Politecnico di Milano

Software Engineering 2 - Project 2025-2026

Best Bike Paths (BBP)

Acceptance Test Deliverable

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Contents

1 Tested Project

1.1 Creators

- **S**imone Rota
- **A**lberto Rotolo

1.2 Repository link

https://github.com/AlbertoRot/RotaRotolo

1.3 Considered documents

- **RASD**: Requirements Analysis Specification Document
- **DD**: Design Document
- **ITD**: Implementation and Testing Document

2 Introduction

2.1 Purpose

This Acceptance Test Document (ATD) provides a comprehensive evaluation of the Best Bike Paths (BBP) Progressive Web Application developed by Team RotaRotolo. The document verifies that the implemented system meets the requirements specified in the RASD (Requirements Analysis and Specification Document) and follows the architecture defined in the DD (Design Document).

The ATD serves to:

- Validate functional requirements through systematic test cases
- Verify system behavior under various conditions
- Document the installation process and any issues encountered
- Provide evidence of acceptance testing completion
- Identify any deviations from expected behavior
- Evaluate the quality of documentation and code

2.2 Project Identification

Field	**Details**
Project Name	Best Bike Paths (BBP)
Project Authors	Alberto Rotolo, Simone Rota
Repository	`https://github.com/AlbertoRot/RotaRotolo`
Branch Tested	main

Table 1: Project Identification

2.3 Reference Documents

The following documents were analyzed for this acceptance testing:

Document	**Description**
RASDv1.pdf	Requirements Analysis and Specification Document - Used to extract functional requirements and derive test cases
DDv1.pdf	Design Document - Used to understand system architecture and component interactions
ITDv1.pdf	Implementation and Test Document - Used to understand implemented features and existing test coverage
README.md	Repository documentation for installation instructions

Table 2: Reference Documents

2.4 Scope

This acceptance testing covers the following implemented features of the BBP system:

- **Goal 1 - Trip Recording**: GPS-based trip tracking with real-time statistics
- **Goal 2 - Manual Path Reporting**: User-contributed path condition reports
- **Goal 4 - Path Visualization**: Route calculation and display with condition-based scoring

Note: Goal 3 (Automated Data Collection) was not implemented and is therefore excluded from acceptance testing.

2.5 Definitions, Acronyms, Abbreviations

ATD: Acceptance Test Document

BBP: Best Bike Paths

DD: Design Document

GPS: Global Positioning System

ITD: Implementation and Test Document

RASD: Requirements Analysis and Specification Document

PWA: Progressive Web Application

UI: User Interface

API: Application Programming Interface

OSRM: Open Source Routing Machine

PostGIS: PostgreSQL Geographic Information System extension

2.6 Document Structure

This document follows the structure specified for ATD deliverables:

1. **Introduction**: Overview of the document purpose, project identification, and reference documents
2. **Installation Setup**: Detailed description of installation process, problems faced, and documentation incoherences
3. **Acceptance Test Cases**: Test cases derived from RASD and implemented features with outcomes
4. **Test Results Summary**: Overview of test execution outcomes

5. **Quality Evaluation**: Assessment of documentation and code quality
6. **Effort Spent**: Hours worked by each team member
7. **References**: Bibliography and external resources

3 Installation Setup

This section documents the installation process followed to set up the BBP prototype.

3.1 Prerequisites

The following software was required for installation:

Software	Required Version	Installed Version
Docker Desktop	Latest	29.2.0
Git	Any	Latest
Web Browser	Chrome/Safari	Latest

Table 3: Software Prerequisites

3.2 Installation Steps Performed

The following steps were executed to install and run the prototype:

1. **Clone Repository**:

```
git clone https://github.com/AlbertoRot/RotaRotolo.git
```

2. **Navigate to Code Directory**:

```
cd "intermediate work/ITD/code"
```

3. **Start Docker Services**:

```
docker compose up -d
```

4. **Verify Services Running**:

```
docker compose ps
```

5. **Access Application**: Open browser to `http://localhost:5173`

3.3 Installation Outcome

No problems were encountered during the installation process. All Docker containers started successfully and the application was accessible immediately after following the installation steps.

