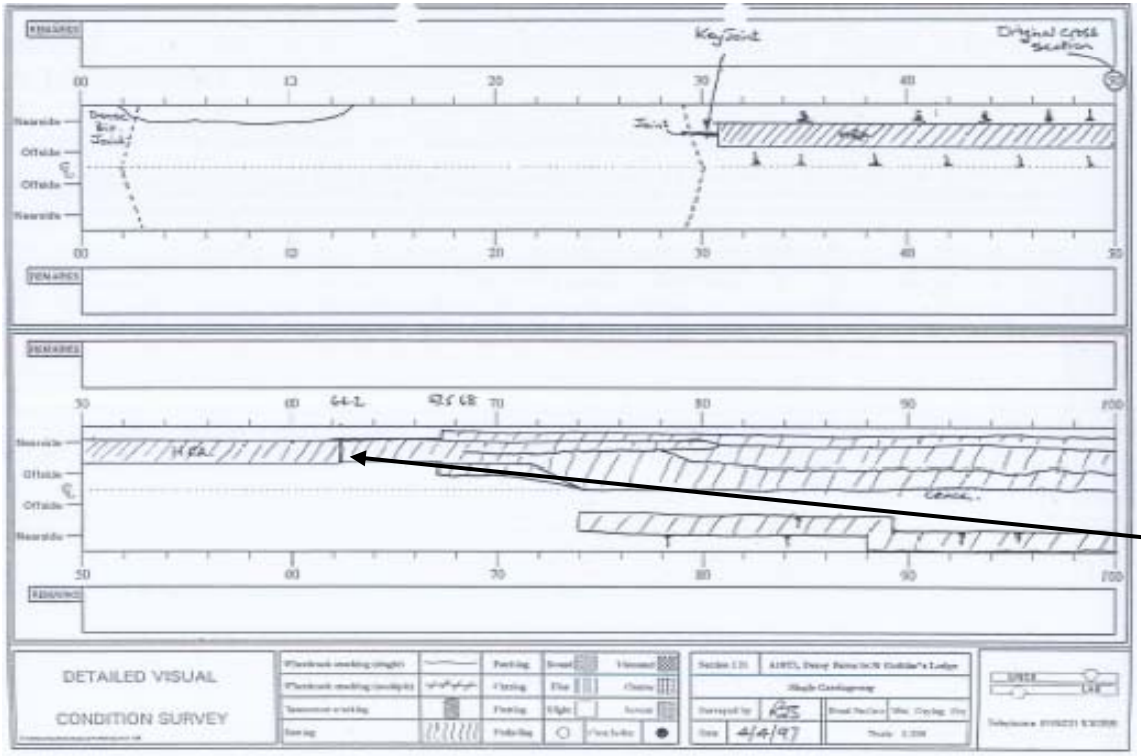
A1073 Crowland “Meshtrack” Trial (April 1997)



