

Supplemental Appendices for A Guide to Managing Where's My Stuff

**An Implementation Guide for a Geospatially-Enabled
Enterprise-Wide Information Management System for
Transportation Agency Real Estate Offices**

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APPENDIX A EXECUTIVE SUMMARIES

The executive summaries presented in this appendix were developed for members of upper management within transportation agencies. The first summary focuses on the current state of the practice in ROW enterprise-level geospatially-enabled information management systems with a discussion of the benefits and costs associated with those systems in the context of designing and implementing such a system for right-of-way offices. The second summary focuses on what information is important for an executive to have for evaluation as part of a request to fund an enterprise-level geospatially-enabled information management system to improve its successful implementation.

Executive Summary 1: *Improving Resource management and Operations in Right-of-Way Offices with Right-of-Way Information Management Systems*

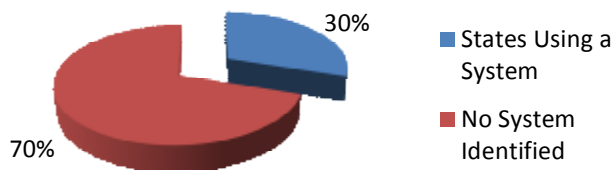
Executive Summary 2: *Implementing an Information Management System in Right-of-Way Offices, An Overview for Executives.*

Improving Resource Management and Operations in Right of Way Offices

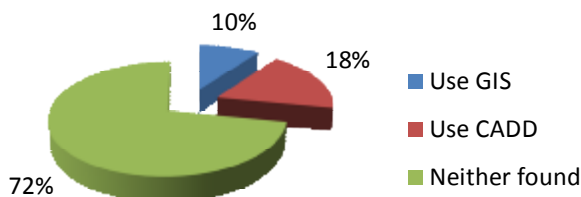
With Right-of-Way Information Management Systems

A well designed and implemented information management system can substantially improve management of resources – **personnel**, **money**, **information**, and **time** – which is critically important to successfully meeting state performance goals and budgets. Adding geospatial capabilities (GIS) to the system to replace hardcopy maps and tabular information and to give additional management and analysis functions can significantly increase its usefulness.

State Use of ROW Information Management Systems



State ROW Office Use of GIS/CADD



In the Right-of-Way office, this is particularly important because of the resources required to deliver real property for transportation improvements and manage state-owned land.

BENEFITS

- ◆ Improved on-time delivery of project real property
- ◆ Expedited project award
- ◆ Reduced staffing and/or improved staff efficiency
- ◆ Improved scheduling
- ◆ Improved access to information both internally and by the public
- ◆ Improved customer service and public relations
- ◆ Improved documentation and reporting uniformity
- ◆ Reduced time to perform tasks
- ◆ Reduced redundancy, primarily in data entry
- ◆ Increased management flexibility
- ◆ Improved oversight capabilities
- ◆ Improved integration, use, and sharing of information

DOCUMENTED SAVINGS

- **A return on investment of more than 21%**

Pennsylvania invested \$829,000 on a ROW information system that **reduced annual operating** costs by nearly \$680,000 while providing **greater convenience** to users. Because the system integrates with their financial system, the time to process payments **reduced from several days to several minutes**.

- **Staffing reductions and improved on-time performance**

In Virginia, the ROW information system provides over 500 staff and contractors all information on ROW projects, providing **exceptional customer service**. Information is entered only once, **eliminating duplication of effort**. **Clear project tracking** provides staff with a comprehensive understanding of the status of each project including resource allocation.

In Maryland, **research staff has been reduced by half** because parcel and other geospatial information is available through the intranet. **In-person courthouse research and travel time have been eliminated**.

New Mexico uses GIS to generate summaries on excess property for sale to the public, **reducing the time required** to provide this information from several hours to several minutes. The information includes a map with an aerial photograph image background resulting in **dramatically reduced questions from the public**.

Using GIS, the San Antonio district of Texas provides its staff with electronic access to project drawings, thus **eliminating the manual locating and reviewing of large drawing sets**. Drawings are accessed by simply clicking on a desired section of road.

