A National Barcode Standard for UK Public Transport Ticketing

Andrew Seedhouse
Chairman

About SAM

- Founded 2010
- Governed by Public Law (10 Staff – 7FTE)
- 79 Public Authority Members
- 82 Bus Operator Members
- 8 Associate Members

www.talktosam.co.uk

"To deliver the benefits of Smart and Integrated Ticketing, achieving economies of scale to SAM Members, through partnership working"

About STAG

https://www.stag.group/

- Trade Membership Body
- Task Force developments

TF2
Standardisation of Barcode/QR Code Ticketing in a Multi-modal Environment

TRANSPORT TICKETING GLOBAL

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The Challenge

RDG 6

trainline

Chilternrailways by arriva
crosscountry
greateranglia
LNER LONDON NORTH EASTERN RAILWAY
EMR EAST MIDLANDS RAILWAY
c2c
GWR
Hull Trains Your local link to London
NORTHERN
southeastern
South Western Railway
TRANSPENNINE EXPRESS

Rail Delivery Group

National Rail
BRITAIN RUNS ON RAIL

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The Challenge

TRANSMACH
Leave ticketing to us

Arrive

ticketer
A world of public transport possibilities

init

VIX

The Challenge

- QR/Barcode – 1.1bn journeys (Bus 29% / Rail 41%)
- Rail has Single Barcode Standard (RDG 6)
- Bus had no Single Barcode Standard
- There is no Single Multi-Modal Barcode Standard for UK

"Our ambition is for an integrated ticketing approach to allow you to buy a through journey for local bus, rail and metro with a single tap on your smartphone" **(pg32)**

Project Readiness

STAG Created a Task Force (TF2) for this 2 years ago, which in 2024:

- Published a standard Specification for a Multi-Modal Barcode ticket based on RDG 6;

Project Readiness

National Steering Group

Rail Delivery Group
National Rail
BRITAIN RUNS ON RAIL

Department for Transport

TRANSPORT SCOTLAND
CÒMHDHAIL ALBA

SAM

TRAFNIDIAETH CYMRU
TRANSPORT FOR WALES

SMARTRAN CONSULTING

Transport for West Midlands

PJAssociates

Security Review

Security Review for National Barcode Ticketing Specification

1 Foreword

This security review examines the proposed specification for a UK National Barcode public transport ticket. The goal of this specification is to overcome the current fragmentation caused by proprietary solutions, facilitating seamless multi-operator and multi-modal travel for passengers.

As a national standard that seeks to unify public transport systems and enhance accessibility, security is paramount. The widespread adoption of barcode-based ticketing introduces potential risks, including data integrity, privacy, fraud prevention, and system resilience. This review aims to identify these risks, evaluate the robustness of the specification's security measures, and ensure the proposed solution meets the highest standards for protecting both operators and passengers.

By addressing security concerns comprehensively, this review supports the vision of a seamless, secure, and efficient public transport experience, removing barriers to adoption and contributing to the growth of sustainable transport solutions across the UK.

- Royal Holloway University Security Review Completed end Dec 24.
- Review of non-rail ticket provisions by Jeremy Meal completed Dec 24.
- Reviewer’s recommendations incorporated into the issued version of the specification.

English Pilot Update

- 7 Operational Partners in Total
- Oxford Parkway was Live Test Venue
- Test was March 12th 2025
- Rail (single) Plus Oxford Period Pass

