

## 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, 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), 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, 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), ProviderName, 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), BusinessName, Type, 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, 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), 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, 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)

