The Test Engineer Development Programme

Developing Professional Test Engineers

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1 Executive Summary

This document sets out a vision for developing Apprentices into professional Test Engineers through a targeted learning and development programme. People passing through the programme will increase their own skills and competencies in multiple disciplines and, importantly, organisational capability to help deliver systems solutions that underpin day to day business operations.

The programme has been developed in concert with (and rolled out to) a major systems integration company that was prepared to invest significantly in training to increase capability and extend its value proposition to new and existing clients alike.

The days of people having a single skill have long gone, so this cogent learning and development programme is based upon achieving multi-skilled competencies for people and organisations in order to maximise staff utilisation and reduce operational costs and staff attrition rates.

The programme comprises five learning and development streams, each of which seeks to imbue people with multi-layered competencies that are relevant to their experience and which provide extended capability within organisational teams – regardless of the development method they employ. The first stream defines a programme for apprentices and people new to testing, with the remaining four streams providing learning matched to career growth and the needs of a modern Test Practice. Each course within a stream has been mapped to SFIA, industry-accepted core principles, competencies and role types, as follows:

1. **Test Engineer** for apprentices and entry level staff joining the Test Practice. Courses in this stream are aligned with the Government's 'Apprenticeship Programme';

This stream will imbue staff with thy skills they need to manage and ensure the right approach to test specification, design, techniques, execution and reporting in:

- Business testing
- Early automation testing
- Mobile app testing
- Risk based approaches
- Agile.

We recommend that the programme of learning be scheduled to run for around 2 years in order to allow students time to use their learning through classroom and on the job training to give them solid learning opportunities as the progress toward graduation. Within the stream is:

- A targeted learning & development programme that provides the necessary foundation for each person to take as part of building their general test capability and career growth;
- A series of optional developmental paths and routes to allow a Test Practice to fulfil its specialist technical needs by developing staff with cross-functional competencies.

For reference only, beyond the stream of learning defined here, there are a further four 2-year development streams to progress from Test Engineer through to Test Manager and Test Expert. Further details are available on request.

The following pages contain the training and support details for Apprentices and new entrants to develop into 'Professional Test Engineers'.

2 Principles and Competencies of the Programme

Following our experience of learning and development programmes and research into what companies require of testing in the future, we have defined a series of 'Principles and Competencies' that fit the gamut and need of corporate skills required to deliver first-class systems that help underpin business operations, as follows:

Principles	Apprentice Test Engineer
Engineering at the heart of designing IT solutions	Implements demonstrable and measurable, structured design techniques appropriate to the technology under Test
Execution excellence through engineering	Implement automation first approaches using industry best practices, targeting appropriate strategies for robust and repeatable automation and the appropriate exploratory / manual testing of change
Velocity - Pinpoint accuracy at speed, enabled by technology	Is able to implement testing best practice methods specific to the technology under Test and aware of the benefits of using them. Has real world experience of implementing these practice
Culture, Collaboration and lifecycle continual improvement	Works within squad of multi skilled teams to discuss / challenge and inform approach for testable solutions and educating best practices in Testing and Quality