April 1997

January 1996

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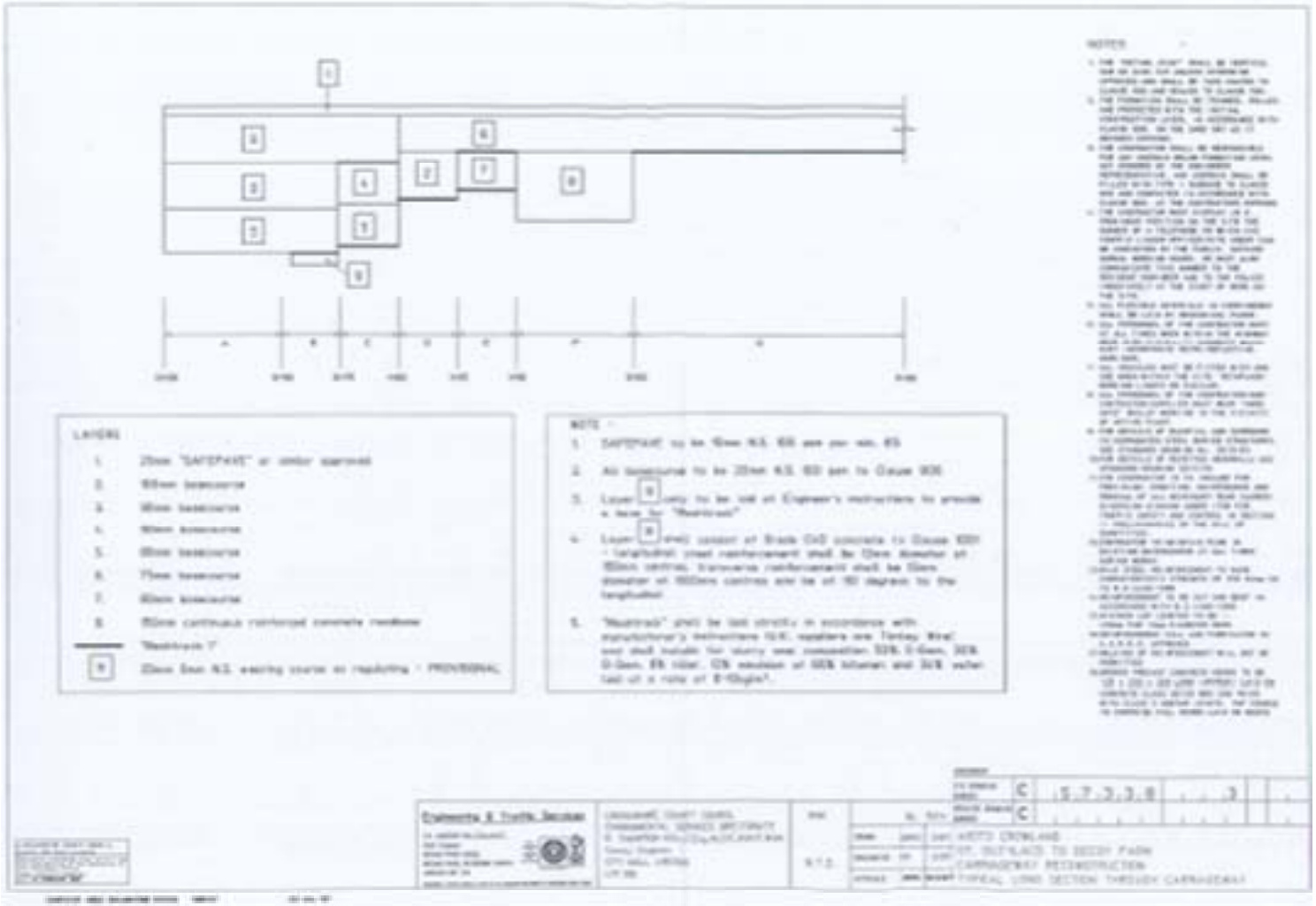
A1073 Crowland “Meshtrack” Trial (April 1997)



