1. Logical Data Design

Introduction:
The focus of logical data design is development of a Logical Data Model. This model represents CMS data within the scope of a system development project and shows the specific entities, attributes, and relationships involved in a business function's view of information.

NOTE: There are references within this section that refer the reader to the Operating Procedures and Guidelines section. Please download the Operating Procedures and Guidelines section to view these references.

The Logical Data Design process diagram depicts the milestones, control points, and deliverables as they occur during the following steps:
- Initiate Data Design Services
- Assess Data Design Needs
- Start the Project Logical Data Model from the EDM
- Extend the Project Logical Data Model
- Assign Data Information Security Categories
- Generate the Project Metadata Repository
- Validate and Approve the Project Logical Data Model
- Complete the Project Logical Data Model

Additional activities related to logical data design are:
- Logical Data Design considerations for Physical Data Design
- Reverse Engineering a Logical Data Model from a Physical Source

Logical data design tasks are performed in the *Requirements Analysis Phase* and the *Design & Engineering Phase* of the CMS *System Development Life Cycle (SDLC)* as indicated in the *CMS Integrated IT Investment & System Life Cycle Framework*, which is available on the CMS Intranet.   The same logical data design tasks are also required in alternative development methods.
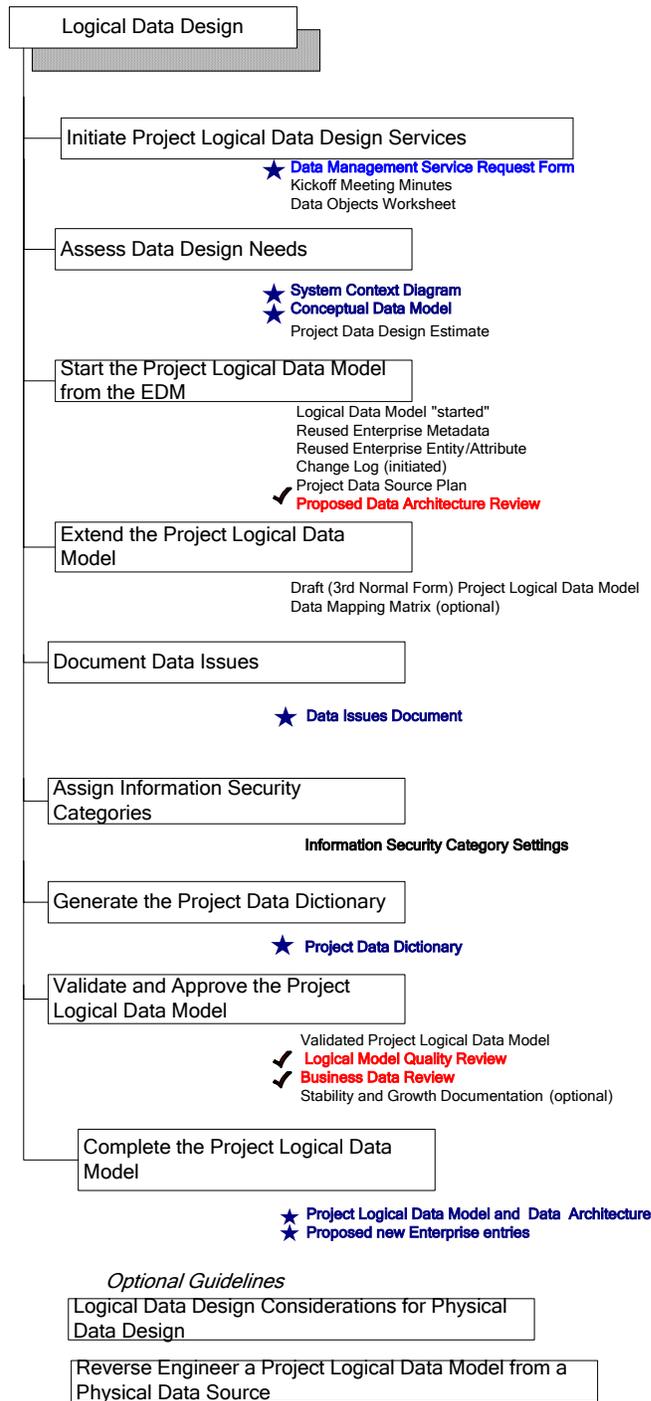
Key Deliverables:
The *Logical Data Design* process creates the following deliverables:
- Data Design Estimate,
- Conceptual Data Model,
- System Context Diagram,
- Project Metadata Repository,
- Data Issue Documents (where applicable),
- Logical Data Model,
- Data Architecture for Repository Update, and
- Proposed New EDM entries

Exhibit 1. Logical Data Design process diagram

Logical Data Design Process

Logical Data Design

Initiate Project Logical Data Design Services

★ Data Management Service Request Form
Kickoff Meeting Minutes
Data Objects Worksheet