- **One-person project oversight and management of real estate activities**

In Illinois, a multi-million dollar airport project is managed by a single person who has desktop **access to near real-time information** about the project.

RISKS OF NOT IMPLEMENTING A SYSTEM

A primary purpose of this type of information management system is to facilitate standard business operations and support information and decision making by providing easy access to both internal and external information relevant to meeting the goals and operational needs of the transportation agency and the real estate office.

Without such a system, decision makers are limited in their ability to monitor performance and identify opportunities quickly and make strategic adjustments to resource allocation as needed. The real estate office will be limited in its ability to respond to the rapidly increasing reliance on digital information exchange to perform its functions.

Expectations in the current technological environment are for faster, more accurate information with fingertip access to on-line maps. Without a geospatially enabled system, these expectations cannot be met for staff or the public.

FOR MORE INFORMATION

This document is part of the National Cooperative Highway Research Project 8-55A "Developing a Logical Model for a Geo-Spatial Right-of-Way Land Management System". The project is managed by Ed Harrigan EHARRIGA@nas.edu and is being performed under Kathleen Hancock hancockk@vt.edu at Virginia Tech and was completed in 2/11.

Results of the first phase, 8-55 "Integrating Geo-Spatial Technologies into the ROW Data-Management Process", including the documented savings reported here, are available at http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rrd_310.pdf and http://www.trb.org/news/blurbs_detail.asp?id=7308

Implementing an Information Management System in Right-of-Way Offices

An Overview for Executives

Increasing responsiveness and maximizing resources are important factors in how transportation agencies improve their business in today's data-driven, performance-based environment. The ability to deliver projects on time and within budget is one measure of a transportation agency's performance. The effective delivery of real property by the right-of-way office is fundamental to achieving this agency objective. A well designed and implemented information management system can substantially improve this capability. Adding geospatial capabilities (GIS) to the system to replace reliance on hardcopy maps and tabular information and to give additional management and analysis functions can significantly increase its usefulness.

Understanding the critical factors necessary to successfully implement an information management system can ensure the best value for the necessary outlay in resources and can substantially improve the realization of the system's full potential. Obtaining strategic buy-in from agency executive-level decision makers to pursue implementation will provide the necessary foundation for system.

Implementing a System

The process to implement an information management system is well documented and follows standard procedures:

- ◆ Formalize support
- ◆ Assess requirements
- ◆ Assess capabilities
- ◆ Define the system
- ◆ Develop an implementation plan
- ◆ Implement the system
- ◆ Maintain the system

Implementation is typically considered complete at the point when the system being implemented has transitioned to "business as usual" for its users.

Implementation Responsibilities

- **Project champion:** This person is typically known and trusted by agency management and is responsible for marketing and promoting the system both inside and outside the agency.

Without an identified champion, history has shown that projects flounder at the first major challenge.

- **Steering group:** The steering group is responsible for ensuring that there is active and appropriate input and feedback to the system during the implementation process.

Transportation agencies consist of multiple departments and offices responsible for different aspects of doing business. Without representation from each group that will be impacted by the system, the system will face numerous challenges including: a) meeting agency information technology (IT) requirements, b) obtaining buy-in from stakeholders, and c) coordinating data sharing between data owners and users, as well as performing the tasks necessary to support right-of-way activities.

- **Project manager:** The project manager is responsible for the day-to-day management of the process.

This person must have the necessary skills, authority and resources to coordinate sometimes conflicting input from the groups and individuals involved in the process. The project manager must also have the organizational skills to ensure that the process stays on track and within design boundaries and sufficient technical understanding of the right-of-way process and individual functions to reasonably evaluate input during the development process.

- **Development team:** The development team consists of the people who will actually be developing the system.

They can be wholly from within the agency or wholly contracted from outside or a combination of both. The importance, at the proposal stage, is that the skills necessary to the project be clearly identified and articulated.