Typical Long Section

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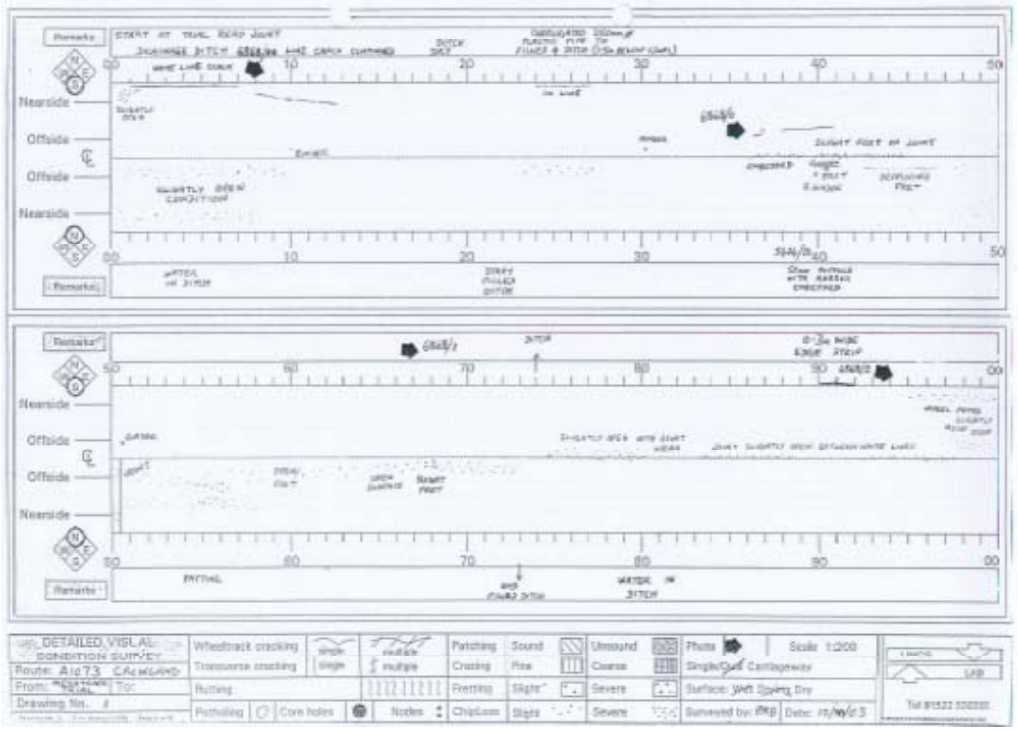
A1073 Crowland “Meshtrack” Trial Performance after 6 ½ years



SUMMARY

Based on visual appearance:

- Good condition maintained where reinforcement has been used in conjunction with at least an inlay of 155mm

October 2003

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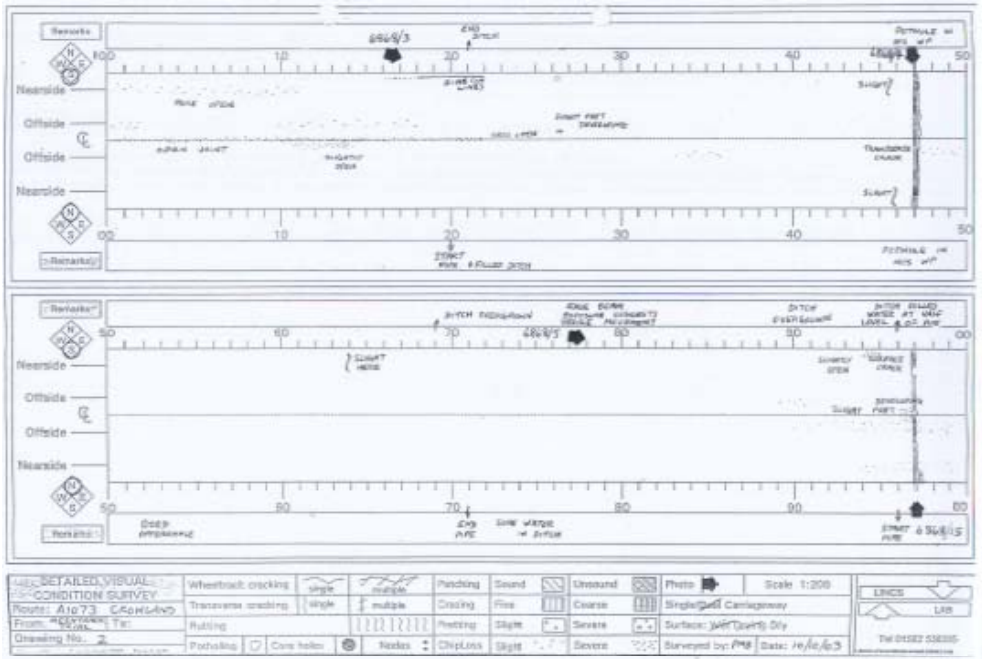
A1073 Crowland “Meshtrack” Trial Performance after 6 ½ years



- Good condition maintained in CRCR section
- Benefit from piping the ditch not yet proven