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English Pilot Update

FastRailTicketing

Chiltern railways

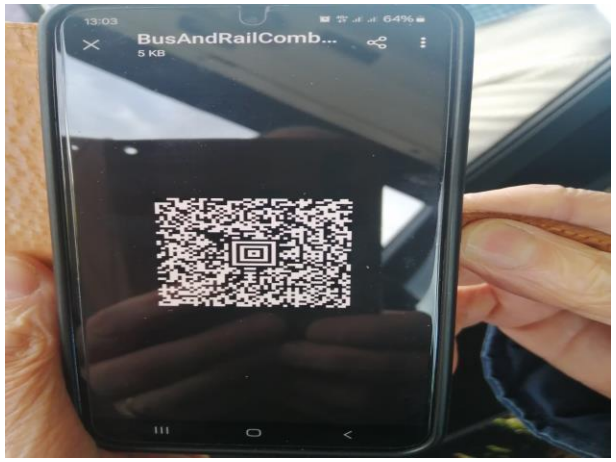
GWR

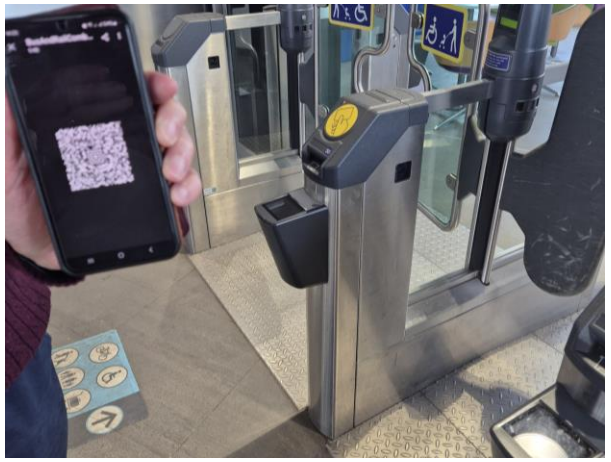
oxford bus company

OurBus Bartons

TRANSMACH

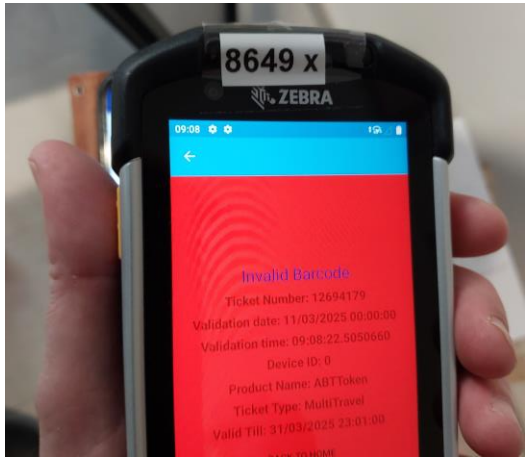
ticketer





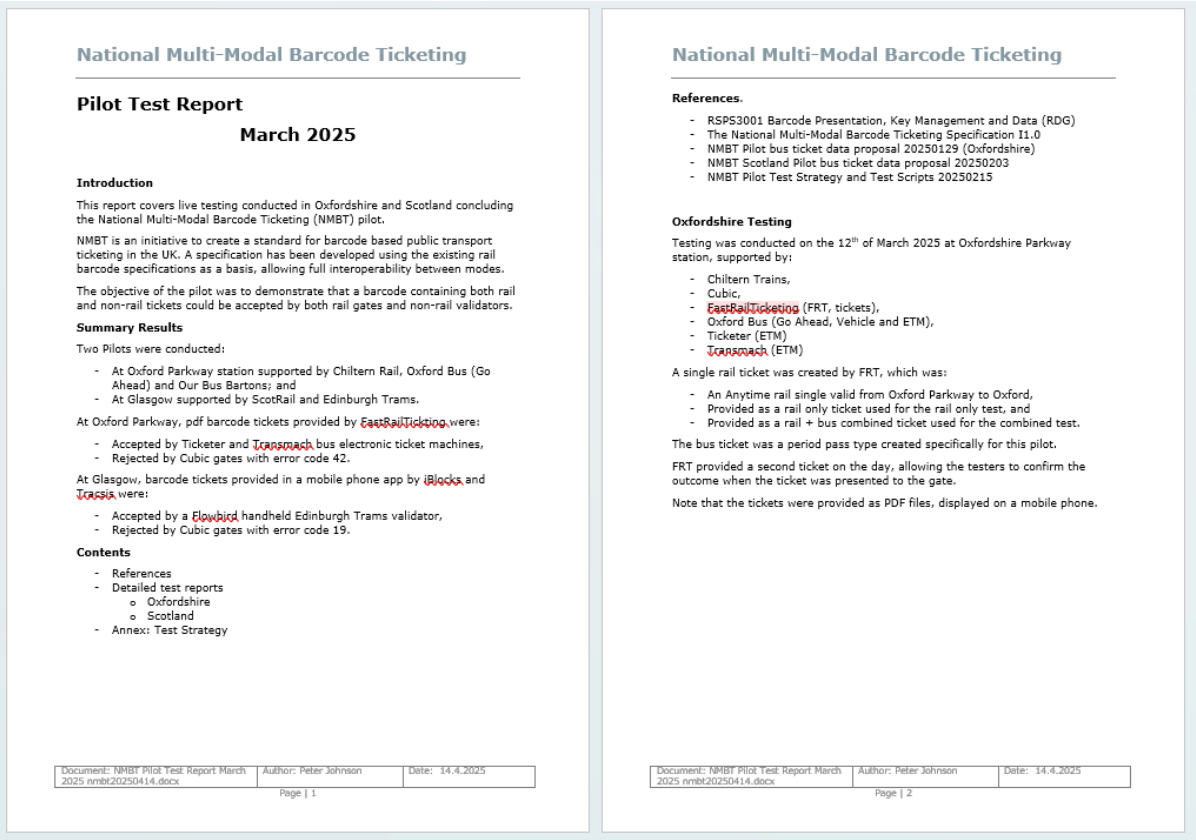
Scottish Pilot Update

- 5 Operational Partners in Total
- Glasgow Central was Live Test Venue
- Test was March 11th 2025
- Product was a closed loop Scotrail ABT PAYG Token



