Avonmouth Bridge Resurfacing

Dave Sledge.

21st March 2013

Who Is This Chap?

Dave Sledge;

30 years in the Highways Industry both Public and Private sector.

11 years in the Highways Agency

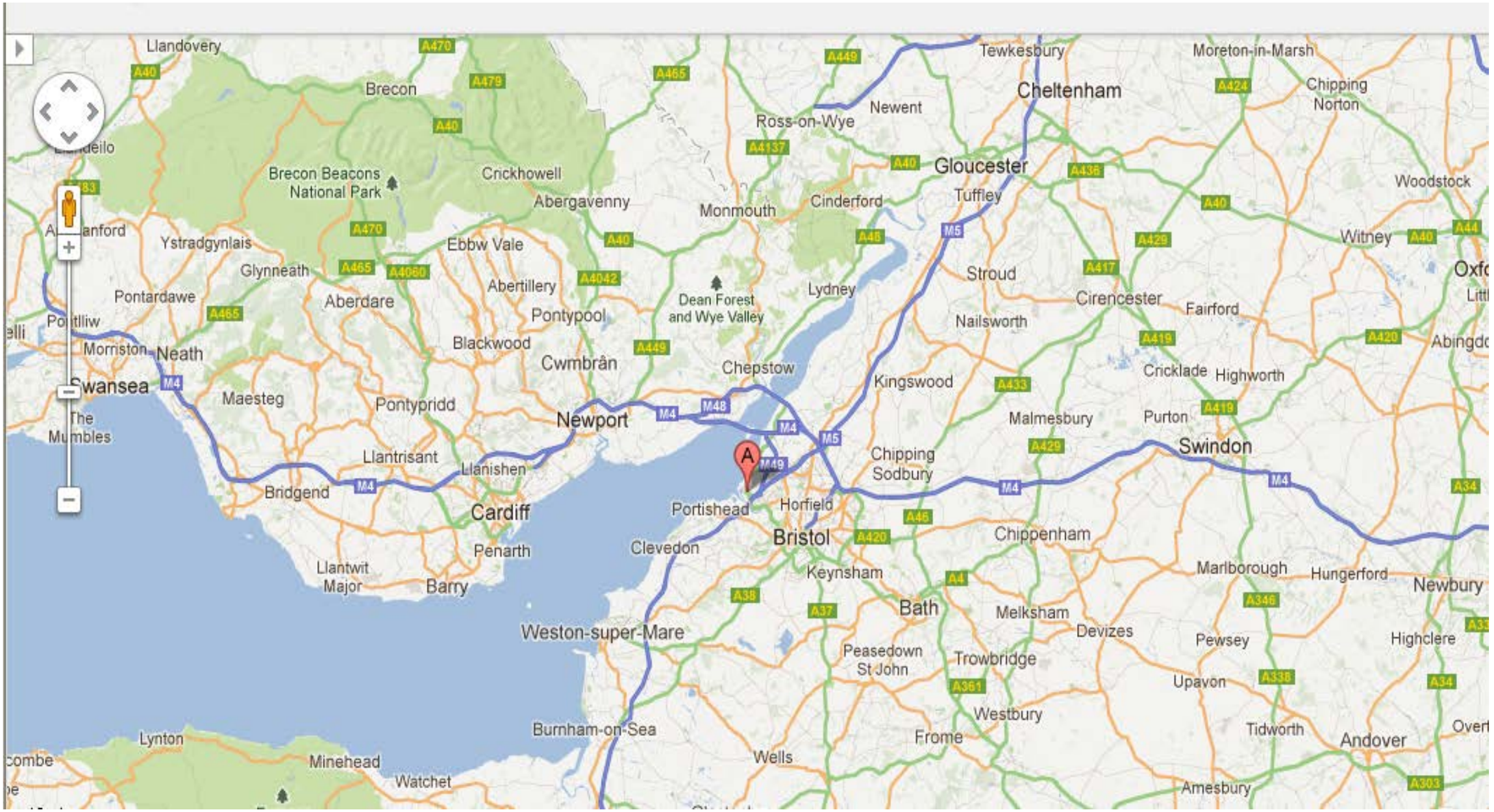
Incorporated Engineer.

