# Relational Model

Changes Made to Accommodate Relational Model

- Addition of "Center Number" as partial primary key for REHAB CENTER entity, instead of having the multivalued partial primary key ACTIVITY TYPE.

- Instead of having STAFF participate in the MONITORS relationship, its subclass ADMIN OFFICER participates in it exclusively.

- Change shift timing to a single valued attribute from being a multivariate attribute

- Add attribute DUTY to STAFF in order to make subclass relationships possible in the schema
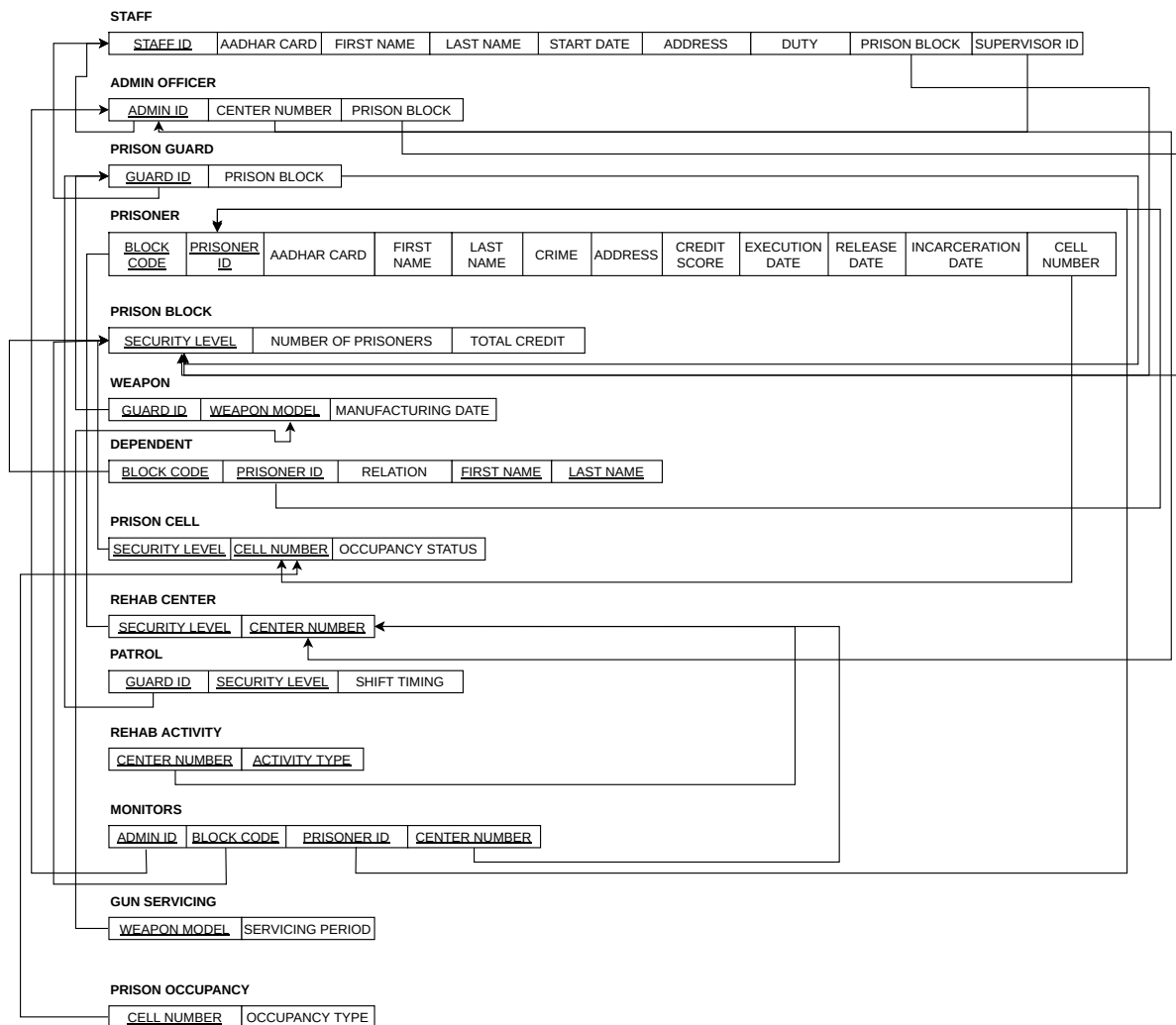
After mapping ER to Relational Diagram
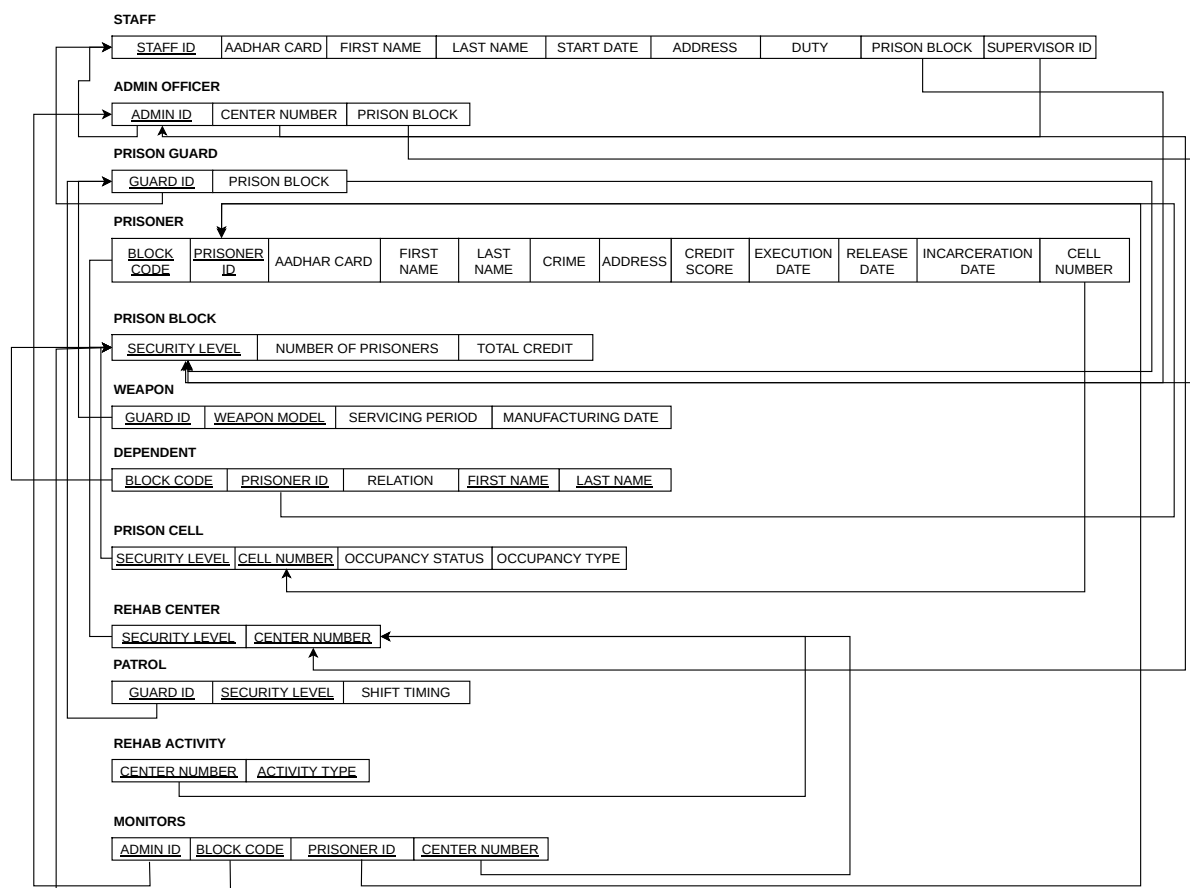
Explanation