Assess Data Design Needs

★ System Context Diagram
★ Conceptual Data Model
Project Data Design Estimate

Start the Project Logical Data Model from the EDM

Logical Data Model "started"
Reused Enterprise Metadata
Reused Enterprise Entity/Attribute
Change Log (initiated)
Project Data Source Plan
✓ Proposed Data Architecture Review

Extend the Project Logical Data Model

Draft (3rd Normal Form) Project Logical Data Model
Data Mapping Matrix (optional)

Document Data Issues

★ Data Issues Document

Assign Information Security Categories

Information Security Category Settings

Generate the Project Data Dictionary

★ Project Data Dictionary

Validate and Approve the Project Logical Data Model

Validated Project Logical Data Model
✓ Logical Model Quality Review
✓ Business Data Review
Stability and Growth Documentation (optional)

Complete the Project Logical Data Model

★ Project Logical Data Model and Data Architecture
★ Proposed new Enterprise entries

Optional Guidelines

Logical Data Design Considerations for Physical Data Design

Reverse Engineer a Project Logical Data Model from a Physical Data Source

★ *Controlled Artifact / Deliverable*   ✓ *Logical Data Model Control Point*

1.1. Initiate Data Design Services

Introduction:
This process step supports the gathering of baseline project information so that the appropriate level of data design service resources is assigned.

The following processes depict the participant roles, milestones, control points, and deliverables occur during data service request activities:

- Assign Data Design Resources
    - DM G-001 Guideline for Assigning Data Analysts
- Conduct the Logical Data Design Kick-Off Meeting
    - DM G-002 Operational Guideline for Conducting the Logical Data Design Kick-Off Meeting

Deliverable(s):
- Kickoff Meeting Minutes
- Data Objects Worksheet (if business requirements are not provided)
- Data Service Request Form

1.1.1 Assign Data Design Resources

Data Services Manager	A. Receive a completed *Data Service Request Form*, indicating a need for logical data design services.
Project Manager, Data Services Manager	B. Collaborate to assign the appropriate initial *Project Data Analyst* resource according to guidelines in DM G-001 Guideline for Assigning Data Analysts

1.1.2 Conduct the Logical Data Design Kick-Off Meeting

Project Data Analyst	C. Briefly research the project goals and object classes; and locate any existing data design artifacts e.g. previous versions of the Project Logical Data Model and relevant EDM definitions. The objective is to be somewhat familiar with the project's business concern prior to the kick-off meeting.
Project Data Analyst	D. Arrange and conduct a kick-off meeting in accordance with DM G-002 Guideline for Conducting the Logical Data Design Kickoff Meeting.

Project Manager, System Developer Team, Project Data Analyst, Business Owner/Partner, (optional invitee)Database Administrator	E. Participate in the data design kick-off meeting.
Project Manager, Business Owner/Partner	F. Provide the project's *business requirements* to the project data analyst. If formal *business requirements* are not available, provide the project data analysts with a spreadsheet that identifies and describes the entities that are of interest to the project.

1.2. Assess Data Design Need

Introduction:
The purpose of this process step is to analyze the project's data design requirements; and to estimate the data service resources needed to do the work.

The objectives of the analysis activities are to:
1.) Understand enough about the project in order to communicate the project's business purpose and anticipated benefits; and
2.) Propose and gain approval for the use of existing data sources, where appropriate.

The objectives of the estimation activities are to:
1.) Make a preliminary assessment of the level of data design service needed;
2.) Obtain the *Project Sponsor*'s approval of the preliminary assessment of data requirements, and approval of data services work estimate; and
3.) Establish the coordination of data design services with business process analysis and the respective roles of data analysts and business owners.

The following processes depict the participant roles, milestones, control points, and deliverables occur during an assessment of data needs:

- Create the System Context Diagram
  - DM OP-002 Operating Procedure for Identifying System Interfaces
- Create the Conceptual Data Model
  - DM OP-003 Operating Procedure for Developing the Conceptual Data Model
- Size and Estimate Data Analysis and Design
  - DM OP-004 Operating Procedure for Estimating Data Management Service Needs
- Authorize Data Management Services
  - DM G-003 Guideline for Monitoring Schedule and Cost of Data Services

Deliverable(s):
- System Context Diagram
- Conceptual Data Model
- Project Data Design Estimate

1.2.1 Create the System Context Diagram

Project Data Analyst   A. Identify existing or proposed *system interfaces* to the target project system in order to analyze the inputs, outputs, controls, and mechanisms involved in the business enterprise. Then, document the prospective high level data flow between system interfaces using a *System Context Diagram.* See DM OP-002 Guideline for Identifying System Interfaces.

1.2.2 Create the Conceptual Data Model

The purpose of creating the Conceptual Data Model is to understand the project's data entity needs and data boundaries.

Project Data Analyst	A.	Identify the principal entities and relationships needed to satisfy the project's business requirements and document them in a *Conceptual Data Model.* These entities will be based on the EDM, information provided in the project's business requirement documentation or obtained through interacting with a Business Analyst if a *Requirements* or a *System Design Document* are not available.
		See DM OP-003 Operating Procedure for Developing the Conceptual Data Model.
Project Data Analyst	B.	The Conceptual Data Model is to be documented according to the standard described in Data modeling tool standard for Creating Conceptual Data Models.
Project Data Analyst	C.	Save a dated copy of the Conceptual Data Model in case it is needed for later reference in the course of project activities.