Service	Technology	Port	Status
Frontend	React 18 + Vite 5	5173	Running
Backend API	Node.js 18 + Express 4	3001	Running
Database	PostgreSQL 14 + PostGIS 3.3	5432	Running
Cache	Redis 7	6379	Running
pgAdmin	pgAdmin 4	5050	Running

Table 4: Services Configuration

3.4 Documentation Observations

The following observations were made regarding the documentation:

1. **Installation Instructions**: The ITD provides clear Docker-based installation steps in Section 6.
2. **Test Credentials**: The ITD documents test credentials (test@bbp.com / Test1234) in Section 6.4.
3. **Email Domain Restriction**: The application restricts registration to @bbp.com email addresses, which could be better documented for end users.
4. **Environment Configuration**: The docker-compose.yml is pre-configured for local development.

3.5 Test Environment

Component	Specification
Device	MacBook Air
Processor	Apple Silicon (ARM64)
Operating System	macOS
RAM	8GB+
Network	Local network with internet access

Table 5: Test Environment Hardware

3.6 Test Credentials

Account Type	Email	Password
Pre-configured Test User	test@bbp.com	Test1234
pgAdmin Administrator	admin@bbp.com	admin
New Registration	*@bbp.com (required domain)	User-defined

Table 6: Test Credentials

4 Acceptance Test Cases

This section presents the acceptance test cases applied to the BBP prototype. Test cases were derived from multiple sources to ensure comprehensive coverage.

4.1 Test Case Derivation

The acceptance test cases were extracted and motivated from the following sources:

1. **RASD Requirements Analysis**: Test cases TC-AUTH-* and core functionality tests were derived directly from the functional requirements specified in the RASD document (R1-R27).
2. **ITD Implemented Features**: The ITD confirmed which features were actually implemented. Goal 3 (Automated Data Collection) was explicitly not implemented, so no test cases target this functionality.
3. **User Perspective Testing**: Additional test cases (TC-SYS-*) were added to verify system reliability, performance, and integration aspects that a real user would experience.
4. **Boundary and Error Conditions**: Tests like TC-AUTH-002 (invalid credentials) verify proper error handling as expected by users.

4.2 Test Case Notation

Status	Description
PASS	Test executed successfully, expected results achieved
FAIL	Test executed but results do not match expectations
PENDING	Test not yet executed
SKIP	Test skipped (feature not available or not applicable)

Table 7: Test Status Legend

4.3 Authentication Tests (9 Test Cases)

The following test cases are derived from RASD Requirement R1 (User Registration and Authentication) and ITD Section 5.3.1.

TC ID	Description	Expected Result	Status
TC-A01	Register with valid email and password	Account created, redirect to home	PASS
TC-A02	Register with existing email	Error message displayed	PASS

TC ID	Description	Expected Result	Status
TC-A03	Register with invalid email format	Validation error shown	PASS
TC-A04	Register with weak password	Validation error shown	PASS
TC-A05	Login with valid credentials	JWT token issued, redirect to home	PASS
TC-A06	Login with invalid password	Error message displayed	PASS
TC-A07	Login with non-existent email	Error message displayed	PASS
TC-A08	Logout clears session	Token invalidated, redirect to login	PASS
TC-A09	Access protected route without auth	Redirect to login page	PASS

Table 8: Authentication Test Cases (from ITD)

4.4 Trip Recording Tests - Goal 1 (10 Test Cases)

The following test cases are derived from RASD Requirements R2-R6 (Trip Recording) and ITD Section 5.3.2.

TC ID	Description	Expected Result	Status
TC-T01	Start trip recording with GPS	Position captured, timer starts	PASS
TC-T02	GPS tracking updates position	Route polyline updates on map	PASS
TC-T03	Distance calculation accuracy	Within 5% of actual distance	PASS
TC-T04	Pause trip recording	Timer stops, position not tracked	PASS
TC-T05	Resume trip recording	Timer continues, tracking resumes	PASS
TC-T06	Stop and save trip	Trip stored in database	PASS
TC-T07	Weather data captured	Weather info attached to trip	PASS
TC-T08	Trip appears in history	Saved trip visible in list	PASS
TC-T09	GPS permission denied	Error message displayed	PASS
TC-T10	Minimum GPS points validation	Error if less than 2 points	PASS

TC ID	Description	Expected Result	Status

Table 9: Trip Recording Test Cases (from ITD)

4.5 Path Reporting Tests - Goal 2 (11 Test Cases)

The following test cases are derived from RASD Requirements R7-R12 (Manual Path Reporting) and ITD Section 5.3.3.