Managed both PFI and maintenance contracts

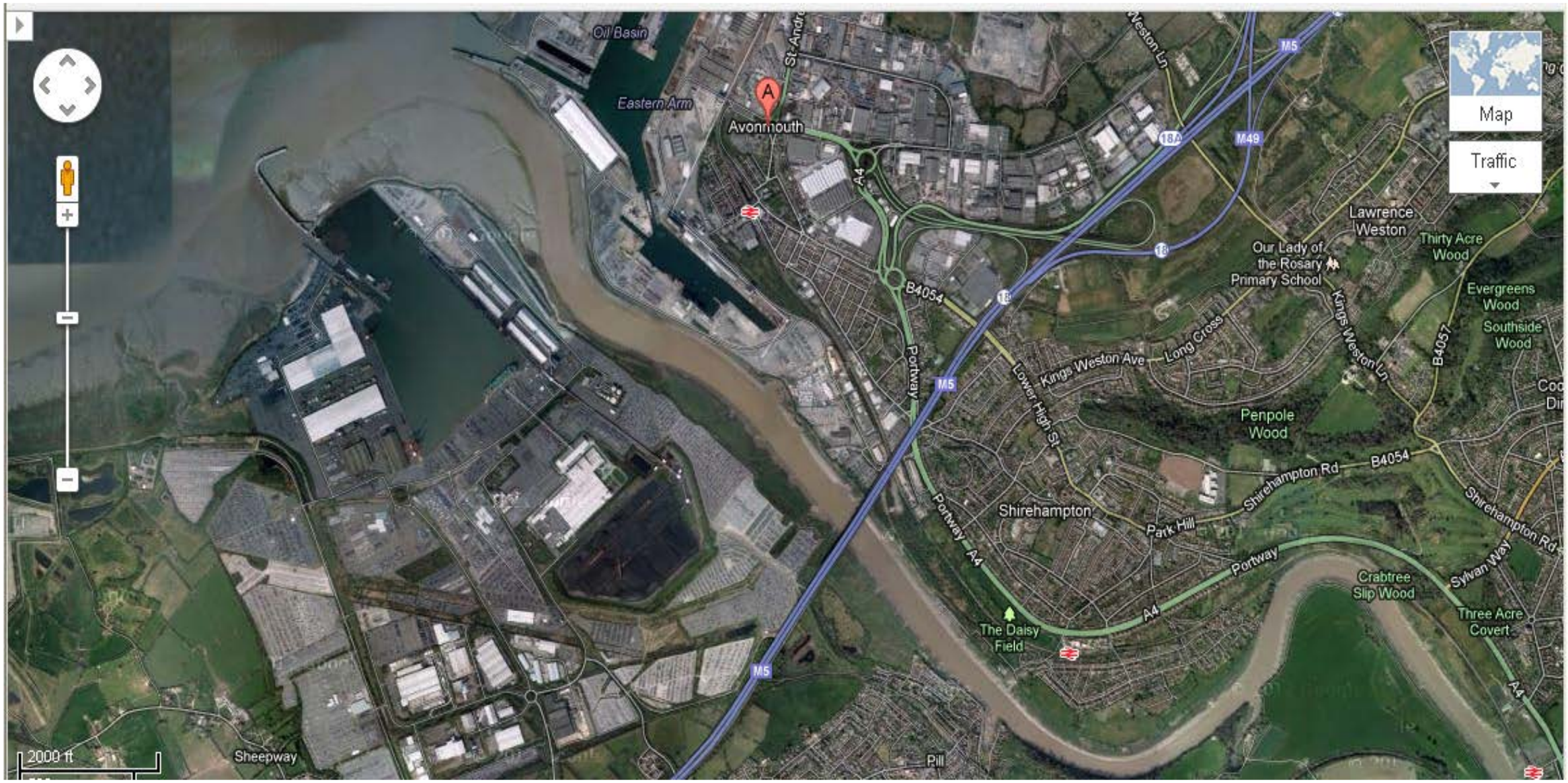
Currently managing the Area 2 maintenance & renewals Contract in the South West.

Knows enough about “blacktop” to be jolly dangerous!

Avonmouth Bridge?