1.2.3 Estimate Data Design Needs

Project Data Analyst	A.	Based on the Conceptual Data Model, perform a brief inventory of existing data stores to determine which entities are available from the EDM or alternative physical data sources. Then gauge the additional work necessary to create the remaining data artifacts needed to satisfy project needs. Document this information as the *description of the work to be done*. Note: Use of existing data stores requires approval from the Data Architect and business area Data Steward. For more information about the approval process see Reuse Enterprise Entities and Attributes.
Project Data Analyst	B.	Estimate the time and effort necessary to complete the project's logical data modeling work.
		Document the results as the *Project Data Design Estimate*. See DM OP-004 Operating Procedure for Estimating Data Management Service Needs.

Project Data Analyst	C. Forward the *System Context Diagram, Conceptual Data Model,* and *Project Data Design Estimate* to the Data Services Manager and arrange a *Data Design Service Level Meeting* to discuss the data analysis and design recommendations and direction.

1.2.4 Authorize Data Management Services

Project Sponsor, Project Manager	A. Obtain the information necessary to approve the baseline *Project Data Design Estimate,* showing schedule and cost. Approval from the *Project Sponsor* and *Project Manager* is required before additional data services work can be performed.
Project Data Analyst	B. After the project's *Project Data Design Estimate* has been approved, request a *Data Design Service Level Meeting* to review and negotiate the proposed estimate and schedule.
Data Services Manager, Project Manager, Project Data Analyst	C. Participate in the *Data Design Service Level Meeting* to confirm the *Project Data Design Estimate* and negotiate service level commitments.
Data Services Manager, Project Manager, Project Data Analyst	D. Monitor the *Project Data Design Estimate* throughout the project effort and report any projected schedule overrun as soon as possible to the Project and Data Services Managers along with a justification for a specified schedule change. The *Data Services Manager* will seek alternatives to meet the project's schedule and, when necessary, negotiate a schedule revision with the Project Manager. See DM G-003 Guidelines for Monitoring Schedule and Cost of Data Services.

1.3. Start the Project Logical Data Model from the EDM

Introduction:

The purpose of this process step is to describe the activities needed to "start" the Project Logical Data Model. The activities describe steps to enter model properties, locate reusable entities and attributes, understand the impact of sharing existing data resources, and obtain approval on the planned project data architecture.

The following processes depict the participant roles, milestones, control points, and deliverables occur when starting a logical data model:

- Set up the Project Logical Data Model
  - DM OP-005 Operating Procedure for Developing the Logical Data Model
- Reuse Enterprise Entities, Relationships, and Attributes
  - DM OP-006 Operating Procedure for Reuse of Enterprise Entities, Relationships, and Attributes
- Develop Project Data Source Plan
  - DM OP-007 Operating Procedure for Reuse of Enterprise Data Resources
- Review the Project Data Architecture
  - DM G-007 Guideline for Conducting the Data Architecture Review

Deliverables:
- Logical Data Model "started"
- Reused Enterprise Entity/Attribute Change Log (initiated)
- Project Data Source Plan

1.3.1 Set up the Project Logical Data Model

Project Data Analyst	A.	All projects that require new or changed data structures must create or update a *Logical Data Model* to represent the project data needs. See DM OP-005 Operating Procedure for Developing the Logical Data Model
	B.	If the model is being created for an existing system, search the model libraries for a prior approved version of the respective project *Logical Data Model.* When a prior version is available, use it as the starting baseline model. When a logical data model for an existing application system is not available or is outdated, use the automatic reverse engineering and comparison functions in the standard data-modeling tool to create a physical data model that reflects the current state of the project system's existing data structures.

Project Data Analyst	C. If no prior version of the logical data model exists, a new model must be created. A standard data model template is available in Model Manager and can be copied to start a new data model. It contains the CMS preferred settings and standard reports. Access to the template and instructions for its use is described in [Data Modeling Tool Standard for Creating Logical Data Models](#).
Project Data Analyst	D. Once you have your project logical data model at hand, enter (or confirm the accuracy of previously entered) *model properties,* including the model name, author, and a brief definition of the logical data model according to instructions in the standard data modeling tool.

1.3.2 Reuse Enterprise Entities, Relationships, and Attributes

Project Data Analyst	A. Retrieve the project's Conceptual Data Model (CDM). (The Conceptual Data Model entity level construction process is described in [Assess Data Design Needs](#).) At this point, the CDM should show the major entities that the project needs.
Project Data Analyst	B. Begin *entity* development in the Project Logical Data Model by comparing the *needed entities* in the CDM with the *existing entities* in the EDM to identify candidate reusable entities. See [DM OP-006 Operating Procedure for Reuse of Enterprise Entities, Relationships, and Attributes](#).
Project Data Analyst	C. Based on the identified data needs, select appropriate candidate entities, attributes, and relationship types from the EDM, using the copy facilities in the standard data modeling tool.
Project Data Analyst	D. Initiate a log, *Reused Enterprise Entity/Relationship/Attribute Change Log*, to record changes made to any reused entities, relationships, and attributes. This log should be maintained throughout the project's life cycle. It will be used by the Data Architect to adjust the EDM.