TC ID	Description	Expected Result	Status
TC-P01	Submit report with valid address	Report created, stored in DB	PASS
TC-P02	Geocoding Italian address	Coordinates returned correctly	PASS
TC-P03	Geocoding with house number	Position near specified number	PASS
TC-P04	Drag marker to adjust location	New coordinates saved	PASS
TC-P05	Select path status	Status value stored correctly	PASS
TC-P06	Add obstacle description	Description saved (max 500 chars)	PASS
TC-P07	Report private by default	is_publishable = false	PASS
TC-P08	Make report public	is_publishable = true	PASS
TC-P09	View own reports	All user reports displayed	PASS
TC-P10	Delete own report	Report removed from DB	PASS
TC-P11	Cannot delete others' reports	403 Forbidden error	PASS

Table 10: Path Reporting Test Cases (from ITD)

4.6 Path Visualization Tests - Goal 4 (10 Test Cases)

The following test cases are derived from RASD Requirements R22-R27 (Path Visualization) and ITD Section 5.3.4.

TC ID	Description	Expected Result	Status
TC-V01	Search route in Milan	Routes displayed on map	PASS
TC-V02	Multiple alternatives shown	Up to 3 routes displayed	PASS
TC-V03	Route scoring calculation	Score between 40-100	PASS
TC-V04	Reports affect route score	Score adjusts based on reports	PASS
TC-V05	Color coding by score	Green/yellow/orange/red colors	PASS
TC-V06	Report markers on route	Markers visible for reports	PASS
TC-V07	Click report for details	Popup shows report info	PASS
TC-V08	Search in other cities	Routes work in Rome, Turin, etc.	PASS
TC-V09	Invalid address handling	Error message displayed	PASS
TC-V10	No route found	Appropriate message shown	PASS

Table 11: Path Visualization Test Cases (from ITD)

4.7 API Endpoint Tests (10 Test Cases)

The following test cases verify the REST API endpoints documented in the ITD Section 5.4.

Endpoint	Method	Auth	Input	Status
/api/auth/register	POST	No	Valid data	PASS
/api/auth/login	POST	No	Valid creds	PASS
/api/auth/logout	POST	Yes	JWT token	PASS
/api/trips	POST	Yes	Trip data	PASS
/api/trips/user/:id	GET	Yes	User ID	PASS
/api/paths/report/manual	POST	Yes	Report data	PASS
/api/paths/user	GET	Yes	-	PASS
/api/paths/search	GET	No	lat, lng	PASS
/api/paths/reports/along-route	POST	No	coordinates	PASS
/api/maps/visualize	POST	No	origin, dest	PASS

Table 12: API Endpoint Test Cases (from ITD)

5 Test Results Summary

5.1 Test Execution Overview

Test execution was performed on February 6, 2026, using automated API testing with curl and manual verification of frontend functionality.

Category	Total	Pass	Fail	Pending	Skip
Authentication	9	9	0	0	0
Trip Recording	10	10	0	0	0
Path Reporting	11	11	0	0	0
Path Visualization	10	10	0	0	0
API Endpoints	10	10	0	0	0
Total	**50**	**50**	**0**	**0**	**0**

Table 13: Test Execution Summary - **100% Pass Rate**

5.2 Requirements Coverage

Requirement	Test Cases	Coverage Status
R1 - Authentication	TC-A01 to TC-A09	Covered
R2 - Start Trip Recording	TC-T01, TC-T02	Covered
R3 - Real-time Statistics	TC-T02, TC-T03	Covered
R4 - Stop Trip Recording	TC-T04, TC-T05, TC-T06	Covered
R5 - Weather Data	TC-T07	Covered
R6 - Trip Storage	TC-T06, TC-T08	Covered
R7 - Manual Report Interface	TC-P01, TC-P09	Covered
R8 - Specify Path by Street	TC-P02, TC-P03	Covered
R9 - Select Path Status	TC-P05	Covered
R10 - Describe Obstacles	TC-P06	Covered
R11 - Control Publishing	TC-P07, TC-P08	Covered
R12 - Submit Report	TC-P01	Covered
R22 - Origin/Destination Input	TC-V01, TC-V08	Covered
R23 - Calculate Paths	TC-V02	Covered
R24 - Order by Effectiveness	TC-V03, TC-V04	Covered
R25 - Visualize on Map	TC-V05	Covered
R26 - Display Route Details	TC-V07	Covered
R27 - Show User Reports	TC-V06	Covered

Table 14: Requirements Coverage Matrix

6 Quality Evaluation

This section provides an assessment of the documentation and code quality of the BBP project.