3 The 5-Stream Programme

The professional Test Engineer career development programme contains five key streams, with each being rigorously designed and tested to reflect the principles and competencies that are key to success and growing capability within a Test Practice. Each stream interfaces seamlessly to the next to provide continuous investment in people and career growth:
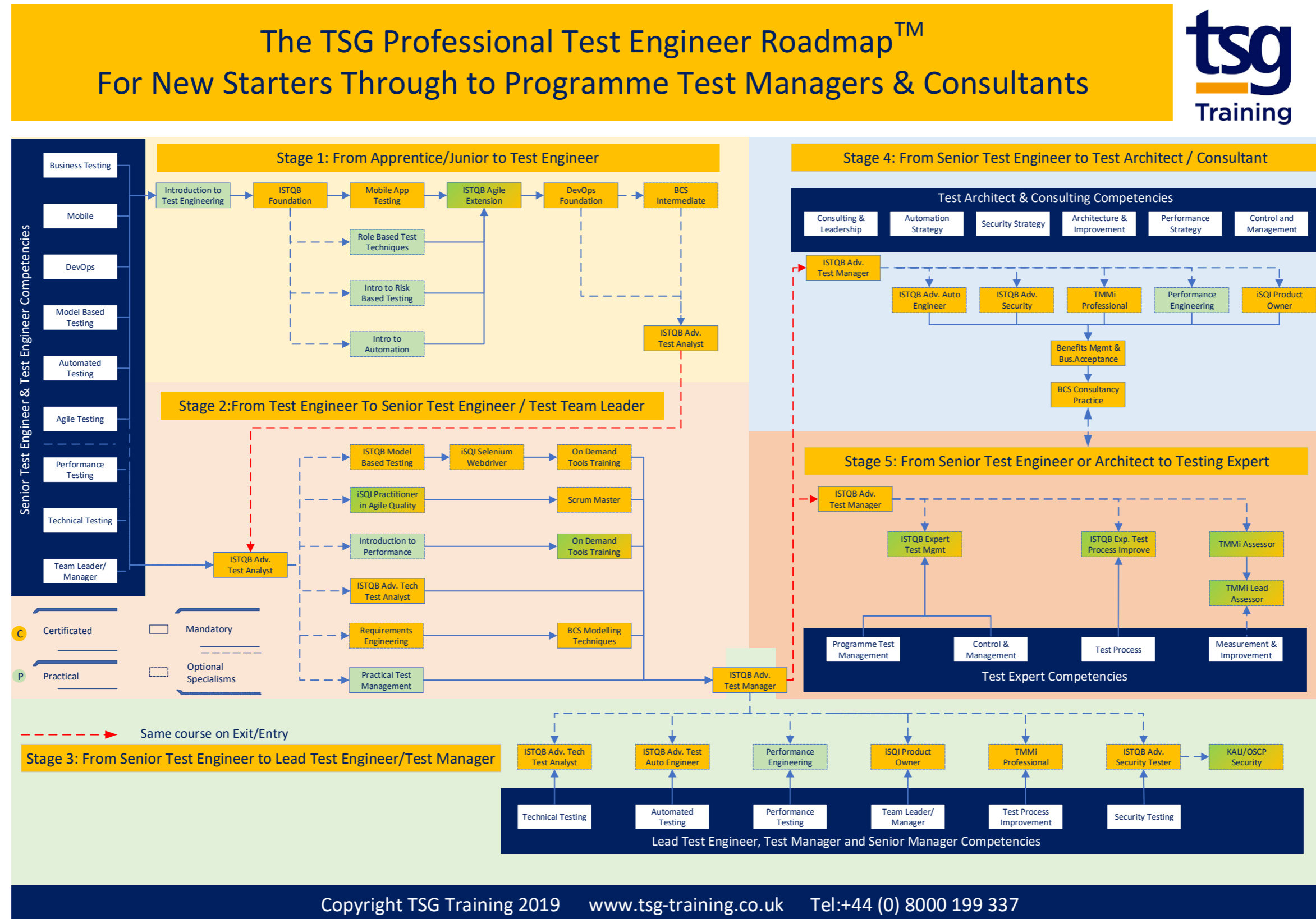

The TSG Professional Test Engineer Roadmap™
For New Starters Through to Programme Test Managers & Consultants

Stage 1: From Apprentice/Junior to Test Engineer

Introduction to Test Engineering · ISTQB Foundation · Mobile App Testing · ISTQB Agile Extension · DevOps Foundation · BCS Intermediate · Role Based Test Techniques · Intro to Risk Based Testing · Intro to Automation · ISTQB Adv. Test Analyst

Stage 2: From Test Engineer To Senior Test Engineer / Test Team Leader

ISTQB Model Based Testing · iSQI Selenium Webdriver · On Demand Tools Training · iSQI Practitioner in Agile Quality · Scrum Master · Introduction to Performance · ISTQB Adv. Tech Test Analyst · Requirements Engineering · BCS Modelling Techniques · Practical Test Management · ISTQB Adv. Test Analyst