1.3.3 Develop Project Data Source Plan

Project Data Analyst

A. Prepare a project *Data Source Plan* that identifies existing or new data sources to satisfy the project's business requirements, and indicates limitations and constraints of proposed sources. See DM OP-007 Operating Procedure for Reuse of Enterprise Data Resources.

1.3.4 Review the Project Data Architecture

Project Data Analyst

B. Arrange a *Data Architecture Review* with the appropriate Data Architect and respective Data Steward(s). Arrange and conduct the review meeting in accordance with DM G-007 Guideline for Conducting the Data Architecture Review.

Major IT projects require a formal review of the proposed data architecture. It is important to schedule a formal review of the project data architecture as early in the modeling process as possible.

Data Steward,
Business Owner/Partner,
Data Architect,
Project Data Analyst

C. Participate in the *Data Architecture Review* for the goal of negotiation of appropriate project data sources and confirmation of requirements for new entities.

Data Architect

D. Consider the agency's data management objectives, and IT standards, and data dissemination regulations, when approving the project's overall Data Architecture and *Data Source Plan.*

1.4. Extend the Project Logical Data Model

Introduction:
The purpose of this process step is to add new entities and attributes that are not available from the EDM.

The processes listed below depict the participant roles, milestones, control points, and deliverables occur during logical data modeling activities. Refer to the section Data Modeling tool standard for Creating Project Logical Data Models for tool specific details.

- Create New Entities
  - DM OP-008 Operating Procedure for Defining Data Entities
  - DM OP-009 Operating Procedure for Naming Data Entities
- Create New Attributes
  - DM OP-010 Operating Procedure for Defining Data Attributes
  - DM OP-011 Operating Procedure for Analyzing Data Attribute Types
  - DM G-004 Guideline for Designating Representation Term and Data Type
  - DM G-006 Standard for Assigning Date Formats
  - DM OP-012 Operating Procedure for Naming Data Attributes
- Model Derived Data
  - DM OP-013 Operating Procedure for Modeling Derived Data
- Identify and Model Supertypes and Subtypes
  - DM G-019 Guideline for Modeling Supertypes and Subtypes
- Define Relationships
  - DM OP-015 Operating Procedure for Defining Relationships, Cardinality, and Optionality
- Determine Primary Identifiers
  - DM OP-016 Operating Procedure for Assigning a Primary Identifier
- Normalize the Project Logical Data Model
  - DM OP-017 Operating Procedure for Normalizing the Project Logical Data Model
- Define Domain Value Rules
  - DM OP-018 Operating Procedure for Assigning Domain Value Rules in the Project Logical Data Model
- Check Completeness of Project Logical Data Model
  - DM G-008 Guideline for Mapping Data Attribute Sources
  - DM OP-019 Operating Procedure for Checking Completeness of a Project Logical Data Model

Deliverables:
- Draft (3rd Normal Form) Project Logical Data Model
- Data Mapping Matrix (optional)

1.4.1 Create New Entities

Project Data Analyst   A.   Look in the EDM before creating a new entity. If the needed entity is in the EDM, copy it and it's attributes into your logical data model.
Entities may also be copied from an alternate approved source. This might be an option when the EDM for the business area is still being developed and a legacy data source is readily available. Such sources might have quality and architectural problems. Therefore, the project's use of alternative sources must be approved by the appropriate Data Architect and Data Steward.

Project Data Analyst   B.   Define new entities following policies for creation of well-formed definitions in DM OP-008 Operating Procedure for Defining Data Entities.

Project Data Analyst   C.   Before naming new entities, it would be helpful to have a list of approved business *Standard Terms* on hand. This information is available in the Standard Terms and Abbreviations List. The *Standard and Abbreviations Terms List* is available from the Standards Terms page (accessible from the Data Administration home web page).   If a needed term is not on the list, follow the procedure outlined on the Standard Terms page.

Project Data Analyst   D.   Assign meaningful entity names in familiar business terms according to DM OP-009 Operating Procedure for Naming Data Entities. The objective of naming standards is to foster a common reference of CMS data.
A shortened version of the naming procedure is available as a quick reference in DM OP-009-QR Quick Reference for Naming Data Entities.

Project Data Analyst   E.   The Project Data Analyst is responsible for assigning the "first cut" physical data names. Assign the physical names in the counterpart physical data model, following the rules outlined in Assign a Table or File Name

1.4.2 Create New Attributes

Project Data Analyst   A.   Identify candidate attributes not found in the EDM. These are the new attributes (facts) needed in one of the project entities.