October 2003

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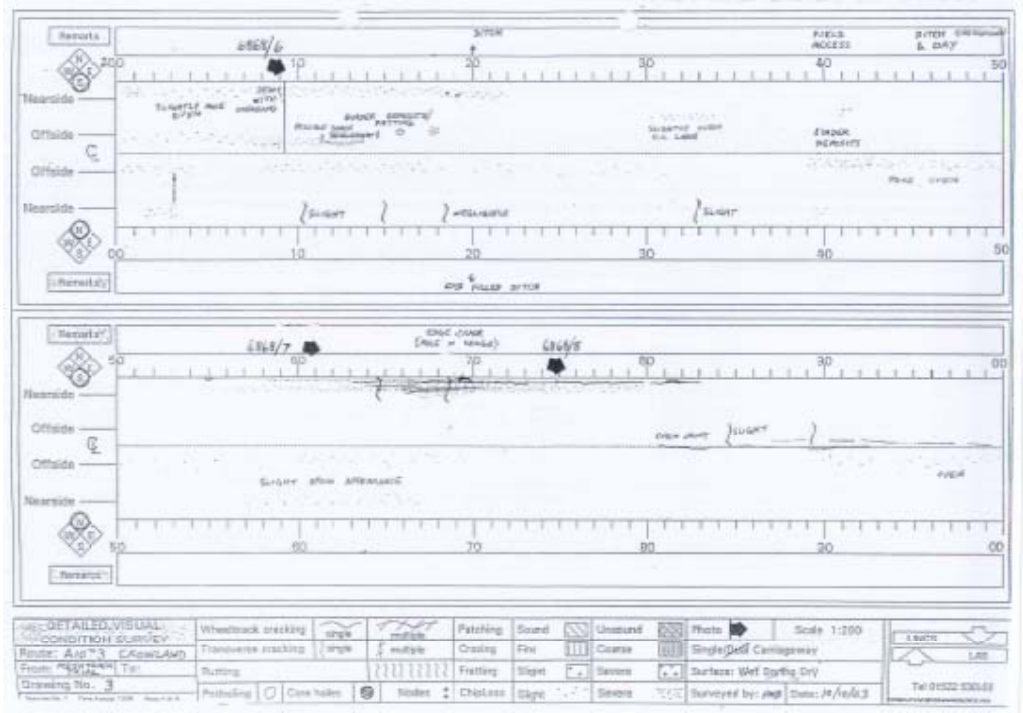
A1073 Crowland “Meshtrack” Trial Performance after 6 ½ years



- Several locations in section with minimum treatment G have reached failed condition.

October 2003

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A1073 Crowland “Meshtrack” Trial Performance after 11 years

June 2008

Maintenance work carried out August/September 2004

- Plane off 50mm
- Proposed to replace with 100mm dense binder course. Actual thickness 70mm to 95mm.
- Surface dressed.

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A1073 Crowland “Meshtrack” Trial
Performance after 11 & 14 years

June 2008

January 2011

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A1073 Crowland “Meshtrack” Trial Performance after 14 years (Jan 2011)

- The majority of the trial section appears sound, particularly with respect to the thicker construction options (A to F) including those with two meshtrack layers and cement bound base.
- The length treated with 75mm of binder course and one layer of grid (option G) exhibits localise nearside cracking in one area of the northbound lane and occasional longitudinal edge cracking.
- Some opening of the centre joint is also apparent in addition to wheel path deformation.
- A 30 metre maintenance patch is also included across the full carriageway width.
- A transverse reflective crack is situated at the transition from cement bound base to treatment G.