Stage 3: From Senior Test Engineer to Lead Test Engineer/Test Manager

ISTQB Adv. Tech Test Analyst · ISTQB Adv. Test Auto Engineer · Performance Engineering · iSQI Product Owner · TMMi Professional · ISTQB Adv. Security Tester · KALI/OSCP Security

Lead Test Engineer, Test Manager and Senior Manager Competencies: Technical Testing · Automated Testing · Performance Testing · Team Leader/Manager · Test Process Improvement · Security Testing

Stage 4: From Senior Test Engineer to Test Architect / Consultant

Test Architect & Consulting Competencies: Consulting & Leadership · Automation Strategy · Security Strategy · Architecture & Improvement · Performance Strategy · Control and Management

ISTQB Adv. Test Manager · ISTQB Adv. Auto Engineer · ISTQB Adv. Security · TMMi Professional · Performance Engineering · iSQI Product Owner · Benefits Mgmt & Bus.Acceptance · BCS Consultancy Practice

Stage 5: From Senior Test Engineer or Architect to Testing Expert

ISTQB Adv. Test Manager · ISTQB Expert Test Mgmt · ISTQB Exp. Test Process Improve · TMMi Assessor · TMMi Lead Assessor

Test Expert Competencies: Programme Test Management · Control & Management · Test Process · Measurement & Improvement

Senior Test Engineer & Test Engineer Competencies: Business Testing · Mobile · DevOps · Model Based Testing · Automated Testing · Agile Testing · Performance Testing · Technical Testing · Team Leader/Manager

C Certificated · P Practical · Mandatory · Optional Specialisms · Same course on Exit/Entry

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Figure 1 - The Long-Term Software Test Engineer Career Development Programme

3.1 The Five Key Streams

At the broadest level, each stream is designed to reflect modern test engineering principles, coupled with competencies that meet the needs of a Test Practice using varying development models, supported by capability from competent, multi-skilled individuals.

1. **The Test Engineer** for apprentices and entry level staff embarking on a career in software testing, and for experienced staff from other disciplines who may be transferring in.
2. **The Senior Test Engineer** with at least two years' experience, who is ready to step up to using more advanced techniques, choosing to specialise or move to the early stages of team leadership.
3. **The Lead Test Engineer** with at least four years' experience, already specialising and needing to be ready for the demands of test management or increasingly complex technical roles.
4. **The Test Architect** with at least five years' experience, ready to make the jump to the business-critical role of defining and building test architectures for major programmes.
5. **The Test Expert** who has at least 10-years' experience of leading major programme delivery and organisational change and benefit.

3.2 The Test Engineer

The Test Engineer stream is designed for people with little or no experience of software testing, but who have expressed a desire to make it their career goal or who need testing experience as a second or third competency to support existing skills.

The programme is structured to meet the requirements of the Government's Apprenticeship programme to qualify for funding.

