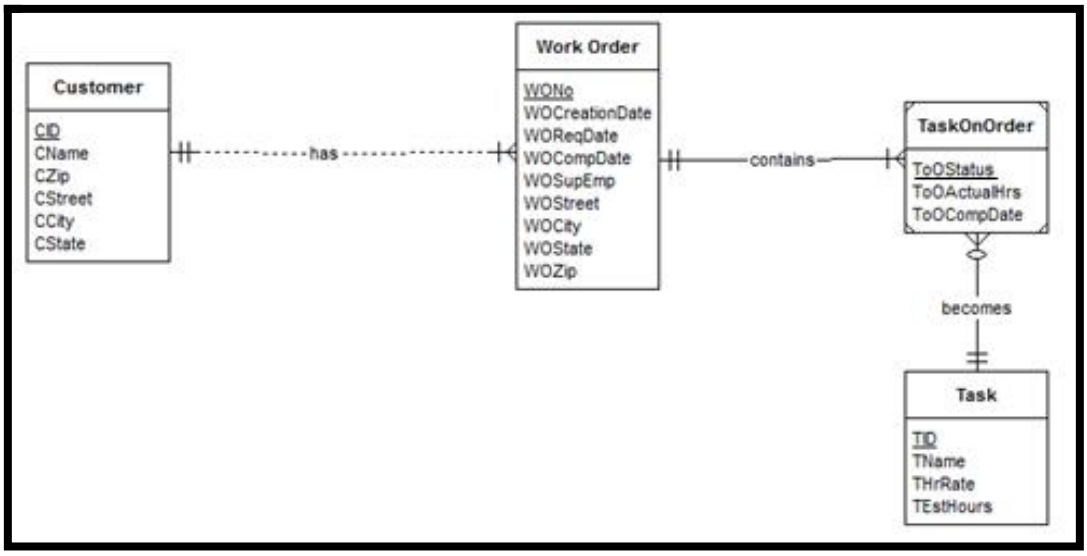
Initial ERD



The *Customer*, *Work Order* and *Task* entity types follow directly from the narrative. The narrative statement also indicates the attributes and the primary keys for each of these entity types.

The difficult part of the narrative involves the relationship between *Task* and *Work Order*. The problem narrative indicates that a *Work Order* has a set of tasks and each *Task* can be performed on many work orders so an M-N relationship is necessary. Also, the minimum cardinalities have not been specified in the narrative clearly, but it states that each *Work Order* has many tasks so the minimum cardinality has been assumed as 1 and it states that tasks are standardized so the minimum cardinality has been chosen as 0, since standardized tasks may or may not be assigned.

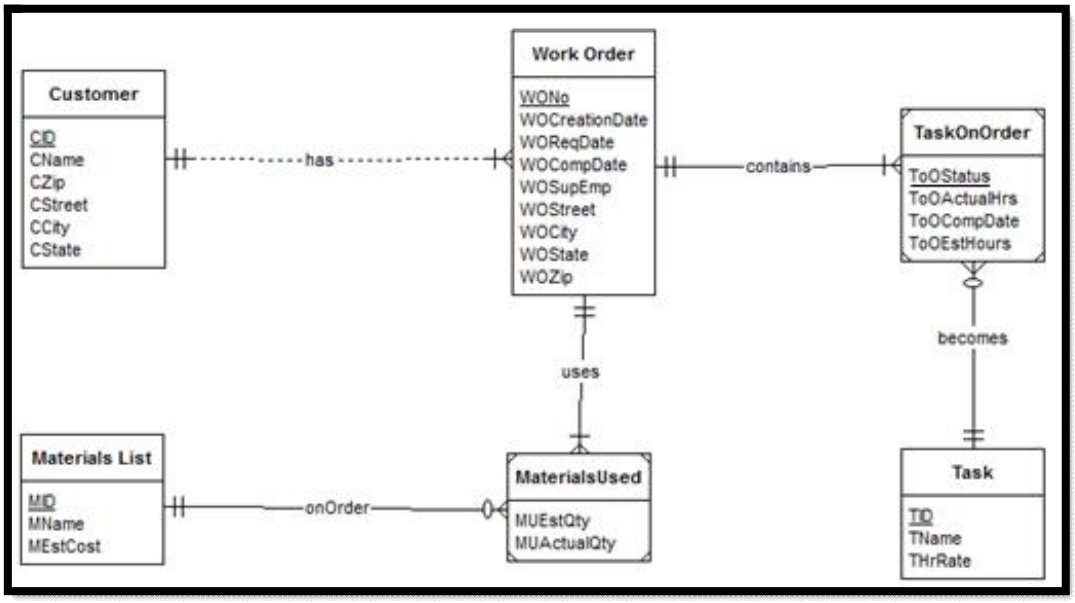
Also, the narrative indicates that each task on a work order has a status (not started, in progress, or completed), actual hours, and a completion date. Thus, the solution ERD uses an associative entity type (*TaskOnOrder*) in which the primary key is a combination of *WONo, ToOStatus* and *TID*.

The M side of the 1-M relationship between *Work Order* and *Customer* follows from the narrative with the *Customer* having a collection of work orders. The one side of the 1-M relationship follows from a *Work Order* having a customer. The minimum cardinalities are not specified in the narrative so additional requirements collection is necessary and have been taken to be 1 in this case.

Revised ERD

Transformations:

- Add an entity type (*Materials List*) so that the company can maintain a list of materials.
- Add an entity type for *MaterialsUsed*.
- As the narrative states that the estimated number of hours for a task depends on the work order and task, not on the task alone. So, *ToOEstHours* is added to *TaskOnOrder* and *TestHours* is removed from *Task* entity.



The *Materials List* entity has been added because the narrative indicates that the company wants to store a list of materials. The primary key and the attributes are clearly stated in the problem statement.

The problem narrative indicates that a *Material* can appear on multiple work orders and each *Work Order* uses a collection of materials so an M-N relationship is necessary. Also, the minimum cardinalities for *Materials List* and *Work Order* have not been specified in the narrative so the minimum cardinality has been assumed as 0 and 1, additional requirements collection may be necessary.

Also, the narrative indicates that each work order uses a collection of materials and a material used on a work order includes the estimated quantity of the material and the actual quantity of the material used. Thus, the solution ERD uses an associative entity type (*MaterialsUsed*) in which the primary key is a combination of *WONo* and *MID*.