Implementation Factors

- **Assessing requirements:** Any proposal for a new information system should include a clearly stated understanding of the scope and goals of that system. As these requirements are refined, consideration should include the business areas to be included (often referred to as the *enterprise*), the functions that should be performed, the data needed to support these functions, other systems that should interact with the proposed system, security issues, and any legal and regulatory requirements.
- **Assessing capabilities:** An understanding of the capabilities in the right-of-way office and across the agency is critical to successfully implementing a system. Considerations include available or required hardware and software, existing applications including database management systems and GIS, datasets along with who is responsible for them, and agency policies and procedures related to IT including application development, data and data standards, and hardware and software acquisition. Knowing who will be responsible for maintaining the system and any corresponding data and output is also necessary. Availability of funding for development and continued maintenance is critical to the project's success.
- **Defining the system:** This is the core of the system and will be the basis for the tool that manages the information associated with right-of-way offices. The technical considerations will be included in the detailed implementation plan. An important aspect of this definition is knowing the starting point for system development. Three common starting points include:
 - ◆ The system is being developed from scratch with no existing information management system or GIS.
 - ◆ The system is expanding on an existing information management system to include GIS.
 - ◆ The system is being developed to take advantage of existing GIS capabilities.
 Knowing this information will ensure that appropriate coordination is considered in the design.

Additional Considerations

The current evolution and expansion of technology is extremely rapid and most transportation agency policies and procedures are not designed to operate at the same rate of change. Innovative and flexible approaches to supporting improved information management tools could save money and time both in their implementation and use.

From concept to operation, a comprehensive information management system can take 12 to 24 months or longer, and, during that time, technology will become more powerful, faster, and more flexible at the same time that the general public will become more technologically sophisticated with fingertip access to information through smart phones and other similar devices. A flexible design can readily take advantage of this changing technology without requiring major modifications. However, waiting for the next advancement before initiating the process can, and often does, result in never starting.

Many transportation agencies are in the process of either designing or building an agency-wide infrastructure for sharing data and/or integrating computer systems. Although, the desire to fold individual systems into this larger initiative is compelling, the reality may be more problematic given the scale, complexity, and cost of the larger effort. With current technologies, consideration should be given to supporting individual systems if they provide the necessary connections to and support for integrating with the larger initiative.

For More Information

This document is part of the National Cooperative Highway Research Project 8-55A "Developing a Logical Model for a Geo-Spatial Right-of-Way Land Management System". The project was managed by Ed Harrigan EHARRIGA@nas.edu and was performed under Kathleen Hancock hancockk@vt.edu at Virginia Tech and was completed in 2/11. A detailed implementation guide was developed as part of this project and will be available through TRB.

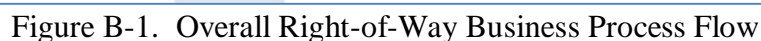
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APPENDIX B GUIDE ON HOW TO USE THE 8-55A LOGICAL MODEL

The 8-55A *logical model* was developed in Enterprise Architect (EA), a Computer Aided Software Engineering (CASE) tool by Sparx Systems, which provides a UML 2.3 modeling environment and supports full product development lifecycle. It includes visual tools for business modeling, systems engineering, enterprise architecture, requirements management, software design, code generation, and testing. At the time of this writing, a single professional license is \$199 while the full corporate version is \$335. Sparx Systems provides a free viewer, Enterprise Architect Viewer, EALite (<http://www.sparxsystems.com/products/ea/downloads.html>), which is included on the attached CD to allow you to view and navigate around the model. A full license is required to modify the model or print model details.

The first section of this guide provides a description of the Overall Logical Model Design Description, and of the Geospatial Model. The second section provides guidance on how to use the EA models as a starting point for your system. This discussion is designed for the implementation committee and not for those actually building the application.

Business processes, based on the FHWA Project Development Guide, are presented in Figure B-1 through Figure B-6. Figure B-1 provides the logic for an overall process for planning, designing, and constructing a transportation project with the core areas that make up the right of way enterprise addressed in this document highlighted in light brown near the center of the figure. Figure B-2 through Figure B-6 provide the processes for appraisal, acquisition, relocation, and property management, respectively. It is important to understand that the arrows in these diagrams do not represent the order that these activities occur but instead reflect a linkage between those activities. The actual order is established during system design.