- First, Mapped strong entity types STAFF, ADMIN OFFICER, PRISON GUARD, PRISONER and PRISON BLOCK to relations

- Mapped weak entity types WEAPON, DEPENDENT, PRISON CELL, REHAB CENTER to relations, adding the primary key of their identifying entity as a foreign key attribute in the table, and primary key of the weak entity relation being the combination of the partial primary key and the foreign key

- Mapped 1:N Binary Relations WORKS IN, SUPERVISES, LIVES IN using foreign key approach by adding columns PRISON BLOCK and SUPERVISOR ID in STAFF and CELL NUMBER in PRISONER respectively

- Mapped M:N Binary Relationship PATROLS to a new relation PATROL with the primary keys of both participating entities as the foreign keys, and jointly forming the primary key of this new table

- Mapped multivalued attribute: ACTIVITY TYPE of REHAB CENTER entity to a new relation REHAB ACTIVITY

- Mapped tertiary relationship MONITORS to a new relation MONITORS with primary keys of all participating entities as foreign key attributes, and the union of them forming the primary key for the new relation

Conversion to 1NF

The steps to convert to relationship schema implicitly convert the schema to a 1NF form, thus no extra conversions are required. Composite and multivalued attributes already do not exist because of the conversion algorithm

Conversion to 2NF

STAFF

STAFF ID	AADHAR CARD	FIRST NAME	LAST NAME	START DATE	ADDRESS	DUTY	PRISON BLOCK	SUPERVISOR ID

ADMIN OFFICER

ADMIN ID	CENTER NUMBER	PRISON BLOCK

PRISON GUARD

GUARD ID	PRISON BLOCK

PRISONER

BLOCK CODE	PRISONER ID	AADHAR CARD	FIRST NAME	LAST NAME	CRIME	ADDRESS	CREDIT SCORE	EXECUTION DATE	RELEASE DATE	INCARCERATION DATE	CELL NUMBER

PRISON BLOCK

SECURITY LEVEL	NUMBER OF PRISONERS	TOTAL CREDIT

WEAPON

GUARD ID	WEAPON MODEL	MANUFACTURING DATE

DEPENDENT

BLOCK CODE	PRISONER ID	RELATION	FIRST NAME	LAST NAME

PRISON CELL

SECURITY LEVEL	CELL NUMBER	OCCUPANCY STATUS

REHAB CENTER

SECURITY LEVEL	CENTER NUMBER

PATROL

GUARD ID	SECURITY LEVEL	SHIFT TIMING

REHAB ACTIVITY

CENTER NUMBER	ACTIVITY TYPE

MONITORS

ADMIN ID	BLOCK CODE	PRISONER ID	CENTER NUMBER

GUN SERVICING

WEAPON MODEL	SERVICING PERIOD

PRISON OCCUPANCY

CELL NUMBER	OCCUPANCY TYPE

- We observe that the attribute OCCUPANCY TYPE of PRISON CELL depends only on the CELL NUMBER and not the entire primary key {SECURITY LEVEL, CELL NUMBER}. Thus, it is partially functionally dependent on the primary key. To abide by the 2NF rules, we create a new relation PRISON OCCUPANCY with CELL NUMBER as primary key and OCCUPANCY TYPE as non key attribute.

- Similarly, we observe that the attribute SERVICING PERIOD of WEAPON depends only on the MODEL and not the entire primary key {GUARD ID, MODEL}. Thus, it is partially functionally dependent on the primary key. To abide by the 2NF rules, we create a new relation GUN SERVICING with MODEL as primary key and SERVICING PERIOD as non key attribute.

Conversion to 3NF

Since our relational schema does not contain transitive dependancies in any relation, our schema obeys 3NF already, hence no conversion is needed.