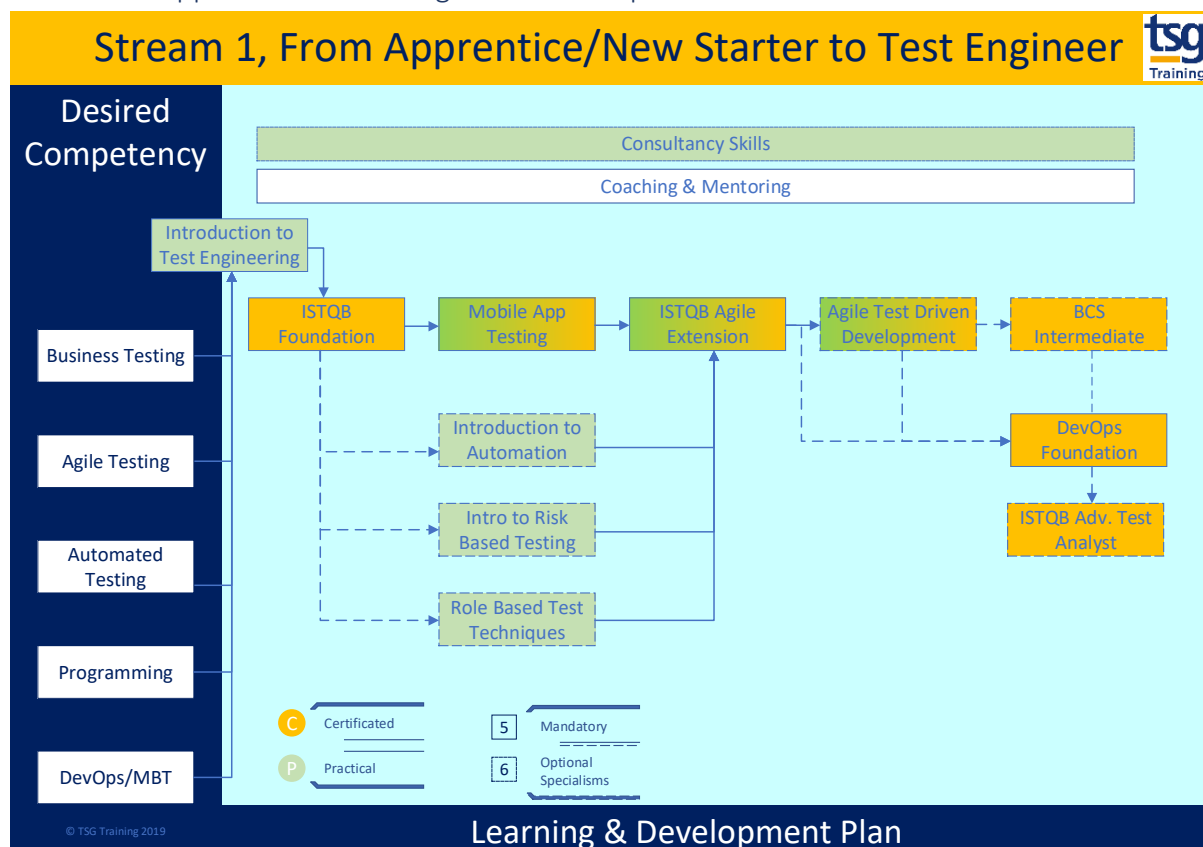### 3.2.1 The Apprentice to Test Engineer Roadmap

Figure 2 - The Test Engineer Capability Roadmap

The stream supports the key competencies of:

- Business Testing
- Agile Testing
- Automated Testing
- Programming
- DevOps & Model Based Testing

As can be seen in Figure 2 - The Test Engineer Capability Roadmap, there is:

- A series of mandatory courses
- Several optional courses to suit early specialisms.

Note: Unless someone is transferring into a Test Practice who has no software testing experience, we envisage the Test Engineer role being the only one of the five to be eligible for 'Government Apprenticeship Funding' in full.

3.3 Test Engineer Learning & Development Narrative

Test Engineer Learning & Development	Mandatory	Days	Pre-Requisites		Rationale
			Months Exp.	Experience and Qualifications	
Introduction to Testing & Test Engineering	Y	2	0	None	Provides the basics of testing and model-based testing in traditional, Agile and DevOps environments. Prepares students for the ISTQB Foundation course.
ISTQB Foundation, 2018 Syllabus and Exam	Y	3	0-6	Ability to absorb significant amounts of information in a short space of time; attention to detail; willingness to do homework.	This is the course that provides students with the common terms and processes they will need through their careers and which are industry-recognised as the de facto standard.
Introduction to Automation	Y	1	6-12	ISTQB/ISEB Foundation and an interest in specialising in or knowing more about test automation.	Modern Test Practices support automation as a key stream and deliverable, and this course provides students with their first 'hands-on' experience. It can also be supplemented with an optional Introduction to Python or other language
Introduction to Python Programming	Optional	3	6-12	ISTQB/ISEB Foundation and an interest in specialising in or knowing more about technical script writing for automation and/or performance testing.	Provides Test Engineers with the basics of Python Programming, as may be used in automation and/or performance and/or other technologies they may be required to support.
Introduction to Risk Based Testing	Optional	2	18	ISTQB/ISEB Foundation and those who are aware of the need to understand, profile and prioritise risk on the projects.	Provides a practical approach to identifying, prioritising and managing risk.