6.1 Documentation Quality

6.1.1 RASD Assessment

Aspect	Observation	Rating
Completeness	All four goals are well-defined with clear requirements	Good
Clarity	Requirements are clearly stated and numbered	Good
Use Cases	Comprehensive use case diagrams and descriptions	Good
Traceability	Requirements can be traced to goals	Good

Table 15: RASD Quality Assessment

6.1.2 DD Assessment

Aspect	Observation	Rating
Architecture	Clean three-tier architecture with clear separation	Good
Component Diagrams	Detailed component interactions	Good
API Specification	REST API endpoints well documented	Good
Database Design	PostGIS integration for geospatial data	Good

Table 16: DD Quality Assessment

6.1.3 ITD Assessment

Aspect	Observation	Rating
Implementation Details	Good coverage of technology choices	Good
Test Coverage	Unit and integration tests documented	Good
Installation Guide	**Mentioned Properly but the test id password not working**	Average
Configuration	properly documented	Good

Table 17: ITD Quality Assessment

6.2 Code Quality

6.2.1 Positive Observations

- **Modern Technology Stack**: Uses React 18, Vite 5, Node.js 18 - all current LTS versions
- **Docker Containerization**: Application is properly containerized for easy deployment
- **Database Design**: Proper use of PostGIS for geospatial queries
- **API Structure**: RESTful API with proper endpoint organization
- **PWA Features**: Progressive Web App capabilities for mobile usage
- **External Services Integration**: Good integration with Nominatim, OSRM, and OpenWeatherMap

6.2.2 Issues Identified

1. **Goal 3 Not Implemented**: Automated Data Collection (Goal 3) is not implemented, reducing the system's ability to gather path conditions automatically. However, this was a deliberate design decision documented in the ITD.

Note: No critical installation or deployment issues were encountered during our testing.

6.3 Known Limitations

- GPS simulation required for desktop testing of trip recording features
- Rate limiting on external APIs (Nominatim, OSRM) may affect testing
- Weather data integration requires OpenWeatherMap API key (included in config)
- Application optimized for mobile use; some features may be less intuitive on desktop

6.4 Recommendations

1. Test id password mentioned not working so edit it
2. Improve the UI for the mobile phone

7 Effort Spent

This section documents the effort spent by each team member on the acceptance testing and ATD preparation.

Team Member	**Activities**	**Hours**
Rajatkant Nayak	Installation and setup Document analysis (RASD, DD, ITD) Test execution ATD document preparation	8
Shashi Bhushan	Installation verification Test execution Quality evaluation ATD review	6
	Total Effort	**14 hours**

Table 18: Effort Distribution

7.1 Effort Breakdown by Activity

Activity	**Hours**
Repository cloning and initial setup	1.0
Document analysis (RASD, DD, ITD)	3.0
Test case Analysis	2.0
Test execution and recording	4.0
ATD document preparation	3.0
Quality evaluation and review	1.0
Total	**14 hours**

Table 19: Effort by Activity

8 References

8.1 Project Documents

1. RotaRotolo Team, "RASD - Requirements Analysis and Specification Document," Version 1.0, 2025.
2. RotaRotolo Team, "DD - Design Document," Version 1.0, 2025.
3. RotaRotolo Team, "ITD - Implementation and Test Document," Version 1.0, 2025.

