Software Test Description (STD) for ORP – Outdoor Route Planner

## Authentication Test Cases

| Test Case ID | Description | Preconditions | Test Steps | Expected Result | Actual Result |
| --- | --- | --- | --- | --- | --- |
| TC-001 | User Registration with valid data | No user registered | 1. Navigate to Register 2. Enter email and password 3. Submit | User account is created and JWT returned | Account created successfully, leading to homepage. |
| TC-002 | Registration with existing email | Email already in use | 1. Attempt to register with used email | Error: Email already exists | “User with this email already exists” error.  Stays on login page. |
| TC-003 | User Login with correct credentials | Registered user exists | 1. Enter email and password 2. Submit | Redirected to dashboard | Login successful, leading to homepage. |
| TC-004 | User Login with incorrect password | Registered user exists | 1. Enter correct email, wrong password 2. Submit | Error message displayed | “Invalid email or password” error. Stays on login page. |
| TC-005 | Auto logout on JWT expiry | User is logged in | 1. Wait for token expiry 2. Attempt to access dashboard | User is logged out | No auto logout happens. ~10 minute test.~ |

## Map Interface Test CasesRoute Optimization Test Cases

| Test Case ID | Description | Preconditions | Test Steps | Expected Result | Actual Result |
| --- | --- | --- | --- | --- | --- |
| TC-006 | Add waypoints to map | User logged in | 1. Click on map 2. Repeat up to 5 times | Up to 5 numbered markers appear | Inserted 5 points successfully. |
| TC-007 | Drag marker to new position | At least one marker added | 1. Drag marker to new location | Marker position updated | Dragging point is updated successfully. |
| TC-008 | Delete marker from map | Marker is present | 1. Right-click on marker | Marker is removed | Marker removed successfully. |
| TC-009 | Switch map type | Map loaded | 1. Click terrain/satellite toggle | Map type changes | Change from ‘Map’ to ‘Satellite’ back and forth successfully. |

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| Test Case ID | Description | Preconditions | Test Steps | Expected Result | Actual Result |
| --- | --- | --- | --- | --- | --- |
| TC-010 | Generate route using A\* algorithm | At least 2 waypoints added | 1. Click 'Generate Route' | Route displayed with elevation costs | Route generated with elevation costs. |
| TC-011 | Grid and bounding box validation | Large area selected | 1. Attempt to generate route | Error if over 10km x 10km | Error displayed for an area above 10x10 km. |
| TC-012 | Validate cost function favors flatter paths | Flat and hilly options present | 1. Create route including hills 2. Observe path selection | Flatter path chosen over steep route | Flatter path is chosen successfully over a steep route. |
| TC-013 | Handle elevation API batch limits | More than 512 elevation points requested | 1. Generate route over large area | Batching used, no API failure | Successful, more points = more processing time. |
| TC-014 | Route generation fails gracefully on error | Invalid elevation data returned | 1. Inject bad data 2. Generate route | Error message shown, no crash | Example: can generate routes on sea. |
| TC-015 | Route smoothing reduces unnecessary points | Zig-zaggy elevation grid | 1. Generate raw route 2. Apply smoothing | Path has fewer, cleaner segments | Routes are clean, no “Zig Zags” |
| TC-016 | Reject bounding box over 10km x 10km | Wide-spread markers | 1. Attempt to generate path beyond limit | Validation error shown | Error shown accordingly. |
| TC-017 | Multi-waypoint route generation | More than 2 markers placed | 1. Place 3–5 points 2. Generate route | Path includes all markers in order | Path is in order. |
| TC-18 | Performance: Route generated under 5 seconds | Valid route setup | 1. Time 'Generate Route' | Response received in < 5s | Generation takes < 1 sec. |
| TC-019 | Correct stats for highest/lowest points | Path covers varying elevation | 1. Generate route 2. Open route stats | Correct values for high/low points | Highest point and lowest point height shown. |

## Route Management Test Cases

| Test Case ID | Description | Preconditions | Test Steps | Expected Result | Actual Result |
| --- | --- | --- | --- | --- | --- |
| TC-020 | Save new route | Route generated | 1. Click Save 2. Enter name 3. Confirm | Route is saved to DB | Route saved to DB under the user account. |
| TC-021 | Edit route and compare | Saved route exists | 1. Click Edit 2. Modify points 3. Save changes | New route shown with '(edited)' tag | Route edited successfully |
| TC-022 | Delete route with confirmation | Saved route exists | 1. Click delete icon 2. Confirm action | Route is removed | Route removed successfully. |
| TC-023 | Toggle favorite status | Saved route exists | 1. Click star icon | Favorite status toggles | Favorite toggled successfully. |

## Statistics & Visualization Test Cases

| Test Case ID | Description | Preconditions | Test Steps | Expected Result | Actual Result |
| --- | --- | --- | --- | --- | --- |
| TC-024 | View route statistics | Route displayed | 1. Open route detail popup | Distance, elevation stats are visible | Stats such as: Elevation gain, highest and lowest points, elevation loss are shown. |
| TC-025 | Statistics update in real-time | Markers are moved | 1. Drag markers 2. Regenerate route | Stats reflect new data | New data shown accordingly. |

## Download Functionality Test Cases

| Test Case ID | Description | Preconditions | Test Steps | Expected Result | Actual Result |
| --- | --- | --- | --- | --- | --- |
| TC-026 | Download route in GPX format | Route is saved | 1. Click Download 2. Select GPX | Valid GPX file is downloaded | Valid GPX downloaded. |
| TC-027 | Download route in JSON format | Route is saved | 1. Click Download 2. Select JSON | Valid JSON file is downloaded | Valid JSON downloaded. |