Results

- Ticketer ETM / Single QR Code Rail & Bus
- Transmach ETM / Single QR Code Rail & Bus
- Arrive ETM / Single QR Code Rail & Bus
- Rail Gate / Single QR Code Rail Only
- Rail Gate / Single QR Code Rail & Bus



National Multi-Modal Barcode Ticketing

Pilot Test Report

March 2025

Introduction

This report covers live testing conducted in Oxfordshire and Scotland concluding the National Multi-Modal Barcode Ticketing (NMBT) pilot.

NMBT is an initiative to create a standard for barcode based public transport ticketing in the UK. A specification has been developed using the existing rail barcode specifications as a basis, allowing full interoperability between modes.

The objective of the pilot was to demonstrate that a barcode containing both rail and non-rail tickets could be accepted by both rail gates and non-rail validators.

Summary Results

Two Pilots were conducted:

- At Oxford Parkway station supported by Chiltern Rail, Oxford Bus (Go Ahead) and Our Bus Bartons; and
- At Glasgow supported by ScotRail and Edinburgh Trams.

At Oxford Parkway, pdf barcode tickets provided by FastRailTicketing were:

- Accepted by Ticketer and Transmach bus electronic ticket machines,
- Rejected by Cubic gates with error code 42.

At Glasgow, barcode tickets provided in a mobile phone app by iBlocks and Trasis were:

- Accepted by a Flowbird handheld Edinburgh Trams validator,
- Rejected by Cubic gates with error code 19.

Contents

- References
- Detailed test reports
  - Oxfordshire
  - Scotland
- Annex: Test Strategy

Document: NMBT Pilot Test Report March 2025 nmbt20250414.docx | Author: Peter Johnson | Date: 14.4.2025

Page | 1

National Multi-Modal Barcode Ticketing

References.

- RSPS3001 Barcode Presentation, Key Management and Data (RDG)
- The National Multi-Modal Barcode Ticketing Specification I1.0
- NMBT Pilot bus ticket data proposal 20250129 (Oxfordshire)
- NMBT Scotland Pilot bus ticket data proposal 20250203
- NMBT Pilot Test Strategy and Test Scripts 20250215

Oxfordshire Testing

Testing was conducted on the 12th of March 2025 at Oxfordshire Parkway station, supported by:

- Chiltern Trains,
- Cubic,
- FastRailTicketing (FRT, tickets),
- Oxford Bus (Go Ahead, Vehicle and ETM),
- Ticketer (ETM)
- Transmach (ETM)

A single rail ticket was created by FRT, which was:

- An Anytime rail single valid from Oxford Parkway to Oxford,
- Provided as a rail only ticket used for the rail only test, and
- Provided as a rail + bus combined ticket used for the combined test.

The bus ticket was a period pass type created specifically for this pilot.

FRT provided a second ticket on the day, allowing the testers to confirm the outcome when the ticket was presented to the gate.

Note that the tickets were provided as PDF files, displayed on a mobile phone.