Project Data Analyst   B. Define the new attribute. The definition of a new attribute shall comply with the Operating Procedure described in [DM OP-010 Operating Procedure for Defining Data Attributes](#).

The above procedure is compliant with a prerequisite standard *ISO IEC 11179-4 Rules and guidelines for the formulation of data definitions*.

Project Data Analyst   F. Before you create new attributes, it would be helpful to have a list of approved business *Standard Terms* on hand. This information is available in the Standard Terms and Abbreviations List. The *Standard and Abbreviations Terms List* is available from the Standards Terms page (accessible from the Data Administration home web page).   If a needed term is not on the list, follow the procedure outlined on the Standard Terms page.

Project Data Analyst C. The other factors to consider when creating a new attribute require data analysis. The purpose of that analysis is to classify new attributes into one of the following categories.

Attribute type	*Definition*	*Example*	*Description*
Prime / Atomic	A basic business fact	Department	Basic information about a business
Derived	A value that can be formulated using values from other attributes.	Invoice Total	Computed from the sum of invoice lines.
Cohesive	Attributes that are usually processed together for business meaning	Employee First Name and Employee Last Name	Neither is very meaningful without the other.
Transaction / Interface	Interface Data	Activity Data	Business required data exchange
Physical Control Data	A system fact used internally to facilitate transactions	Record Count	Processing Data

See DM OP-011 Operating Procedure for Analyzing Data Attributes Types for methods that can improve how the attributes types are best modeled.

Note that **Physical control data**, such as "next record number", are not included in the logical data model. For information on how to model such system data, see Model System Control Data.

Project Data Analyst D. Determine the types of data values that the attribute will eventually represent. Then, identify the appropriate data type for each new attribute. See DM G-004 Guidelines for Designating Representation Term and Data Type

| | | Project Data Analyst | E. | Assign each new attribute a business name of the following structure: |

Project Data Analyst

E. Assign each new attribute a business name of the following structure:

Position	Component	M/O
1	Object Class Term (Prime Word)	One mandatory *Object Class Term*
2	Qualifier Term, Property Term (Modifier Word)	One or more optional *Qualifier* and/or *Property Terms*
3	Representation Term (Class Word)	One mandatory *Representation Term*.

Project Data Analyst

F. Verify that the new attribute name is compliant using the full Operating Procedure for naming attributes DM OP-012 Operating Procedure for Naming Data Attributes or the quick reference DM OP-012-QR Quick Reference for Naming Data Attributes.

The objective of naming standards is to foster a common reference of CMS data.

The above procedure is compliant with a prerequisite standard *ISO IEC 11179-5 Naming and identification principles for data elements.*

Project Data Analyst

G. Apply the following information to each new attribute:
- optionality
- length
- data type
- security category

Project Data Analyst

H. Attributes that represent dates must follow the rules outlined in DM G-006 Standard for Assigning Date Formats.

Project Data Analyst

I. Consult with the *Project Database Administrator* to confirm the likely DBMS platform for implementation in order to stay in compliance with physical data name length limitations.

Project Data Analyst

J. The Project Data Analyst is responsible for assigning the "first cut" physical data names. Assign the physical names in the counterpart physical data model, following the rules outlined in Assign a Column or Element Name.

Project Data Analyst	K. Consider long-term management for electronic records when adding new attributes to record types. Appropriate classification of data types will facilitate easier archival for those records with federal archival mandates.

1.4.3 Model Derived Data

Project Data Analyst	A. A derived attribute represents a value that can be formulated from other factors. Analyze the pros and cons of including each derived attribute in the logical data model. Follow the guidelines cited in DM OP-013 Operating Procedure for Modeling Derived Data.

1.4.4 Identify and Model Supertypes and Subtypes

Project Data Analyst	A. Some entities are related through their roles. For example, the *supertype* "Organization" could include the *subtype*s for "Organization for Profit" and "Organization as Non-Profit". Analyze any project entities that show similar roles relationships for common characteristics.
Project Data Analyst	B. When common attributes are identified, create a supertype.
Project Data Analyst	C. Follow the guidelines on the identification and creation of supertypes and subtypes in DM G-019 Guideline for Modeling Supertypes and Subtypes.
Project Data Analyst	D. Create a name for the supertype that describes all member subtypes.
Project Data Analyst	E. Place the attributes common to all subtypes in the supertype.
Project Data Analyst	F. Review similar entities with similar attributes for common characteristics.

1.4.5 Define Relationships

Project Data Analyst	A. Review the functional business rules controlling entity relationships.
Project Data Analyst	B. Ensure that all relationship standards are met to model a valid relationship. See [DM OP-015 Operating Procedure for Defining Relationships, Cardinality, and Optionality.](#)
Project Data Analyst	C. The IDEF1x standard dictates that when a single attribute is migrated to an entity to express two separate relationships, the attribute must be unified in the child entity. The result is a single attribute migrated through two relationships. To avoid unification, use *rolenames* to distinguish the migrated attributes. This will clarify the distinct relationships in the model. Include the appropriate definitions, cardinalities, and optionality for each *rolename* relationship.
Project Data Analyst	D. Label entity relationships in the Project Logical Data Model with verb phrases and relationship names.
Project Data Analyst	E. Determine and document the cardinality of each relationship, based on business rules in the functional data requirements.