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C627 Fodderdyke (August 2004)
Structural grade foambase & “RoadMesh”

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C627 Fodderdyke

Prior to Works
(August 2004)

Condition after 4 years
(June 2008)

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C627 Fodderdyke

Condition after 4 years
(June 2008)

Condition after 7 years
(May 2011)

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C627 Fodderdyke

Prior to Works
(August 2004)

Condition after 4 years
(June 2008)

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C627 Fodderdyke

Condition after 4 years
(June 2008)

Condition after 7 years
(May 2011)

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C627 Fodderdyke
Embankment slippage (1)

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C627 Fodderdyke
Embankment slippage (2)

May 2011

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A17 Winglands Marsh, Sutton Bridge
Scheme completed March/April 2009

Problem: regular transverse reflective cracks (typically 5m to 10m spacing) associated with Cement Bound Granular Material (CBGM) base. Improvement constructed in 1989.

Future Traffic Loading: 32msa (20 year design life)

Solution: replace bituminous layers and incorporate a proprietary grid and sealing technique.

Detail:

- Plane 200mm to expose CBGM base
- 50mm dense binder course levelling course
- Proprietary reinforcement system
- 110mm dense binder course
- 40mm hot rolled asphalt surface course

Last inspection = February 2011 (after 23 months) - no surface cracking was evident

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Lincolnshire's Maintenance Design Manual (1994 & 2003)

- "Overlaying existing concrete carriageways or carriageways with lean concrete bases needs special consideration. Even large overlays of 200mm cannot be guaranteed to prevent reflective cracking propagating to the road surface. The use of geogrids & rubberised asphalt should always be considered when overlaying concrete."

- "SEEK ADVICE"

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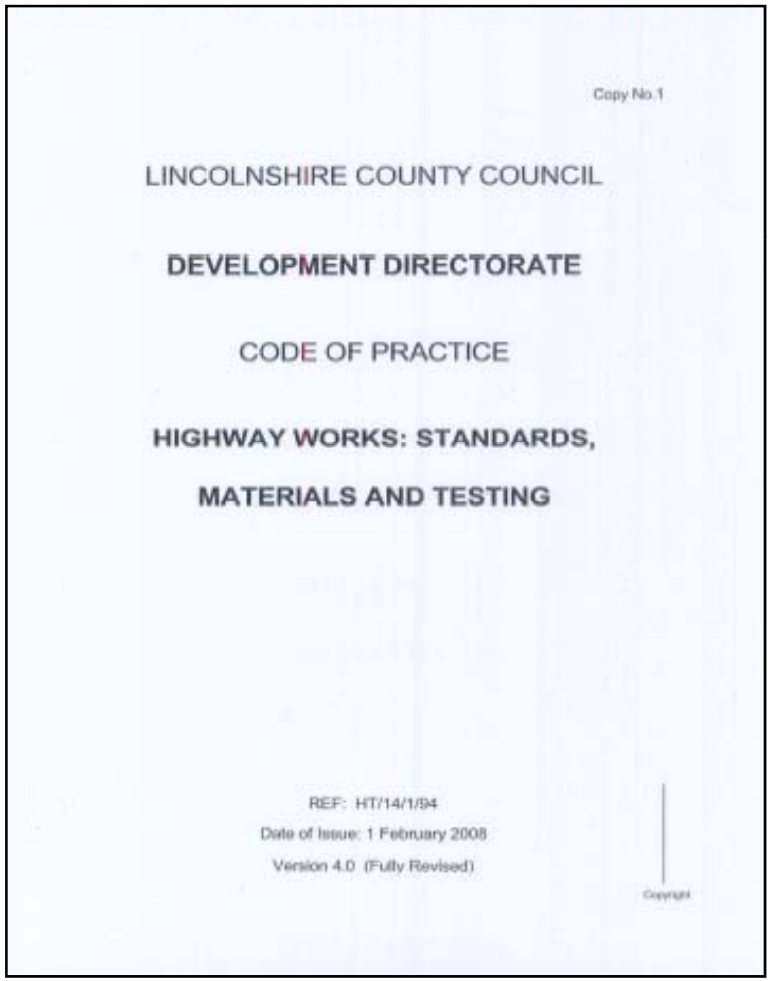
Lincolnshire's Code of Practice for Highway Works: Standards, materials and Testing (2008)



- If geosynthetics or steel meshes are included in the design ….they shall be supplied by approved suppliers and incorporated into the works in strict accordance with the supplier's installation advice.

