# Work Breakdown Structure (WBS) - Atlanta FIFA Navigator (Revised v1.1)

This WBS is updated to reflect the Next.js/Vercel architecture for M2 and includes a critical performance spike in M4. Multilingual support has been moved to a dedicated M7.

| **ID** | **Task Description** | **Dependencies** | **Notes** |
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| **1.0** | **Milestone 1: Research APIs** | - | Objective: Validate technical feasibility and secure necessary access. |
| 1.1 | Secure API Credentials & Access | - | Obtain keys for Google Maps, MARTA, and ParkMobile Sandbox. |
| 1.2 | ParkMobile API Research Spike (R-3.3.3) | 1.1 | **Crucial:** Determine feasibility of in-app payment transactions. |
| 1.2.1 | Document parking discovery and pricing endpoints. | 1.2 |  |
| 1.2.2 | Document in-app payment / deep-link requirements based on spike outcome. | 1.2 | Finalizes R-3.3.3 outcome. |
| 1.3 | Review Google Maps SDK for Traffic (R-3.1.1) and Transit (R-3.1.2) layer support. | 1.1 |  |
| 1.4 | Review MARTA API documentation for Bus (R-3.2.2) and Rail (R-3.2.1) Real-Time data formats. | 1.1 |  |
| **2.0** | **Milestone 2: Data Architecture** | 1.0 | Objective: Build the secure, scalable backend foundation using Next.js/Vercel. |
| 2.1 | Initialize **Next.js/Vercel Environment** & Firebase Plugin Setup. | - | Environment setup leveraging Vercel's platform. |
| 2.2 | Implement Secure Proxy for MARTA APIs (Bus & Rail). | 1.4, 2.1 | Protects API keys and handles data rate limits. |
| 2.3 | Define and document core Data Model Schemas (Parking Zones, Transit Stops, ETA objects). | 1.2, 1.4 |  |
| 2.4 | Implement Caching Layer Strategy (R-4.3) for MARTA static data and API results. | 2.2, 2.3 | Improves performance and reliability. |
| 2.5 | Implement Initial Firebase Authentication Setup (Custom Token / Anonymous Sign-in). | 2.1 | Required for secure user data storage (future). |
| **3.0** | **Milestone 3: Proof of Concept: Google Maps APIs** | 2.0 | Objective: Validate map rendering and core navigation features. |
| 3.1 | Set up Mobile Application Project (Next.js/React Native wrapper). | - |  |
| 3.2 | Integrate Google Maps SDK and basic map rendering. | 1.3 |  |
| 3.3 | Implement Map Traffic Layer Overlay (R-3.1.1). | 1.3 |  |
| 3.4 | Implement Map Transit Layer Overlay (R-3.1.2). | 1.3 | Displays static MARTA routes. |
| 3.5 | Implement Basic Driving/Walking Route Planning (R-3.1.3). | 1.3 |  |
| 3.6 | **Unit Testing:** Write unit tests for map state management and route calculation helpers. | 3.5 | Ensures correctness of navigation logic. |
| **4.0** | **Milestone 4: Proof of Concept: MARTA APIs** | 3.0 | Objective: Integrate real-time transit data and evaluate bus tracking performance risk. |
| 4.1 | Integrate Real-Time Rail ETAs (R-3.2.1) via backend proxy. | 2.2, 3.2 | Show next arrival times for rail stations. |
| **4.2** | **Performance Spike: MARTA Bus Tracking & Cost Analysis.** | 2.2 | **Crucial:** Investigate API tools (e.g., filtering, throttling) and model Vercel/cloud infrastructure cost for high-frequency updates. |
| **4.3** | Implement Real-Time Bus Location Overlay (R-3.2.2) via backend proxy. | 4.1, **4.2**, 3.2 | Display moving bus icons on the map (conditional on 4.2 findings). |
| 4.4 | Implement Dynamic Route Update Logic (R-3.2.3) based on live MARTA data. | 4.1, 4.3 | Adjusts transit route estimates dynamically. |
| 4.5 | **Unit Testing:** Write unit tests for API response parsing, proxy error handling, and ETA calculation logic. | 4.4 | Focus on data accuracy and resilience. |
| **5.0** | **Milestone 5: Design Sprint based on POC Findings** | 4.0 | Objective: Translate POC into high-fidelity user experience. |
| 5.1 | Review POC 3.0 & 4.0 findings and identify UX challenges (e.g., data density). | 4.5 | Incorporate technical lessons learned. |
| 5.2 | Develop High-Fidelity Wireframes for all core flows (Navigation, Transit Search, Parking). | 5.1 |  |
| 5.3 | Create Visual Design System and High-Fidelity Mockups (R-3.4.1 Clear UI). | 5.2 | Finalize branding and aesthetics. |
| 5.4 | Stakeholder Review and Final Design Sign-off. | 5.3 | Approval from FIFA/Atlanta team. |
| **6.0** | **Milestone 6: Implement FE Designs** | 5.0 | Objective: Final feature implementation and polish. |
| 6.1 | Implement Core UI Shell and Navigation based on approved designs. | 5.4 |  |
| 6.2 | Refactor POC features (M3 & M4) using the new UI components. | 6.1 |  |
| 6.3 | Implement Parking Spot Discovery and Pricing UI (R-3.3.1, R-3.3.2). | 1.2.1, 6.1 |  |
| 6.4 | Implement Parking Payment Integration (R-3.3.4) or Deep-Linking (R-3.3.3 outcome). | 1.2.2, 6.3 |  |
| 6.5 | End-to-End Testing, Accessibility, and Performance Review (QA). | 6.4 |  |
| 6.6 | **Unit Testing:** Write comprehensive unit tests for all new UI components and interaction logic. | 6.5 | Final coverage sign-off. |
| **7.0** | **Milestone 7: Multilingual Support** | 6.0 | Objective: Implement comprehensive English/Spanish localization. |
| 7.1 | Finalize all required English and Spanish localized strings. | 5.4 | Requires translation file generation. |
| 7.2 | Implement Language Toggle and Content Localization (R-3.4.2). | 6.1, 7.1 | Enable switching between English and Spanish. |
| 7.3 | QA Pass on all translated content and language flow. | 7.2 | Verification of localization correctness. |