1.4.6 Determine Primary Identifiers

Project Data Analyst	A. The purpose of the *Primary Identifier* is to distinguish one instance of an entity from another instance. Determine the Primary Identifier for each new entity following the criteria in [DM OP-016 Operating Procedure for Assigning a Primary Identifier](#).

1.4.7 Normalize the Project Logical Data Model

Project Data Analyst	A. Normalize the LDM, in order to represent data in a stable format. See the normalization criteria described in [DM OP-017 Operating Procedure for Normalizing the Project Logical Data Model.](#)
Project Data Analyst	B. Organize an entity into *first normal form* by moving repeating or multi-valued attributes to a separate entity. Assign a *primary identifier* to each new entity.
Project Data Analyst	C. Organize an entity into *second normal form* by removing attributes that are not dependent on the primary identifier to a separate entity.
Project Data Analyst	D. Organize an entity into *third normal form* by removing transitive relationships. That is, an attribute should be dependent only on the primary identifier and not on another non-identifier attribute. Then ensure that data exists in only one place.
Project Data Analyst	E. Consider further normalization to fourth normal form and fifth normal form when it is beneficial to do so.

1.4.8 Define Domain Value Rules

Project Data Analyst	A. Document the attribute business valid value rules where the business operation requires adherence to a discrete set of permissible data values. Record the business data value rules in the logical model by following [DM OP-018 Operating Procedure for Assigning Domain Value Rules to Attributes](#). For additional instructions on documenting valid domain value rules in the data modeling tool, see [Modeling tool standard for Creating Project Logical Data Models](#).
Project Data Analyst	B. Related information describing the use of *reference tables* (also called *look up tables* or *constants*) is available in [DM G-017 Guidelines for Reference Tables](#).

Project Data Analyst   C. The management of domain values through database management system features (e.g. *referential integrity or check constraints*) is ultimately decided in the *Physical Data Modeling* by the *Database Administrator.* See [DM G-018 Guidelines for Managing Data Values through Physical Constraints](#).

1.4.9 Check Completeness of the Project Logical Data Model

Project Data Analyst   A. Verify that the logical model meets business needs by mapping the data sources for each project data attribute. See [DM G-008 Guideline for Mapping Data Requirement Sources](#)

Project Data Analyst   B. Verify completeness of the logical model using the criteria in [DM OP-019 Operating Procedure for Checking Completeness of a Project Logical Data Model.](#)

1.5. Assign Information Security Categories

Introduction:
This process step provides direction for complying with Title III of the E-Government Act, titled the Federal Information Security Management Act (*FISMA*). *FISMA* requires federal organizations to develop, document, and implement an organization-wide program to provide information security for the information systems that support its operation and assets.

The following processes depict the participant roles, milestones, control points, and deliverables that occur during assignment of information security categories:

- Assign Information Security Categories
  - DM OP-021 Operating Procedure for Assigning Information Security Categories

Deliverable(s):
- Information Security Category Settings

1.5.1 Assign Information Security Categories

Project Data Analyst, *Data Steward*	A.	Analyze the security categories for the Project Logical Model entities and attributes using standards and guidelines in DM OP-021 Operating Procedure for Assigning Information Security Categories.
		This procedure supports the federal requirements outlined in *FIPS Publication 199 – Standards for Security Categorization of Federal Information and Information Systems.*
Project Data Analyst	B.	Document the security and levels of impact (low, moderate, and high) in the Project Logical Data Model following the format in Data Modeling tool standard for Creating Project Logical Data Models.

1.6. Generate the Project Metadata Repository

Introduction:
The Project Logical Data Model is used to generate the Project Metadata Repository, which reports information about each entity and attribute.

The following processes depict the participant roles, milestones, control points, and deliverables that occur during preparation of a Metadata Repository:

- Generate the Project Metadata Repository
  - DM OP-022 Operating Procedure for Generating the Project Metadata Repository

Deliverable(s):
- Project Metadata Repository

1.6.1 Generate the Project Metadata Repository

Project Data Analyst	A. Draft a project Metadata Repository following DM OP-022 Operating Procedure for Generating the Project Metadata Repository.
Project Data Analyst	B. Generate the Project Metadata Repository using the *Metadata Repository report* option specified in Modeling tool standard for Creating Logical Data Models
Business Owner / Partner, Data Steward	C. Validate the Project Metadata Repository.
Project Data Analyst	D. Submit the Project Metadata Repository to the project manager prior to or as a part of the quality review in Validate and Approve the Project Logical Data Model.

1.7. Validate and Approve the Project Logical Data Model

Introduction:
After the Project Logical Data Model is drafted, it should be reviewed. First, it is to be examined for proper model format. Second, it is to be evaluated for accuracy in representing project data needs.