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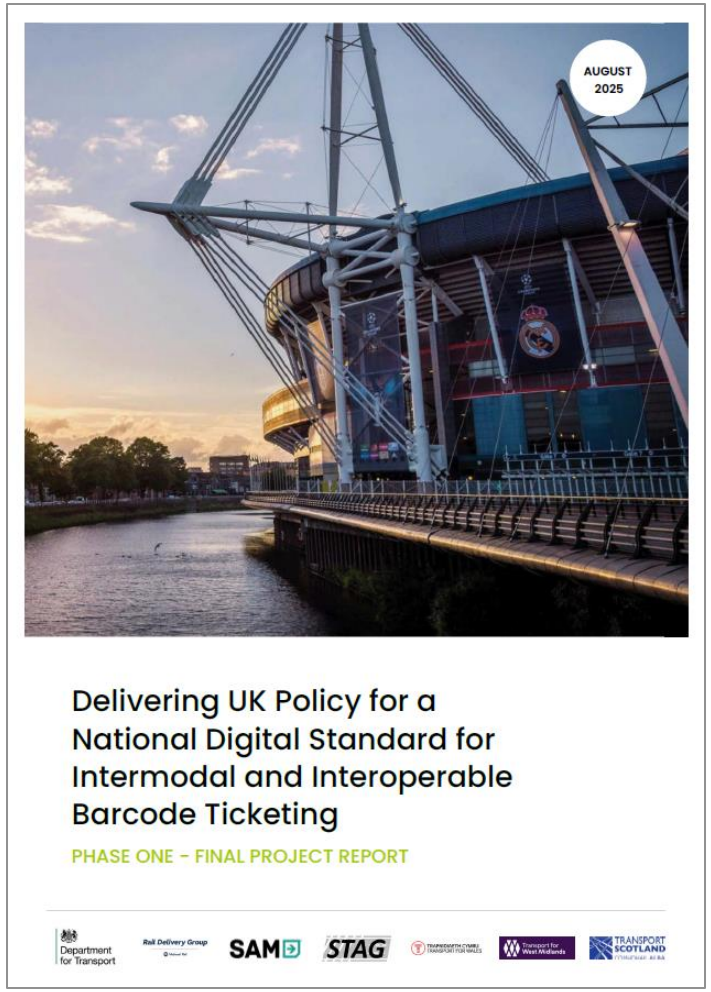
Page | 2

Phase One Report

Phase One Report Published

August 2025



Contents

Lessons Learned

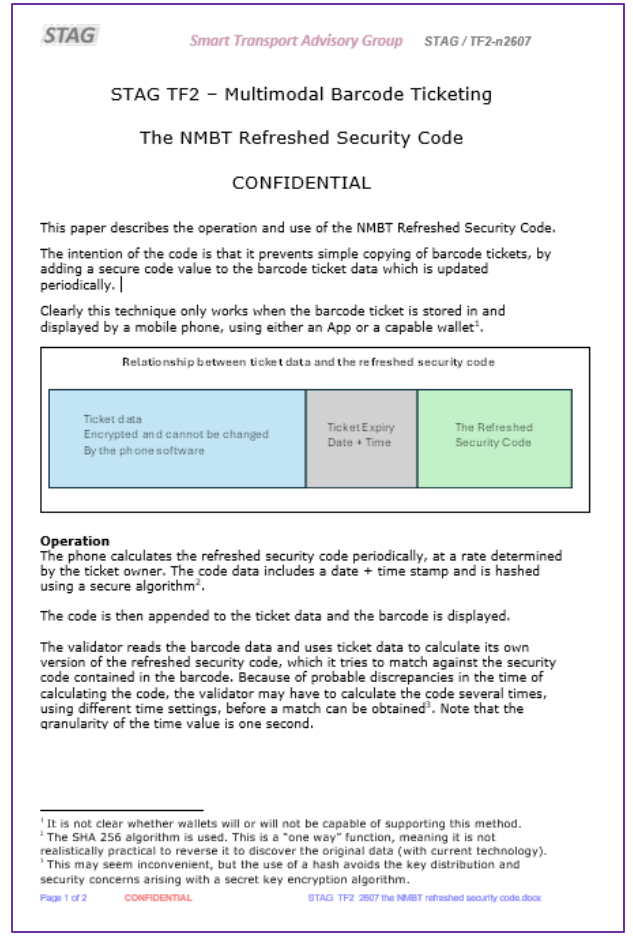
Core Lessons Learned

1. Rail Gates unable to Ignore RSPS3001 Empty Data Block
2. Limited ability of Rail barcode to host single multi-modal ticket
3. Ability of New Spec to Deliver Single QR for Non-Rail Modes

Phase Two

Status Today

1. Refreshed Security Code & Specification
2. Funding Request to DfT for Phase Two funding
3. Certification Options being developed
4. Live, decent scale Pilot to test with Customers.



STAG Smart Transport Advisory Group STAG / TF2-n2607

STAG TF2 – Multimodal Barcode Ticketing

The NMBT Refreshed Security Code

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This paper describes the operation and use of the NMBT Refreshed Security Code.

The intention of the code is that it prevents simple copying of barcode tickets, by adding a secure code value to the barcode ticket data which is updated periodically.

Clearly this technique only works when the barcode ticket is stored in and displayed by a mobile phone, using either an App or a capable wallet[1].

Relationship between ticket data and the refreshed security code

Ticket data Encrypted and cannot be changed By the phone software | Ticket Expiry Date + Time | The Refreshed Security Code

Operation
The phone calculates the refreshed security code periodically, at a rate determined by the ticket owner. The code data includes a date + time stamp and is hashed using a secure algorithm[2].

The code is then appended to the ticket data and the barcode is displayed.