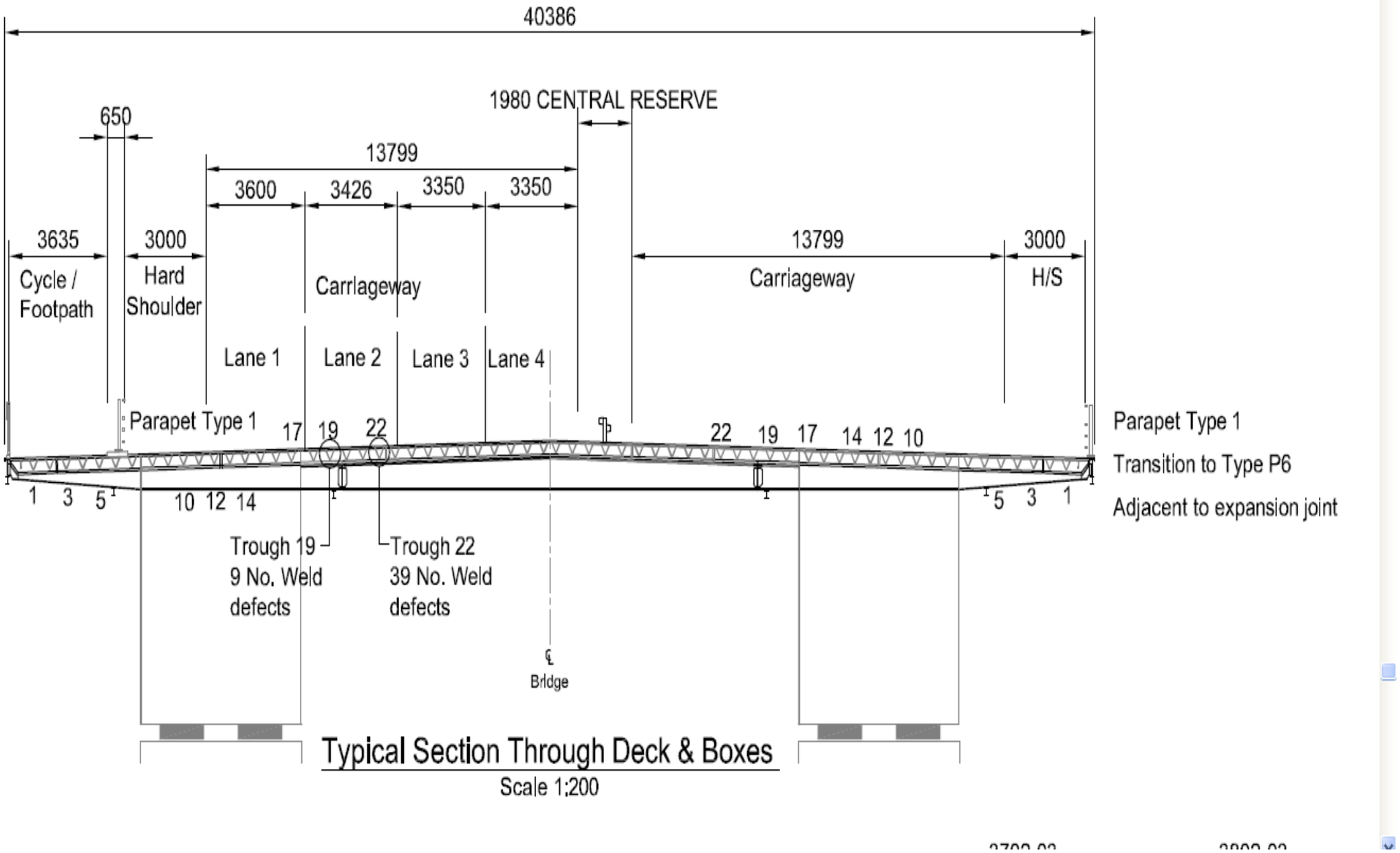


A Bit Closer.


Oil Basin
Eastern Arm
Avonmouth
St Andr
A4
B4054
Portway
M5
M49
18A
Weston Ln
Lawrence Weston
Thirty Acre Wood
Our Lady of the Rosary Primary School
Evergreens Wood
Southside Wood
Kings Weston Ave
Long Cross
Kings Weston Ln
B4057
Lower High St
Penpole Wood
Shirehampton Rd
Shirehampton
Park Hill
Portway A4
Crabtree Slip Wood
Sylvan Way
Three Acre Covert
The Daisy Field
Sheepway
Pill
2000 ft
Map
Traffic

We All Like Pictures?

