

Sustainable Tourism Management System

P3 - Logical ER Model

Submitted By: Group 11

Normalized Entities in 3NF

1. Destination

- **Attributes:** DestinationID (PK), Name, Country, Region, Climate, PeakSeason, OffSeason, AverageAnnualVisitors, SustainabilityScore, CarryingCapacity
- **Relationships:**
 - 1-to-Many with Accommodation
 - 1-to-Many with Attraction
 - 1-to-Many with Local_Business
 - 1-to-Many with Carrying_Capacity_Alert
 - M-to-M with Tourist (through a **Visits** junction table)
 - M-to-M with Tour_Operator (through an **Organizes** junction table)

2. Accommodation

- **Attributes:** AccommodationID (PK), DestinationID (FK), Name, Type, Capacity, SustainabilityRating, EnergyEfficiencyScore, WaterConservationScore, WasteManagementScore, LocalEmploymentPercentage
- **Relationships:**
 - Many-to-1 with Destination
 - M-to-M with Tourist (via **Stays_At**)
 - M-to-M with Tour_Operator (via **Partners_With**)
 - M-to-M with Sustainability_Certification
 - 1-to-Many with Environmental_Impact

3. Tourist

- **Attributes:** TouristID (PK), FirstName, LastName, Nationality, Age, Email, PreferredLanguage, SustainabilityPreference, CarbonOffsetParticipation
- **Relationships:**
 - M-to-M with Destination (via **Visits**)
 - M-to-M with Accommodation (via **Stays_At**)
 - M-to-M with Attraction (via **Visits_Attraction**)
 - M-to-M with Transportation_Provider (via **Uses**)
 - 1-to-Many with Visitor_Review
 - M-to-M with Educational_Content (via **Engages_With**)

4. **Tour_Operator**

- **Attributes:** OperatorID (PK), Name, Headquarters, SustainabilityCertification, LocalPartnershipPercentage, CarbonOffsetProgram, SustainablePackagesOffered
- **Relationships:**
 - M-to-M with Destination (via **Organizes**)
 - M-to-M with Accommodation (via **Partners_With**)
 - M-to-M with Transportation_Provider (via **Collaborates_With**)

5. **Attraction**

- **Attributes:** AttractionID (PK), DestinationID (FK), Name, Type, Capacity, AverageVisitDuration, PeakHours, SustainabilityMeasures, AccessibilityFeatures
- **Relationships:**
 - Many-to-1 with Destination
 - M-to-M with Tourist (via **Visits_Attraction**)
 - 1-to-1 with Cultural_Heritage_Site

6. **Transportation_Provider**

- **Attributes:** ProviderID (PK), Name, Type, SustainabilityScore, EmissionsPerPassengerKm, RenewableEnergyPercentage, AccessibilityFeatures
- **Relationships:**
 - M-to-M with Tourist (via **Uses**)
 - M-to-M with Tour_Operator (via **Collaborates_With**)

7. **Local_Business**

- **Attributes:** BusinessID (PK), DestinationID (FK), Name, Type, OwnershipType, EmployeeCount, SustainabilityPractices, LocalSourcedProductPercentage
- **Relationships:**
 - Many-to-1 with Destination
 - M-to-M with Economic_Impact

8. **Sustainability_Certification**

- **Attributes:** CertificationID (PK), Name, IssuingBody, ValidityPeriod, CriteriaDescription, AuditFrequency
- **Relationships:**
 - M-to-M with Accommodation
 - 1-to-Many with Sustainability_Metric

9. **Environmental_Impact**

- **Attributes:** EVTImpactID (PK), AccommodationID (FK), Date, CarbonEmissions, WaterConsumption, WasteGenerated, RecyclingRate, BiodiversityIndex
- **Relationships:**
 - Many-to-1 with Accommodation
 - M-to-M with Sustainability_Metric

10. Economic_Impact

- **Attributes:** ECOImpactID (PK), DestinationID (FK), Year, TourismRevenue, LocalEmploymentRate, AverageWageInTourism, LocalBusinessGrowthRate, EconomicLeakagePercentage
- **Relationships:**
 - Many-to-1 with Destination
 - M-to-M with Local_Business
 - M-to-M with Sustainability_Metric

11. Cultural_Heritage_Site

- **Attributes:** SiteID (PK), AttractionID (FK), Name, Type, YearEstablished, ProtectionStatus, VisitorManagementPlan, CulturalSignificance
- **Relationships:**
 - 1-to-1 with Attraction

12. Visitor_Review

- **Attributes:** ReviewID (PK), TouristID (FK), EntityReviewed, Rating, Comment, SustainabilityFeedback, DatePosted
- **Relationships:**
 - Many-to-1 with Tourist

13. Sustainability_Metric

- **Attributes:** MetricID (PK), Name, Description, Unit, BenchmarkValue, DataCollectionMethod, FrequencyOfMeasurement
- **Relationships:**
 - M-to-M with Sustainability_Certification
 - M-to-M with Environmental_Impact
 - M-to-M with Economic_Impact

14. Educational_Content

- **Attributes:** ContentID (PK), Title, Type, Topic, Language, TargetAudience, EngagementRate, LastUpdated
- **Relationships:**
 - M-to-M with Tourist (via **Engages_With**)

15. **Carrying_Capacity_Alert**

- **Attributes:** AlertID (PK), DestinationID (FK), Date, CurrentVisitorCount, ThresholdPercentage, AlertLevel, RecommendedActions
- **Relationships:**
 - Many-to-1 with Destination

Junction Tables for Many-to-Many Relationships / Associative Entities

1. **Visits** (TouristID, DestinationID)
2. **Stays_At** (TouristID, AccommodationID)
3. **Uses** (TouristID, ProviderID)
4. **Engages_With** (TouristID, ContentID)
5. **Organizes** (OperatorID, DestinationID)
6. **Partners_With** (OperatorID, AccommodationID)
7. **Collaborates_With** (OperatorID, ProviderID)
8. **Visits_Attraction** (TouristID, AttractionID)
9. **Accommodation_Certification** (AccommodationID, CertificationID)
10. **Business_Impact** (BusinessID, ImpactID)
11. **Environmental_Metric** (EVTImpactID, MetricID)
12. **Economic_Metric** (ECOImpactID, MetricID)
13. **Certification_Metric** (CertificationID, MetricID)