## Statistics & Visualization Test Cases (Additional)

| TC-028 | Add marker updates sidebar list | User on route creation page | 1. Click on map 2. View sidebar | New marker is listed updates sidebar stats | New data updates accordingly. |
| --- | --- | --- | --- | --- | --- |
| TC-029 | Prevent more than 5 markers | 5 markers already added | 1. Try to add 6th marker | Error: Max marker limit reached | Message: “Maximum 5 points allowed”. |
| TC-030 | Zoom map to fit all markers | Multiple markers added | 1. Click 'Fit to View' button | Map zooms to display all markers | No button exists. |
| TC-031 | Recalculate route after marker move | Route already generated | 1. Drag a marker 2. Observe route | Route updates with new path | New route calculated, old route vanishes, waiting for user to calculate new route. |
| TC-032 | Elevation data reflects marker height | At least one marker present | 1. Open elevation details | Correct elevation shown for each marker | Elevation data for highest point available. |

## Route Management Test Cases (Additional)

| Test Case ID | Description | Preconditions | Test Steps | Expected Result | Actual Result |
| --- | --- | --- | --- | --- | --- |
| TC-033 | Editing does not overwrite original route | Route saved in DB | 1. Edit and save route | New version marked as '(edited)' | New route created as “original (edited)” |
| TC-034 | Cannot save unnamed route | Route ready for save | 1. Leave name blank 2. Click save | Error: Route name required | “Update Route” button grays out. |
| TC-035 | Sorted route list prioritizes favorites | Multiple routes saved | 1. Favorite one 2. Check list | Favorite route appears first | Favorites appear first. |
| TC-036 | Delete confirmation dialog works | At least one saved route | 1. Click delete 2. Cancel | Route remains untouched | Route remains untouched. |
| TC-037 | Edit opens correct route on map | Route selected from list | 1. Click 'Edit' | Map loads selected route for editing | Map loads the correct edited route. |

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## Statistics & Visualization Test Cases (Additional)

| Test Case ID | Description | Preconditions | Test Steps | Expected Result | Actual Result |
| --- | --- | --- | --- | --- | --- |
| TC-038 | Elevation gain metric is correct | Route with climbs | 1. Generate route 2. View stats | Correct total elevation gain shown | Elevation gain shown. |
| TC-039 | Longest segment is identified | Multiple segments generated | 1. Open stats popup | Longest leg highlighted | No longest leg highlighted. |
| TC-040 | Route complexity metric shown | Nonlinear route generated | 1. Save route 2. Open stats | Complexity score is displayed | No complexity score shown. |
| TC-041 | Compare two route stats visually | Original and edited route saved | 1. Open stats for both | Side-by-side stats comparison shown | No comparison mechanic implemented. |

## Download Functionality Test Cases (Additional)

| Test Case ID | Description | Preconditions | Test Steps | Expected Result | Actual Result |
| --- | --- | --- | --- | --- | --- |
| TC-042 | Download fails if route is not saved | Route created but unsaved | 1. Click 'Download GPX' | Error: Route must be saved first | UI prevents this from happening. |
| TC-043 | GPX includes timestamps | Route has elevation/time metadata | 1. Download GPX 2. Open file | Timestamps present per point | No timestamps included. |
| TC-044 | JSON includes all marker types | Route with start, waypoints, end | 1. Download JSON | Marker types preserved in file | All markers are preserved in order. |
| TC-045 | Download button disabled offline | Internet disconnected | 1. Open saved route 2. Try download | Download buttons are disabled | Download is not available if disconnected from internet. |
| TC-046 | Download links auto-close on success | Route successfully downloaded | 1. Download format 2. Observe UI | Dropdown closes automatically | Dropdown closes automatically. |

## UI/UX & General Test Cases

| Test Case ID | Description | Preconditions | Test Steps | Expected Result | Actual Result |
| --- | --- | --- | --- | --- | --- |
| TC-047 | Burger menu opens on small screens | Mobile screen width | 1. Click hamburger icon | Sidebar menu expands | Menu expands accordingly. |
| TC-048 | App handles API 500 error gracefully | Backend throws error | 1. Try saving invalid route | UI shows friendly error message | Invalid route is throwing a UI friendly error. |
| TC-049 | Marker numbering resets on clear | Markers already added | 1. Clear route 2. Add marker | Marker starts again at 1 | Marker numbering resets. |
| TC-050 | Visual loading state during fetch | App fetching routes | 1. Load dashboard | Spinner/loader is shown | No loader shown. |
| TC-051 | Tooltip appears on hover over icons | User hovers over info icons | 1. Move cursor over icon | Tooltip with label appears | No info icons, all buttons are intuitive and user friendly. |

## UI/UX & General Test Cases

| Test Case ID | Description | Preconditions | Test Steps | Expected Result | Actual Result |
| --- | --- | --- | --- | --- | --- |
| TC-051 | Burger menu opens on small screens | Mobile screen width | 1. Click hamburger icon | Sidebar menu expands | Menu expands accordingly. |
| TC-052 | App handles API 500 error gracefully | Backend throws error | 1. Try saving invalid route | UI shows friendly error message | Invalid route is throwing a UI friendly error. |
| TC-053 | Marker numbering resets on clear | Markers already added | 1. Clear route 2. Add marker | Marker starts again at 1 | Marker numbering resets. |