Avonmouth Cross Section



Typical Section Through Deck & Boxes

Scale 1:200

Some Facts.

1.4km complex multispan viaduct opened in 1975

Main span - Twin box girder, steel deck

Approaches- comp box girder, conc deck

60,000 vehicles per day (each direction) incl 7,200 HGVs

Major renewal carried out 1995 to 1999, including strengthening, widening and resurfacing

Avonmouth Bridge steel centre span is classed as “long span” – deflection at centre up to 400mm.

Surfacing History

By 2001 failures occurring

Various Studies – TRL & various consultants

Jul 2005 – EMAC appointed – wholesale resurfacing required

Sep 2006 – Feasibility Study

Nov 2006 – Resurfacing workshop

March 2007 – Whole Life Costing exercise

May 2007 – Best Value Study

Surfacing History

Last surface was hand laid

It had an Expected Life of 8 to 10 years – issues within 24months

Porous nature of surface contributed to creation of pot holes

Bond between surface and waterproofing failing

Possibility of damage by welded deck repairs

Surface damage affecting waterproofing and could lead to damage to bridge structure beneath

Design

Wide range of road surface temperatures due to exposed location and box girder construction.

Heavy traffic, 8 lane carriageway.

The design considered the surfacing and waterproofing to work compositely with the bridge deck.

Whole life costing used in selection process.

Best Value.

"determine the best long term solution to the resurfacing of Avonmouth Bridge"