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Inlays with Steel Grids

- Use where there is significant distress / movement
- Inlay preferred, if possible, to avoid further loading.
- Grid MUST be adequately secured (nailed) to sub-strate.
- Minimum of 110mm of bound material placed over grid
- When properly designed and installed works very well
- Exceptionally binder may be 100/150 grade
- Tracked pavers are essential
- Not recommended in urban locations
- Install over the carriageway's full width

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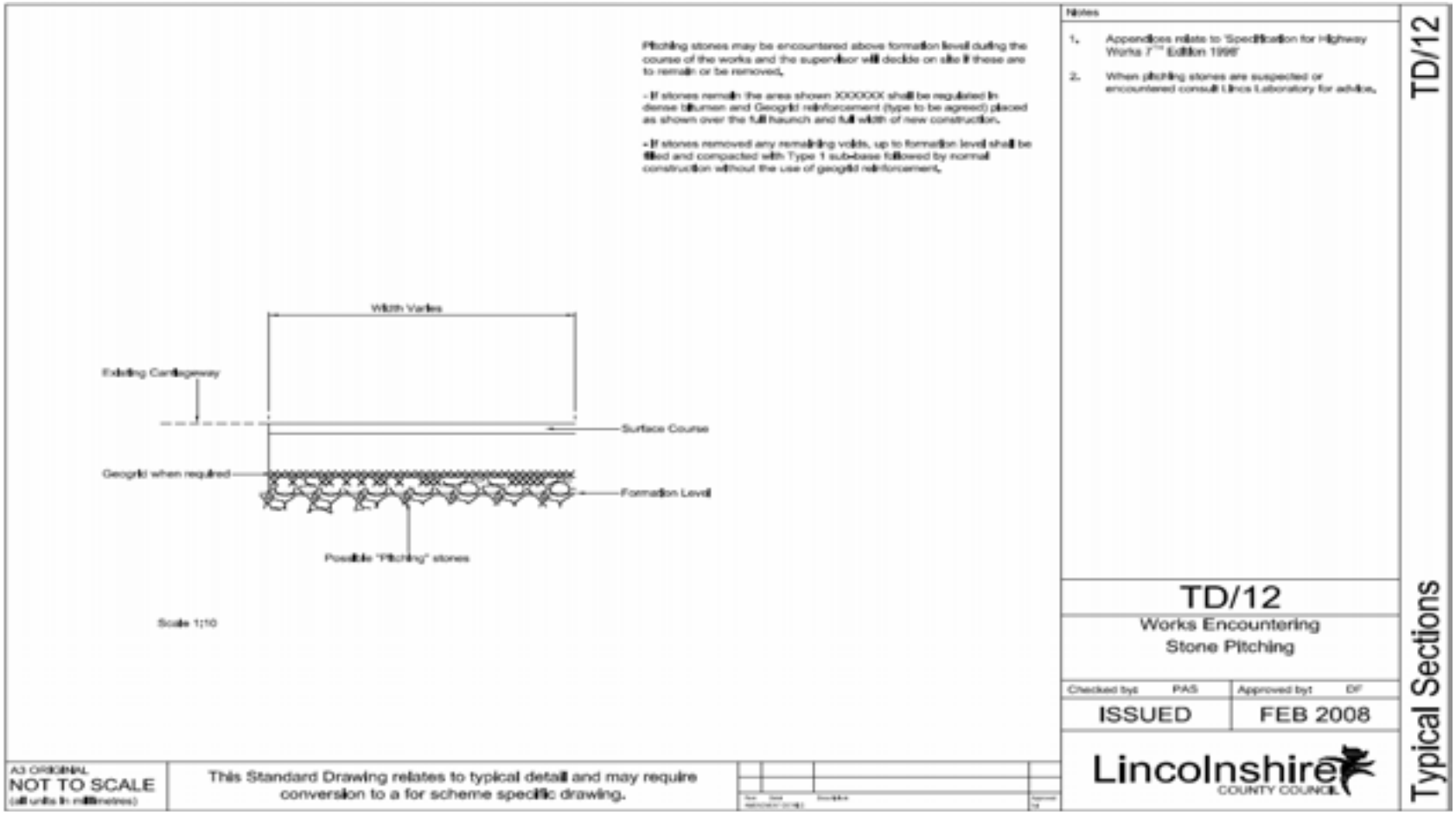
Lincolnshire's Typical Detail for Works encountering stone pitching (2008)



