

# Company Database Mapping & Implementation

## ER-to-Relational Mapping Steps Applied

1. **Step 1:** Mapping of Regular Entity Types (Strong Entities)
2. **Step 2:** Mapping of Weak Entity Types
3. **Step 3:** Mapping of 1:1 Relationships
4. **Step 4:** Mapping of 1:N Relationships
5. **Step 5:** Mapping of M:N Relationships

## Database Schema Tables

### DEPARTMENT TABLE

#### Step 1: Strong Entity Mapping

COLUMN NAME	DATA TYPE	CONSTRAINTS	DESCRIPTION
DNum	INT	PRIMARY KEY	Department Number (Unique Identifier)
DName	VARCHAR(50)	NOT NULL	Department Name
Manager_SSN	CHAR(11)	FOREIGN KEY → Employee(SSN)	Manager's Social Security Number
Manager_Hire_Date	DATE	NULL	Date when manager was hired for this department

### EMPLOYEE TABLE

#### Step 1: Strong Entity Mapping

COLUMN NAME	DATA TYPE	CONSTRAINTS	DESCRIPTION
SSN	CHAR(11)	PRIMARY KEY	Social Security Number (Unique Identifier)
Fname	VARCHAR(50)	NOT NULL	First Name
Lname	VARCHAR(50)	NOT NULL	Last Name
Birth_Date	DATE	NULL	Date of Birth
Gender	CHAR(1)	CHECK (Gender IN ('M', 'F'))	Gender (M/F)
Supervisor_SSN	CHAR(11)	FOREIGN KEY → Employee(SSN)	Supervisor's SSN (Self-referencing)
DNum	INT	FOREIGN KEY → Department(DNum), NOT NULL	Department Number (Total Participation)
Hire_Date	DATE	NULL	Date of Hiring

## PROJECT TABLE

### Step 1: Strong Entity Mapping

COLUMN NAME	DATA TYPE	CONSTRAINTS	DESCRIPTION
PNumber	INT	PRIMARY KEY	Project Number (Unique Identifier)
PName	VARCHAR(50)	NOT NULL	Project Name
Location	VARCHAR(100)	NULL	Project Location
City	VARCHAR(50)	NULL	Project City
DNum	INT	FOREIGN KEY → Department(DNum), NOT NULL	Controlling Department Number

## WORKS\_ON TABLE

### Step 5: M:N Relationship Mapping

COLUMN NAME	DATA TYPE	CONSTRAINTS	DESCRIPTION
Employee_SSN	CHAR(11)	PRIMARY KEY, FOREIGN KEY → Employee(SSN)	Employee's SSN (Composite PK)
PNumber	INT	PRIMARY KEY, FOREIGN KEY → Project(PNumber)	Project Number (Composite PK)
Hours	DECIMAL(5,2)	CHECK (Hours >= 0)	Hours worked on project

## DEPENDENT TABLE

### Step 2: Weak Entity Mapping

COLUMN NAME	DATA TYPE	CONSTRAINTS	DESCRIPTION
Employee_SSN	CHAR(11)	PRIMARY KEY, FOREIGN KEY → Employee(SSN)	Employee's SSN (Composite PK)
Dependent_Name	VARCHAR(50)	PRIMARY KEY	Dependent's Name (Composite PK)
Gender	CHAR(1)	CHECK (Gender IN ('M', 'F'))	Dependent's Gender
Birth_Date	DATE	NULL	Dependent's Date of Birth

## Relationship Mappings Applied

### Database Relationship Diagram

**DEPARTMENT (1) → (N) EMPLOYEE**

DNum → DNum (1:N - Employee works in Department)

**DEPARTMENT (1) ←→ (N) PROJECT**

DNum → DNum (1:N - Department controls Project)

**EMPLOYEE (1) ←→ (1) DEPARTMENT**

Manager\_SSN ← SSN (1:1 - Employee manages Department)

**EMPLOYEE (1) ↔ (N) EMPLOYEE**

Supervisor\_SSN ← SSN (1:N - Employee supervises Employee)

**EMPLOYEE (M) ↔ (N) PROJECT**

Through WORKS\_ON table (M:N - Employee works on Project)

**EMPLOYEE (1) ↔ (N) DEPENDENT**

Employee\_SSN → SSN (1:N - Employee has Dependents)

## Entity Relationship Diagram

**Legend:**

Strong Entity

Weak Entity

Relationship Table

= Primary Key

= Foreign Key

## 🔗 ER Diagram Relationships Explained

RELATIONSHIP	TYPE	DESCRIPTION	IMPLEMENTATION
Department → Employee (manages)	1:1	Each department has one manager	Manager_SSN in DEPARTMENT table
Department → Employee (employs)	1:N	Department has many employees	DNum in EMPLOYEE table (NOT NULL)
Department → Project	1:N	Department controls many projects	DNum in PROJECT table
Employee → Employee (supervises)	1:N	Employee supervises other employees	Supervisor_SSN in EMPLOYEE table
Employee ↔ Project	M:N	Employee works on multiple projects	WORKS_ON relationship table
Employee → Dependent	1:N	Employee has multiple dependents	Employee_SSN in DEPENDENT table

## Key Mapping Decisions Made:

- **Primary Keys:** All strong entities have simple primary keys as specified
- **Weak Entity (DEPENDENT):** Composite primary key includes Employee\_SSN + Dependent\_Name
- **M:N Relationship (WORKS\_ON):** New table created with composite primary key from both entities
- **1:N Relationships:** Foreign keys placed in the "many" side tables
- **1:1 Relationship:** Manager\_SSN placed in DEPARTMENT table (assuming fewer managers than departments)
- **Self-Referencing:** Supervisor\_SSN in EMPLOYEE table for employee supervision hierarchy
- **Participation Constraints:** DNum in EMPLOYEE is NOT NULL (total participation)

## Database Characteristics:

- **Tables Created:** 5 tables total
- **Strong Entities:** DEPARTMENT, EMPLOYEE, PROJECT
- **Weak Entity:** DEPENDENT
- **Relationship Table:** WORKS\_ON (M:N relationship)
- **Foreign Key Relationships:** 6 foreign key constraints
- **Referential Integrity:** All relationships properly constrained