Noise

similar structures

Skid resistance

Ride quality

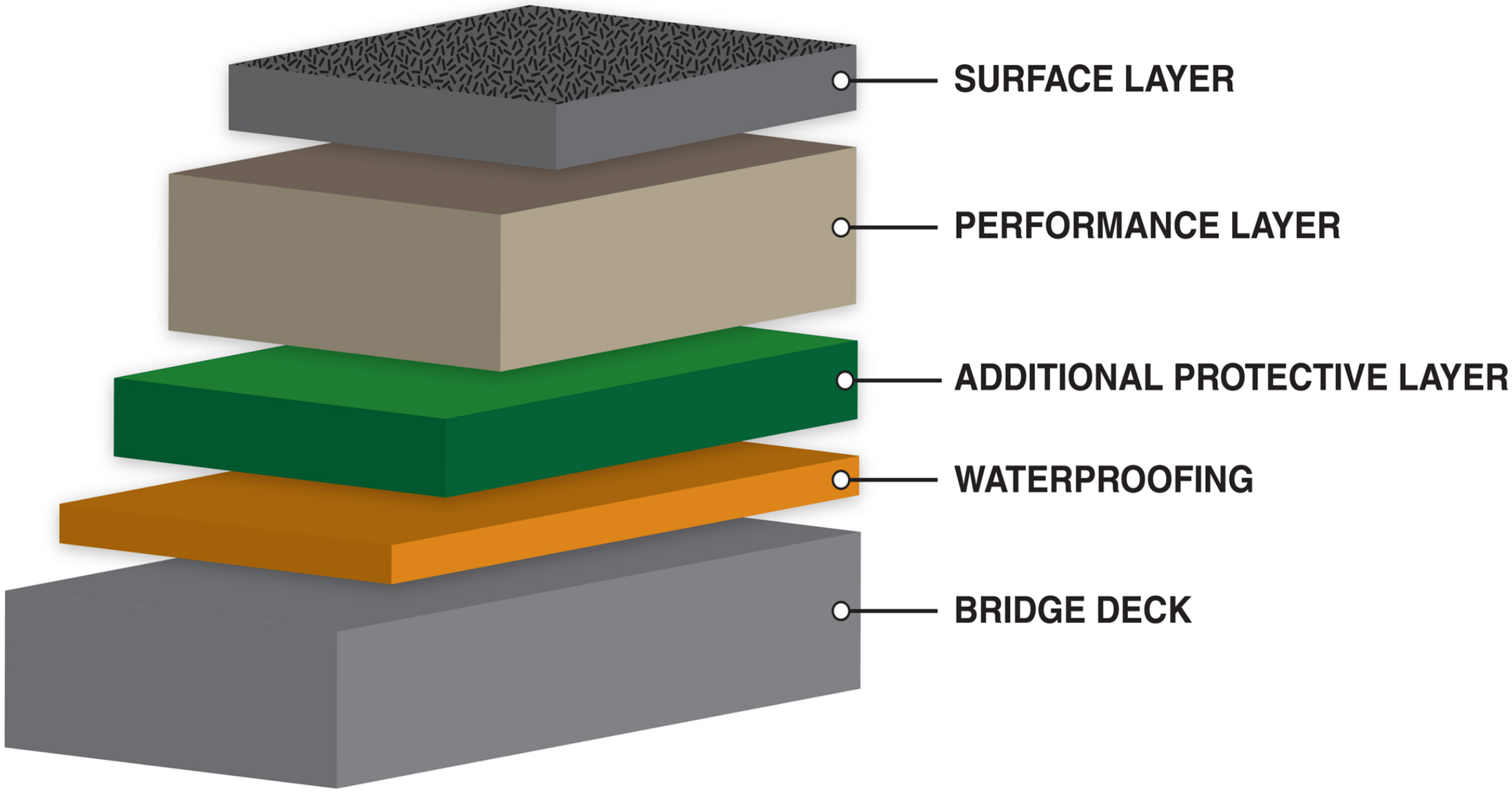
Tensile bond

Low permiability

Weighted Issues.

Issues	*Weighting*
Track Record Proven System	
Durability, Design, Life expectancy	
Serviceability rutting, frets, cracks etc	
Skid Resistance: in line with standards	
Adhesion: of WP and surfacing interfaces	
Tensile Bond: highest value used	
Low Permeability: reduced hydrostatic pressure	
Replaceability	
Maintainability – Efficacy of maintenance solution	
Ease of approval. Meets specs	
Drainage Surface and sub surface	
Thickness and layer control	
Joint reliability Mastic v Epoxy	
Fatigue/contribution to composite deck strength	
Flexibility of surfacing – compatible with steel deck	
Ability to omit central reserve and/or hard shoulder	
Noise to driver	
Noise to residents	
Spray	
Ride Quality	
Replacement cycle/TM/congestion	
Competitive supply	
Programme reliability	
Traffic Management Impact	
Weather susceptibility	
Local congestion caused	
CDM	
QA/QC Requirements	
Programme duration	
Build ability: tolerance to site conditions includes level control	

Bridge Layers



Waterproofing

Approved options;

Bituminous sheet system – Usually used with a additional protective layer (APL)

Slurry Epoxy system – usually a thin squeegee layer but prone to deformation

Spray applied epoxy – A more tested system that can achieve high tensile strength with the APL.

Additional Protection Layer?

TRL study in 1986 concluded that APLs provided protection during construction operations and as an indicator of the waterproofing below. This material was often a coloured sand carpet

However modern materials are less fragile and waterproofing often needs removal with the surfacing. Benefits are questionable.

Omitting the layer was considered to be a benefit to bond, tensile strength and weight.

Performance & Surface Layer.

Performance Layer (45 – 70mm)

Rolled asphalt

Stone mastic asphalt

Modified mastic asphalt (Gussasphalt)

Surface Layer (20 – 50mm).

Thin surface SMA min 20mm lasts up to 10 years, is easy to lay and relatively impermeable.

Hot rolled asphalt (HRA) min’ 45mm lasts up to 15 years, more complex to lay.

Mastic Asphalt. Min 20mm lasts up to 50 years, traditionally nasty to lay, reuires a thin skid resistance surface.

Modified Mastic Asphalt (Gussasphalt). Used in Europe, up to 50 years life and easier to lay and compact.

Whole Life Costs

HRA/ SMA Replacement every 12 years, 12 weeks construction

Modified Mastic Asphalt every 20 years, 12 weeks construction

Epoxy Asphalt 20 years life, 17 weeks construction

80 year time period.

Traffic Management was estimated to be almost £2 million.

Delay costs were modelled (QUADRO).

2007 - £4 million.

2018 - £15 million.

2066 - £41 million.

Whole Life Costs.

Concrete deck

Option	Total cost at Q3/2006 prices
Option C1 (Single layer modified HRA)	£219,525,000
Option C2 (Single layer Gussasphalt)	£127,210,000

Steel Deck

Option	Total cost at Q3/2006 prices
Option S1A (Gussasphalt with high PSV chippings)	£52,383,000
Option S1B (Gussasphalt with high friction surface dressing)	£71,003,000
Option S2 (Epoxy asphalt)	£78,157,000

The family tree of delivery.