Test Engineer Learning & Development	Mandatory	Days	Pre-Requisites		Rationale
			Months Exp.	Experience and Qualifications	
Role Based Techniques	Optional	1	12-18	Those needing more techniques but who are not ready for ISTQB Advanced Test Analyst.	The gap between Foundation and either BCS Intermediate or ISTQB Advanced can be too long for some, and this course bridges the gap.
iSQI/ISTQB Certified Mobile App Tester and Exam	Y	2	12	Ability to use a computer for basic functions such as accessing files and using the command line interface. Willingness to learn how to use virtual machines for testing. Dexterity with fingers to test functions on mobile devices.	With 'mobile' being increasingly used as a delivery platform, it is now accepted that Test Engineers must understand how to test applications on mobile devices.\n\nNote: The iSQI qualification is to be retired in October 2019 in favour of an ISTQB qualification.
ISTQB Foundation – Agile Extension and Exam	Y	2	12-18	An ISTQB/ISEB Foundation Certificate is required for students to sit the exam, but not the course.	Agile is now mainstream, and students must be able to work within it. The course expands on the techniques and learning in the Foundation Course and the difference that Agile brings.
iSQI Agile Test-Driven Design (TDD)	Optional	3	12-18	Ability to use a computer for basic functions such as accessing files and using the command line interface. Willingness to learn how to programme whilst specialising in testing.	Test Driven Development (TDD) is a software development process that relies on the repetition of a very short development cycle of developer automated test case that defines a desired improvement or new function, then produces the minimum amount of code to pass that test, and finally refactors the new code to acceptable standards.

Test Engineer Learning & Development	Mandatory	Days	Pre-Requisites		Rationale
			Months Exp.	Experience and Qualifications	
BCS Intermediate and Exam	Optional	4	18-24	A solid understanding and usage of the terms, processes and techniques gained on prior courses.	This course expands upon the skills taught by ISTQB Foundation. Passing the exam on this course is a pre-requisite for students to graduate from the Apprenticeship Scheme and qualify for full Government funding.
DevOps Foundation	Y	2	24	None	Provides the basics of DevOps that Test Engineers must master to work in this environment.
ISTQB Advanced Test Analyst with exam	Optional	4	24	Must hold an ISTQB/ISEB Foundation certificate (from either the 2011 syllabus or the more recent 2018 syllabus) to sit the exam. At least 24-months solid testing experience using test design techniques, self-motivated, ability to analyse requirements. Ability to sit a multiple-choice exam lasting 3 hours. This is an optional course that may be sat at 18-months for the high-flyer or those on accelerated learning programmes.	This course is the natural route and progression for those who want to move up the ladder. It will increase knowledge and understanding of industry standard functional techniques and imbue the students with additional skills to take on more complex work.
Coaching and Mentoring	Optional	Ongoing	Ongoing	None	Optional for those not on a government sponsored Apprenticeship programme, but mandatory for those who are if full funding is to be secured

| Test Engineer Learning & Development | Mandatory | Days | Pre-Requisites | | Rationale |
			Months Exp.	Experience and Qualifications	
Consultancy Skills	Optional	1	0-24	0-2 years of testing experience for those expected to be deployed on client site as a fee-earning consultant.	Provides students with the behavioural and communication skills they will be expected to display to both internal and external stakeholders.

