

Group 11

Sustainable Tourism Management System

P3 - Logical ER Model

Normalized Entities in 3NF

1. Destination

- **Attributes:** DestinationID (PK), DestinationName, 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), AccommodationName, AccType, 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, DateofBirth, 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), OperatorName, 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), AttractionName, AttType, 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), ProviderName, TpType, 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), BusinessName, LcoBType, OwnershipType, EmployeeCount, SustainabilityPractices, LocalSourcedProductPercentage
- **Relationships:**
 - Many-to-1 with Destination
 - M-to-M with Economic_Impact

8. **Sustainability_Certification**

- **Attributes:** CertificationID (PK), CertificateName, 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), SiteName, SiteType, 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), MetricName, 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, EduType, 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(FK), DestinationID(FK), Visit_Timestamp
2. **Stays_At** - (TouristID(FK), AccommodationID(FK), Stay_Period
3. **Uses** - TouristID(FK), ProviderID(FK), Transportation_Duration
4. **Engages_With** - TouristID(FK), ContentID(FK), Education_Domain
5. **Organizes** - OperatorID(FK), DestinationID(FK), Number_of_Tourists
6. **Partners_With** - OperatorID(FK), AccommodationID(FK), Partnership_StartDate, Partnership_EndDate
7. **Collaborates_With** - OperatorID(FK), ProviderID(FK), Collaboration_StartDate, Collaboration_EndDate
8. **Visits_Attraction** - TouristID(FK), AttractionID(FK), Days_of_Visit
9. **Business_Impact** - BusinessID(FK) , ImpactID (FK), Revenue_Generated
10. **Economic_Metric** - Eco_ImpactID(FK) , MetricID(FK), Eco_Metric_Timestamp
11. **Environmental_Metric** - Evt_ImpactID(FK) , MetricID(FK), EVT_Metric_Timestamp
12. **Certificate_Metric** - CertificateId(FK), MetricID(FK), Compliance_Rating
13. **Accommodation_Certification** - AccommodationID(FK), CertificateID(FK), Certification_Grade