Client	Highways Agency.
Tier 1	Balfour Beatty/ Mott Macdonald Joint Venture (EMAC).
Tier 2	Stirling Lloyd
Tier 3	Aechlimann International
Tier 4	Hanson, Nynas.

What is this “blacktop”?

Gussasphalt;

Developed by Aeschlimann International of Switzerland.

Uses Nynas Endura N5 Binder

Trinidad Lake Asphalt.

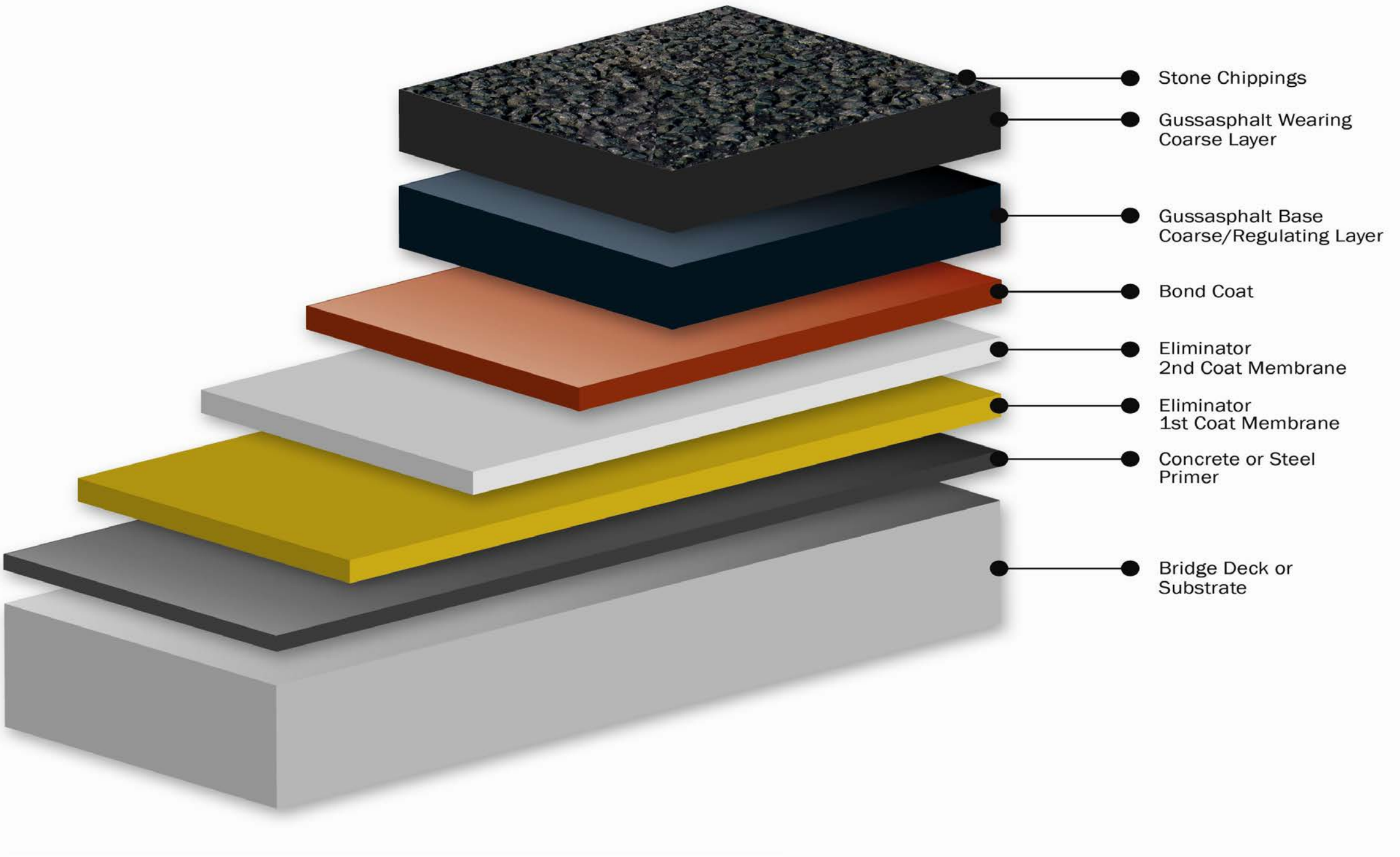
High proportion of limestone filler.