8.2 Repository

- GitHub Repository: `https://github.com/AlbertoRot/RotaRotolo`
- Branch Tested: main
- Access Date: February 8, 2026

8.3 External Technologies

- React.js: `https://react.dev/`
- Vite: `https://vitejs.dev/`
- Node.js: `https://nodejs.org/`
- Express.js: `https://expressjs.com/`
- PostgreSQL: `https://www.postgresql.org/`
- PostGIS: `https://postgis.net/`
- Redis: `https://redis.io/`
- Docker: `https://www.docker.com/`
- Leaflet: `https://leafletjs.com/`

8.4 External APIs Used by BBP

- Nominatim (Geocoding): `https://nominatim.org/`
- OSRM (Routing): `https://project-osrm.org/`
- OpenWeatherMap (Weather Data): `https://openweathermap.org/api`

A Appendix A: Test Execution Checklist

Authentication Tests (9 tests) - 9/9 PASS

ID	Test Case	Executed	Pass/Fail
TC-AUTH-001	Login Valid Credentials	✓	PASS
TC-AUTH-002	Login Invalid Credentials	✓	PASS
TC-AUTH-003	New User Registration	✓	PASS
TC-AUTH-004	User Logout	✓	PASS
TC-AUTH-005	Duplicate Registration Prevention	✓	PASS
TC-AUTH-006	Password Validation	✓	PASS
TC-AUTH-007	Protected Route Access	✓	PASS
TC-AUTH-008	Token Expiration	✓	PASS
TC-AUTH-009	Session Persistence	✓	PASS

Trip Management Tests (10 tests) - 10/10 PASS

ID	Test Case	Executed	Pass/Fail
TC-TRIP-001	Start Trip Recording	✓	PASS
TC-TRIP-002	View Real-time Statistics	✓	PASS
TC-TRIP-003	Pause and Resume Trip	✓	PASS
TC-TRIP-004	Stop and Save Trip	✓	PASS
TC-TRIP-005	View Trip History	✓	PASS
TC-TRIP-006	Trip Detail View	✓	PASS
TC-TRIP-007	Delete Trip Record	✓	PASS
TC-TRIP-008	Trip Statistics Accuracy	✓	PASS
TC-TRIP-009	GPS Tracking Display	✓	PASS
TC-TRIP-010	Multiple Trip Storage	✓	PASS

Path Report Tests (11 tests) - 11/11 PASS

ID	Test Case	Executed	Pass/Fail
TC-REP-001	Create Path Report	✓	PASS
TC-REP-002	Report Status Types	✓	PASS
TC-REP-003	Report with Description	✓	PASS
TC-REP-004	Toggle Report Visibility	✓	PASS
TC-REP-005	Delete Report	✓	PASS
TC-REP-006	View All User Reports	✓	PASS
TC-REP-007	Report Location Accuracy	✓	PASS
TC-REP-008	Report Timestamp	✓	PASS
TC-REP-009	View Report	✓	PASS
TC-REP-010	Report Filtering	✓	PASS
TC-REP-011	Report Map Display	✓	PASS

Map Visualization Tests (10 tests)

Map Visualization Tests (10 tests) - 10/10 PASS ID	Test Case	Executed
TC-VIS-001	Map Initial Load	✓
TC-VIS-002	Route Display	✓
TC-VIS-003	Alternative Routes View	✓
TC-VIS-004	Route Color Coding	✓
TC-VIS-005	Route Scoring Display	✓
TC-VIS-006	Location Search	✓
TC-VIS-007	Map Zoom and Pan	✓
TC-VIS-008	Report Markers Display	✓
TC-VIS-009	Current Location Display	✓
TC-VIS-010	Map Layer Controls	✓

API Integration Tests (10 tests) - 10/10 PASS

ID	Test Case	Executed	Pass/Fail
TC-API-001	Backend Health Check	✓	PASS
TC-API-002	Database Connection	✓	PASS
TC-API-003	Response Time Performance	✓	PASS
TC-API-004	Nominatim Geocoding	✓	PASS
TC-API-005	OSRM Routing	✓	PASS
TC-API-006	Weather API Integration	✓	PASS
TC-API-007	Error Handling	✓	PASS
TC-API-008	Rate Limiting Response	✓	PASS
TC-API-009	CORS Configuration	✓	PASS
TC-API-010	Redis Cache Functionality	✓	PASS

B Appendix B: Docker Commands Reference

```
# Start all services
docker compose up -d

# Check service status
docker compose ps

# View backend logs
docker logs bbp-backend --tail 50

# View frontend logs
docker logs bbp-frontend --tail 50

# Restart a specific service
docker compose restart backend

# Stop all services
docker compose down

```

```
# Stop and remove volumes (reset database)
docker compose down -v
```

Listing 1: Useful Docker Commands