The validation reviews are opportunities to make corrections and additions. Also, the reviews provide a convenient time to collect information about the amount and growth of data to be collected along with information about anticipated business events that might significantly change the volume of data over the long term.

The following processes depict the participant roles, milestones, control points, and deliverables that occur during review and approval of a project's logical data model:

- Perform a Quality Review of the Project Logical Data Model
    - DM OP-023 Operating Procedure for Performing a Quality Review of the Project Logical Data Model

- Validate and Approve the Project Model based on Business Data Views
    - DM OP-024 Operating Procedure for Validation of the Project Logical Data Model based on Business Data Views

- Document Data Stability and Growth Information
    - DM OP-025 Operating Procedure for Collecting Data Stability and Growth Information

Deliverable(s):
- Validated Project Logical Data Model
- Logical Model Quality Review
- Business Data Review
- Stability and Growth Documentation (optional)

1.7.1 Perform a Quality Review of the Project Logical Data Model

Project Data Analyst	A. Arrange a quality review of the Project Logical Data Model to check for standards compliance, completeness, and consistency with CMS Data Management policies/standards, and the Enterprise Data Architecture.

Project Data Analyst	B. Prepare the following deliverables for the model quality review:
	1. Project Logical Data Model
	2. Project Metadata Repository
	3. Data Comparison Report showing versioned changes to the model, when applicable.
	4. Reused Enterprise Entity/Attribute Change Log, if any.
	5. Proposed new EDM entities, if any.
Project Data Analyst, *Peer Data Analyst,* *Data Architect*	C. Review the project deliverables following guidelines in [DM OP-023 Operating Procedure for Performing a Quality Review of the Project Logical Data Model]().
Project Data Analyst, *Data Architect*	D. Research and resolve any issues uncovered in the quality review.

1.7.2 Validate and Approve the Project Model based on Business Data Views

Project Data Analyst	A. Arrange a business validation review of the Project Logical Data Model to check for completeness in meeting the project's business data needs.
Project Data Analyst	B. Prepare the following deliverables for the business data review:
	1. Project Logical Data Model,
	2. Metadata Repository,
	3. Data Mapping Matrix.
Project Data Analyst, *Project Manager,* *Business Owner/Partner*	C. Participate in a business review of the Project Logical Data Model and validate its representation of each business view requirement.
Project Data Analyst, *Project Manager,* *Business Owner/Partner*	D. Ensure that all business-needed attributes are in the Project Logical Data Model.
Project Data Analyst, *Project Manager,* *Business Owner/Partner*	E. Verify that all entities can be accessed to serve the business data views.
Project Manager, *Business Owner/Partner*	F. Approve the Project Logical Data Model in compliance with [DM OP-024 Operating Procedure for Approval of Data Models based on Business Data Views]() and send a confirming email message to the *Project Data Analyst* and *Data Services Manager*.

1.7.3 Document Data Stability and Growth Information

Project Data Analyst	A.	Collect information about the anticipated volume and potential growth of all *entity* occurrences. See [DM OP-025 Operating Procedure for Collecting Data Stability and Growth Information.](#)
Project Data Analyst	B.	Document imminent or expected near-term changes in information for the business enterprise that has implications for the Project Logical Data Model entities.
Project Data Analyst	C.	Document any anticipated law or regulatory changes that affects the business enterprise area and suggests volume changes among the entities being collected.
Project Data Analyst	D.	Record the feedback on the entity growth concerns listed above in the respective entity's User Defined Properties [*notes*] section in the data modeling tool. See [Modeling tool standard for Creating Logical Data Models](#)

1.8. Complete the Project Logical Data Model

Introduction:
After the development work on the Project Logical Data Model ends, it must be stored to facilitate ongoing analysis of application data and future changes.

This process step describes the change control activities that catalogs and stores the Project Logical Data Model in the appropriate model library.

Additional activities in this process decide whether any new entities and attributes that were added for the project have the potential for serving other business applications and therefore whether they should be proposed as new Enterprise Data objects.

The following processes depict the participant roles, milestones, control points, and deliverables that occur during completion of a project logical data model:

- Complete the Project Logical Data Model
  - DM OP-026 Operating Procedure for Completing the Data Model

Deliverable(s):
- Published Project Logical Data Model

1.8.1 Complete the Project Logical Data Model

Data Administration Analyst	A. Accept the new Project Logical Data Model and publish the model according to instructions in Production Change Control for Model Management. Note: All models shall be appropriately stored when work is completed (or halted in an incomplete or unapproved status).
Project Data Analyst, *Data Architect*	B. Review new data elements in the *Project Metadata Repository* and identify new entities and attributes for inclusion in the EDM. Then, draft a *Proposed New Enterprise Data Report* (when no new EDM appropriate data objects are identified, the report will show that "no new EDM entries are proposed from the respective project").
Data Architect	C. Review the Reused Enterprise Entity/Attribute Change Log to evaluate impact on the EDM.
Project Data Analyst	D. Provide any input that might be important to subsequent physical data design. Related activities are described in Logical Data Design considerations for Physical Data Design.