Laid at 220 degrees C!

Low permeability avoiding “pumping” (less than 1% voids).

Few joints.

The Layers.


Stone Chippings
Gussasphalt Wearing Coarse Layer
Gussasphalt Base Coarse/Regulating Layer
Bond Coat
Eliminator 2nd Coat Membrane
Eliminator 1st Coat Membrane
Concrete or Steel Primer
Bridge Deck or Substrate

Resurfacing In Action!

The laying Rails.

What a Lovely Surface!

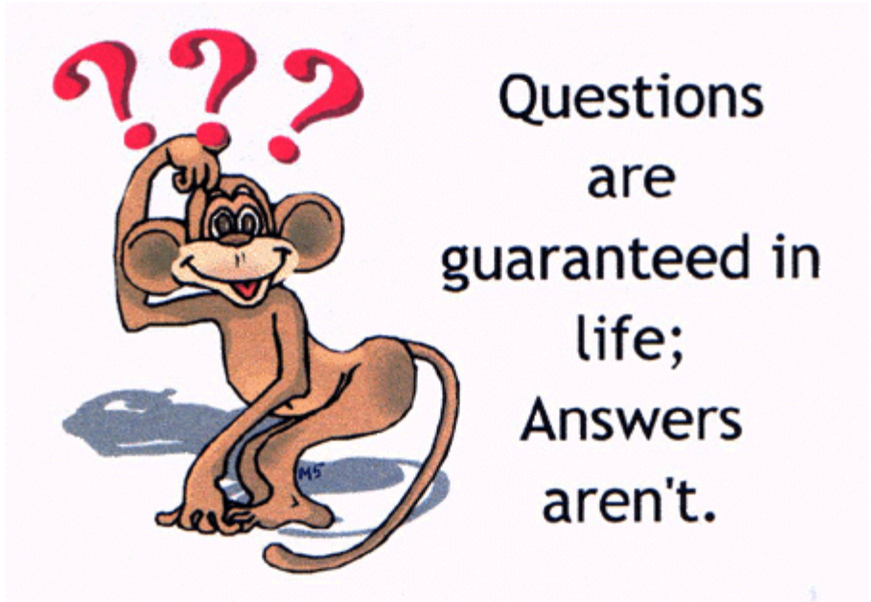
Friction Course

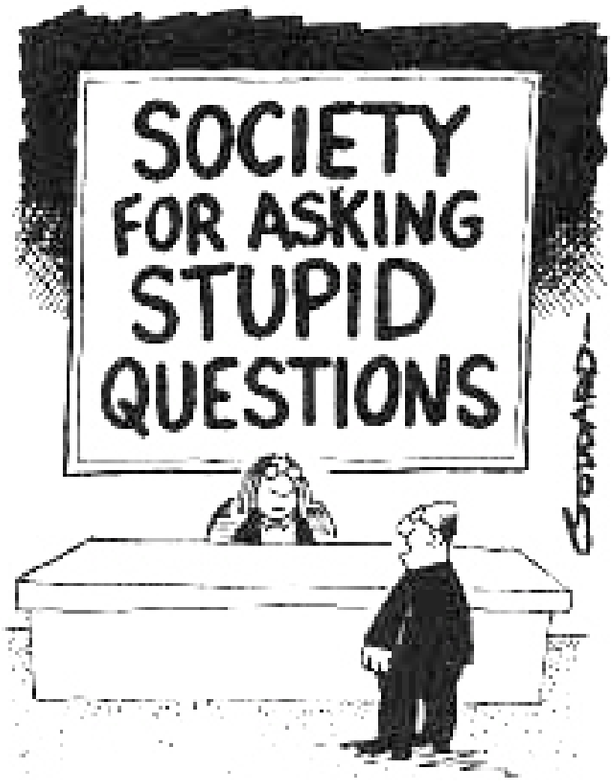
How Is It Today?

So far……..so good!

1 small incident related defect on the northbound carriageway which we are rectifying using blocks of material supplied at time of construction.

Questions?





"Excuse me, but is this The Society for Asking Stupid Questions?"