Table 1 - Test Engineer Courses, Pre-Requisites and Rationale

Note: the courses marked as 'Mandatory' and one of either the BCS Intermediate Certificate of ISTQB Advanced Test Analyst Certificate are required to qualify for full funding and graduate from the Apprenticeship Programme as Professional Test Engineers.

4   Meeting the Needs of the Apprentice

The programme has been designed to meet the skills of multiple business sectors and companies . It is composed of industry-accepted and proven courses to deliver best-practice training for Test Engineers. The programme provides professional training that will allow the apprentices to learn and develop on the job as they exercise acquired skills in:

- Test Analysis;
- Test Specification;
- Test Design;
- Test Execution;
- Test Reporting and Defect Management
- Test Automation
- Risk-Based Testing
- Testing of systems and components on a variety of delivery platforms, including mobile and desk based applications.

Training shall be delivered in the classroom with:

- An experienced trainer who has real coal face experience;
- A complete course manual and examples on which students can make their own notes;
- Support from the trainer via email for life.

We would expect that the skills identified and exercised consume at least 75% of an apprentice's time – which more than exceed the 20% OTJ training requirement.

5   Meeting the Needs of the Employer

The programme is based upon industry best practice and support a series of different development methods that are used in the market today.

TSG shall work with the employer to define the most suitable work for students to undertake based upon each course. Work is expected to be exercised aligned with the skills learned in Section 4, Meeting the Needs of , above.

In defining the right type of work, we shall agree with the employer an appropriate percentage of daily tasks to be allocated to learning. However, as noted above, we would expect that at least 75% of an Apprentice's time be spent on the job using the skills learned in the classroom.

The programme has been defined to turn out best-practice Test Engineers, but it can be modified in technical content to meet the specific needs of any particular methods, environments, skills and architectures as the employer may rely upon to underpin their business systems.

6   Benefits of the Approach

In helping to meet the requirements of building capability within a modern Test Practice we have clearly delineated the roles and mapped them to training functions to be supported, aligned with stated principles and competencies:

- Courses will be delivered by experienced staff who have at least 20-years' experience gained from training and programme delivery at the sharp-end.
- The experience the trainers bring will allow them to offer the ever-important analogies and war-stories to make training relevant and accessible.
- Courses can be tailored to meet specific requirements; although for ISTQB courses we are limited to 10% variation without having to reaccredit.

- We can provide private training courses anywhere or staff can attend any of the courses that we run on our public schedule.
- We will agree and put in place a monitoring and measurement system to make sure that:
    - The delegate experience is rich.
    - People are passing exams at the expected rate.
    - The overall programme is delivering against its aims.

A. Training & SFIA Cross Reference

The following table identifies:

- The Knowledge Levels (K) that each course and exam is aimed at:
- The SFIA Levels and the suitability of courses by the identified role types.

Courses & SFIA Levels		Introduction to Test Engineering	ISTQB Foundation	Introduction to Automation	Introduction to Risk-Based Testing	Role Based Test Techniques	iSQI/ISTQB Mobile App Testing	ISTQB Foundation Level Agile Extension	Agile Test Driven Development	BCS Intermediate	DevOps Foundation	ISTQB Advanced Test Analyst
Stream 1: Test Engineer												
Mandatory or Optional		M	M	O	O	O	M	M	O	O	M	O
Blooms Taxonomy	**Days**	2	3	1	2	2	2	2	2	4	2	4
K-Levels 6: Evaluate												
5: Synthesis												
4: Analyse												■
3: Apply		■	■	■	■	■	■	■	■	■	■	■
2: Understand		■	■	■	■	■	■	■	■	■	■	■
1: Remember		■	■	■	■	■	■	■	■	■	■	■
Strategy/Inspire — *Head of Testing*	7											
Initiate/Influence — *Test Architect*	6											
Ensure/Advise — *Lead Test Engineer*	5											
Enable — *Senior Test Engineer*	4											■
Apply / Assist — *Test Engineer*	2/3	■	■	■	■	■	■	■	■	■	■	

Table 2 - SFIA Levels by Course and Role Type