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Stone pitching Base
Road Note No 5 (1950)

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Stone Pitching

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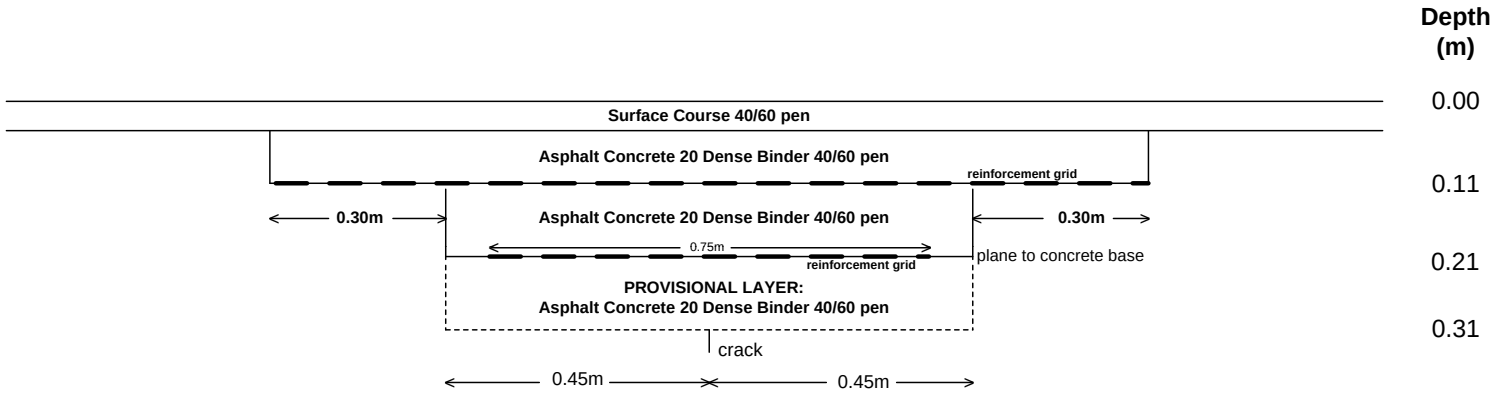
Typical Transverse Crack Repair Detail



Notes:

1. Compaction by 800 mm wide vibratory roller.
2. Minimum width of lower excavation to be 900 mm.
3. Typical roll width of reinforcement available is 1.5m.
4. The surface course must be either Special Mix hot rolled asphalt (wheel tracking class 1) or a thin surface course system capable of texture depth performance level 3 for site stress levels 1 and 2 at traffic levels of at least 2500 commercial vehicles per lane per day. The surface course must exhibit a maximum wheel tracking rate of 2.0 mm/h when tested at 45 °C for 45 minutes and a maximum rut depth of 4.0mm.
5. Asphalt concrete material used in structural layers should not be manufactured using siliceous gravel coarse aggregate. The fines should consist of crushed rock or slag.

Scale

Horizontal 1:10
Vertical 1:8

Drawing No. 2 **November 2008** **Job No. 31784**	**A17 Winglands Marsh: 2008/09 Ex Trunk Road Renewal Scheme** **Transverse Crack Repair Detail.**	LINCS LAB Tel 01522 530355

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Typical Transverse Crack Repair Detail

Scheme completed May 2002

April 2010

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Installation (1)

Ensure geogrid is installed in accordance with manufacturer's guidelines by an approved sub-contractor.

Our first experience (October 1985)

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Installation (2)

Tracked paver is essential

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Installation (3)
Where it can go wrong!