1.9. Logical Data Design considerations for Physical Data Design

Introduction:
This process step guides the logical data modeler in providing comments or suggestions that might assist the physical data designer in the subsequent preparation of an efficient and effective physical data model. The objective is to record information about anticipated physical performance obstacles, and how they might be addressed by the physical data model.

The following processes depict the participant roles, milestones, control points, and deliverables that occur during preparation of a project logical data model for physical design:

- Preparing the Project Logical Data Model for Physical Design
    - DM G-009 Guideline for Preparing the Project Logical Data Model for Physical Design

Deliverable(s):
- Comments to be considered in the transformation of the Logical Data Model to a Physical Design.

1.9.1 Preparing the Project Logical Data Model for Physical Design

Project Data Analyst	A.	To start the preparation for transforming the logical design to physical design, hypothetically assume the Project Logical Data Model is the physical database design, then: ・ View entities as record types or rows, ・ View attributes as fields or columns, ・ View relationships as integrity rules.
Project Data Analyst	B.	Using this "hypothetical" physical model, analyze whether the data will be accessible in a manner needed to satisfy each required business data retrieval scenario. For example, sketch a set of SQL queries that could retrieve the data in the manner needed.
Project Data Analyst	C.	Consider the factors outlined in DM G-009 Guideline for Preparing the Project Logical Data Model for Physical Design.
Project Data Analyst	D.	Make notes about factors that might be important to the subsequent physical data design (do not modify the approved project logical data model).
Project Data Analyst, Project Database Administrator	E.	Collaborate to: hand-off the approved logical data model to the Project Database Administrator, who will continue the physical data modeling process; discuss any issues that are relevant to physical modeling and data definition.

1.10. Reverse Engineer a Logical Data Model from a Physical Source

Introduction:
Reverse engineering is the automatic capture of data structure(s) to a physical data model using data modeling tool facilities. The captured physical data model can then serve as the basis for modeling a logical data model.

The reverse engineering of a logical data model from physical sources is an expeditious method to further one or more of the following goals:
- To convey and document existing physical data resources in a logical format that is suitable for business user analysis and planning,
- To assess which existing physical sources of organization data might serve additional business information needs,
- To jump-start a logical data model based on existing un-modeled physical data resources.

The Reverse Engineer a Logical Data Model from a Physical Data Source diagram depicts the flow of activities and their outputs as they occur during the following process:

- Reverse Engineering a Logical Data Model

Deliverable(s):
- A physical data model of existing data resources within a business area.
- Logical data model components based on upward abstraction of all or portions of the above physical data model.

Exhibit 2. Reverse Engineer a Logical Data Model from a Physical Data Source
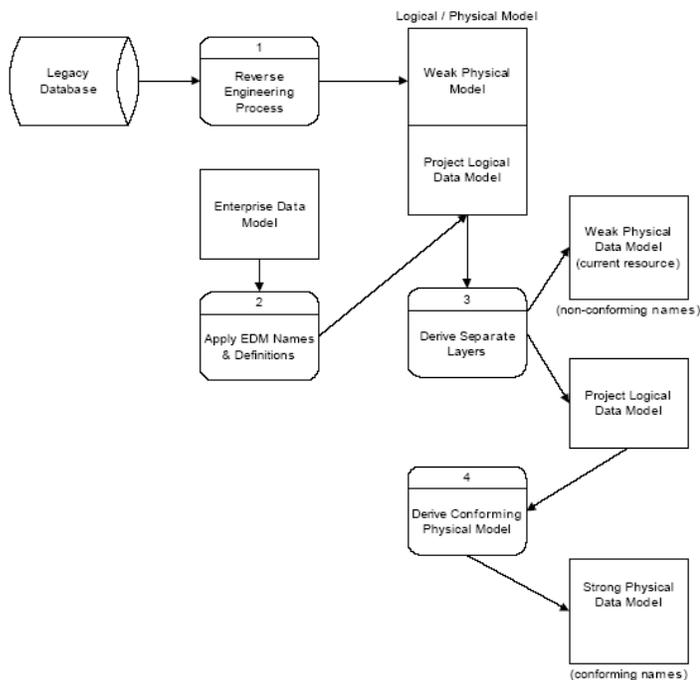
1.10.1 Reverse Engineering a Logical Data Model

Project Data Analyst	A. Contact the database administrator who has assigned responsibility for the existing physical database and request the Data Definition Language (DDL) script from which the data modeling tool can produce a re-engineered physical data model. See the HELP facility of the data modeling tool for more information about how to reverse engineer a physical model.
Project Data Analyst	B. If you are developing an EDM, see Enterprise Data Planning. The remaining activities in this process are targeted toward development of project logical data models.
Project Data Analyst	C. Normalize the physical data model and compare it to the Enterprise Data Model for related abstract business entities and attributes. For application projects, apply full business names to the conforming logical pieces (see Start the Project Logical Data Model) then add the non-conforming logical pieces (see Extend the Project Logical Data Model).