The validator reads the barcode data and uses ticket data to calculate its own version of the refreshed security code, which it tries to match against the security code contained in the barcode. Because of probable discrepancies in the time of calculating the code, the validator may have to calculate the code several times, using different time settings, before a match can be obtained[3]. Note that the granularity of the time value is one second.

[1] It is not clear whether wallets will or will not be capable of supporting this method.
[2] The SHA 256 algorithm is used. This is a "one way" function, meaning it is not realistically practical to reverse it to discover the original data (with current technology).
[3] This may seem inconvenient, but the use of a hash avoids the key distribution and security concerns arising with a secret key encryption algorithm.

Page 1 of 2 CONFIDENTIAL STAG TF2 2607 the NMBT refreshed security code.docx

Phase Two

Transport Mode	Capability
Bus, Tram or Ferry **(This is the B_Ticket)**	• Single and Return tickets including multi-leg and timed versions, • Period (season pass) tickets, • Stored rides and Stored pass tickets, • Concessions, and Account Based Ticketing (ABT) tokens, supporting both ABT and MaaS.
Rail plus Bus or Tram or Ferry in a single barcode **(A Standard Rail Ticket + a Non-rail C_Ticket)**	• Standard rail tickets (excluding reservation data), • Basic Non-rail Singles and Returns, • Basic Non-rail Period tickets, and • ABT tokens (supporting MaaS). Concessions, stored rides/passes, multi-leg, timed tickets and storage of some geographic location methods are not supported

Phase Two

Ticket type	Details	Dynamic (refreshed)
Rail (only)	Standard rail ticket	Possible
Non-Rail only	NMBT B_Ticket	Yes
Rail + Non-Rail	Rail ticket + NMBT C_Ticket	Yes (C_Ticket only)

Phase Two

Supplier Mobilisation – A **National Town Hall Event** to bring together:

- Ticket retail providers
- Gateline suppliers
- Reader manufacturers
- Mobile app developers
- Back-office system providers

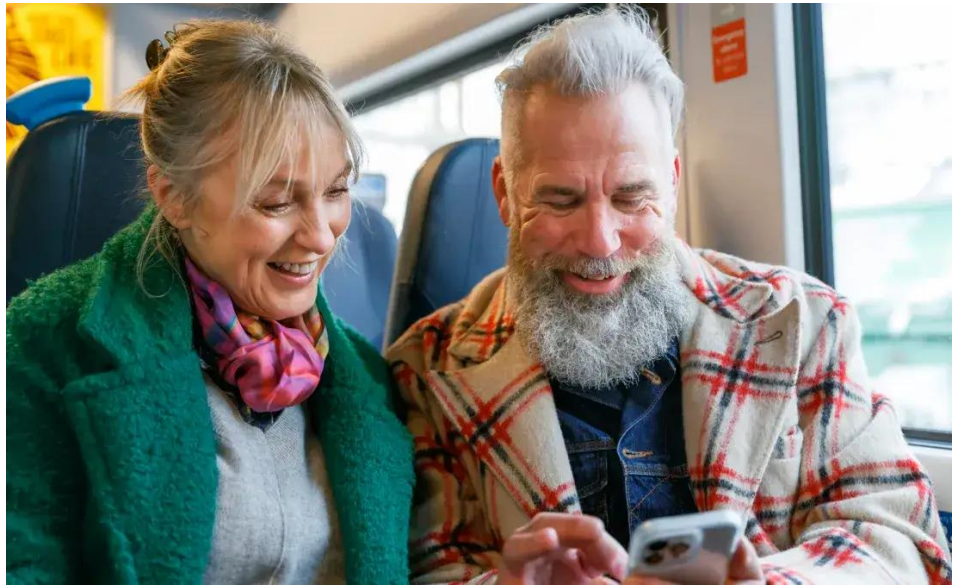
Purpose:

- Formal release of the final specification
- Technical clarification
- Adoption pathway discussion
- Supplier implementation planning

Aim - to ensure a coordinated and consistent market response.

Phase Two

Supplier Mobilisation – A **National Town Hall Event** to bring together:



At least two live multi-operator trials will be delivered to:

- Test full encryption compatibility
- Validate updated rail gate software
- Assess real-world passenger behaviour
- Confirm interoperability across multiple regions
- Generate evidence for policy endorsement

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Thank You

Rail Delivery Group

National Rail

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Department for Transport

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TRANSPORT FOR WALES

TRANSPORT SCOTLAND
CÒMHDHAIL ALBA

TRACSIS iBLOCKS Transit and Ticketing

Edinburgh Trams

Lothian Buses

ScotRail
Scotland's Railway

Arriva

GWR

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