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A153 Donna's Corner, Billinghay Dales (Scheme completed March 2004)

October 2010

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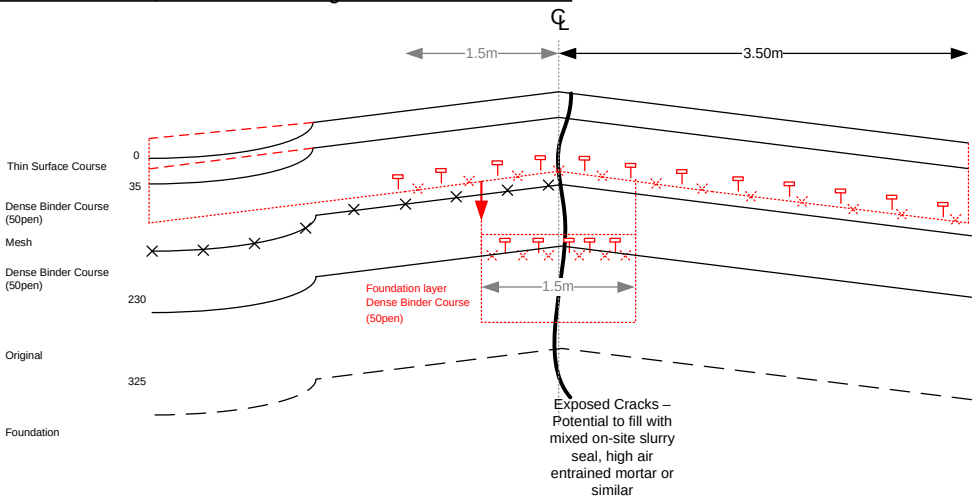
A153 Donna's Corner, Billinghay Dales

Crack Repair detail

Centreline crack, subsidence & single lane width steel mesh

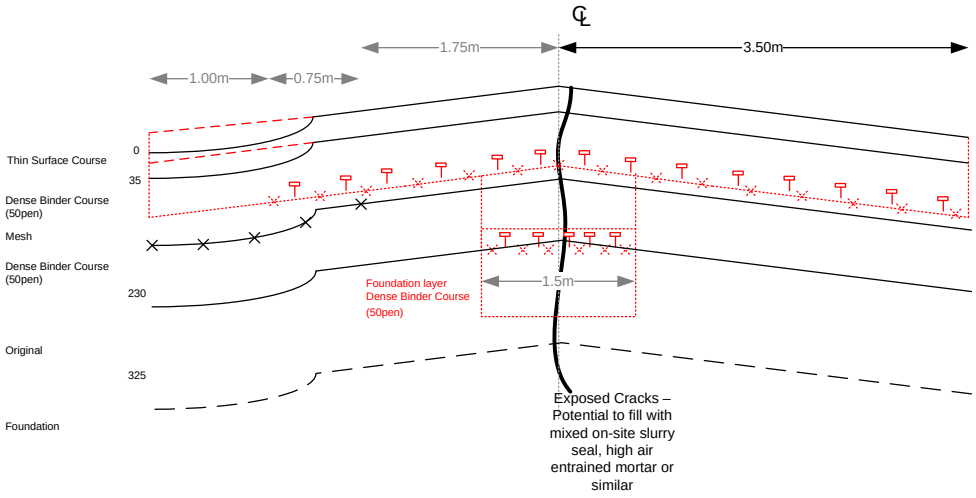


KEY

- Saw Cut
- New Galvanised Steel Mesh
- Planing
- Nail Fixing
- Existing Galvanised Steel Mesh (approx position)
  NB – Detailed position – refer to core logs

Assumptions used:
1. Galvanised steel mesh roll width = 3m
2. Road planer width = 1.5m
3. Paver width (min) = 1.5m

Centreline crack, subsidence & half lane width steel mesh



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A153 Donna's Corner, Billinghay Dales (Oct 2010)

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A153 Donna’s Corner, Billinghay Dales

October 2010

May 2011

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Thank you

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