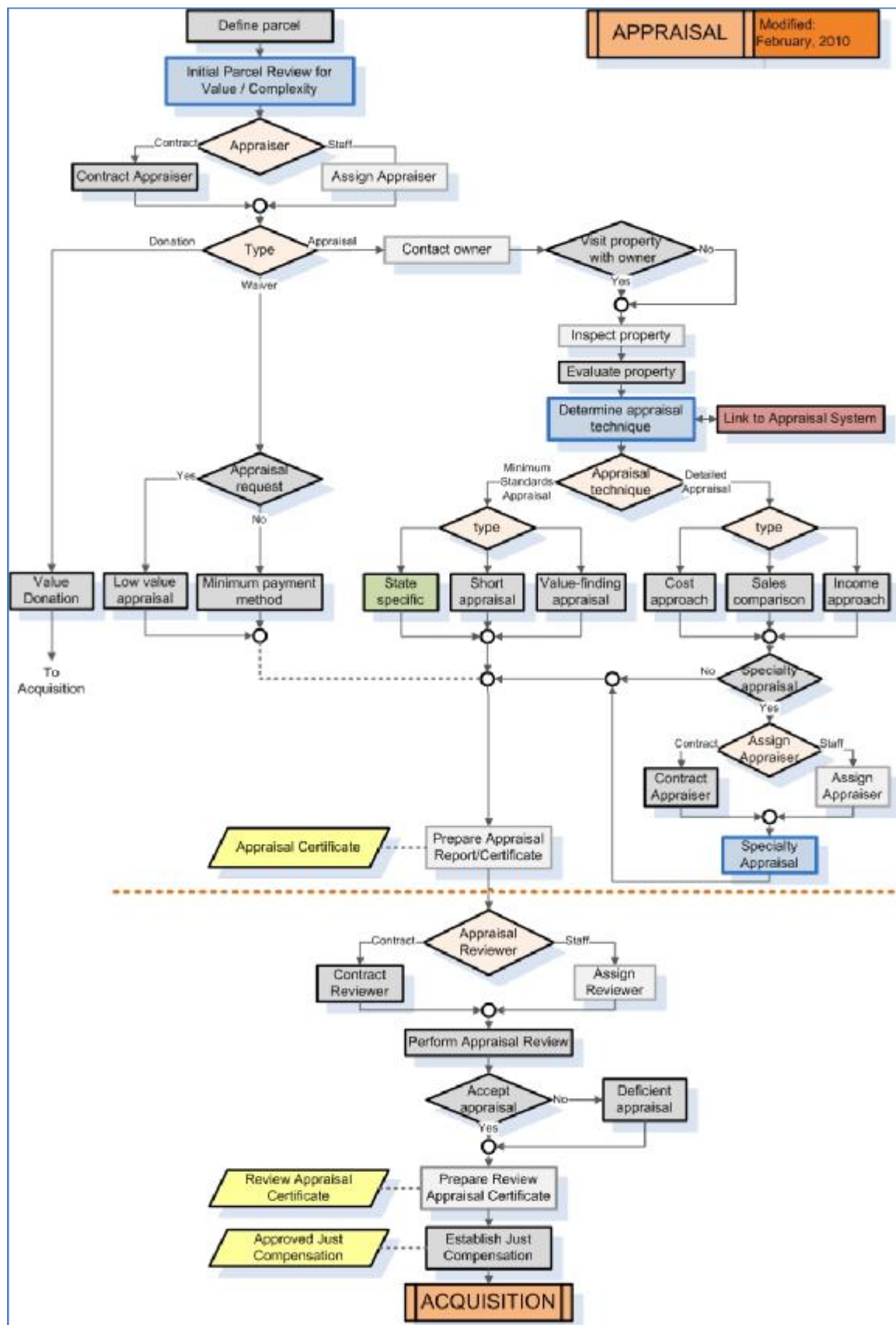


Figure B-2. Process Flow Diagram for Appraisal

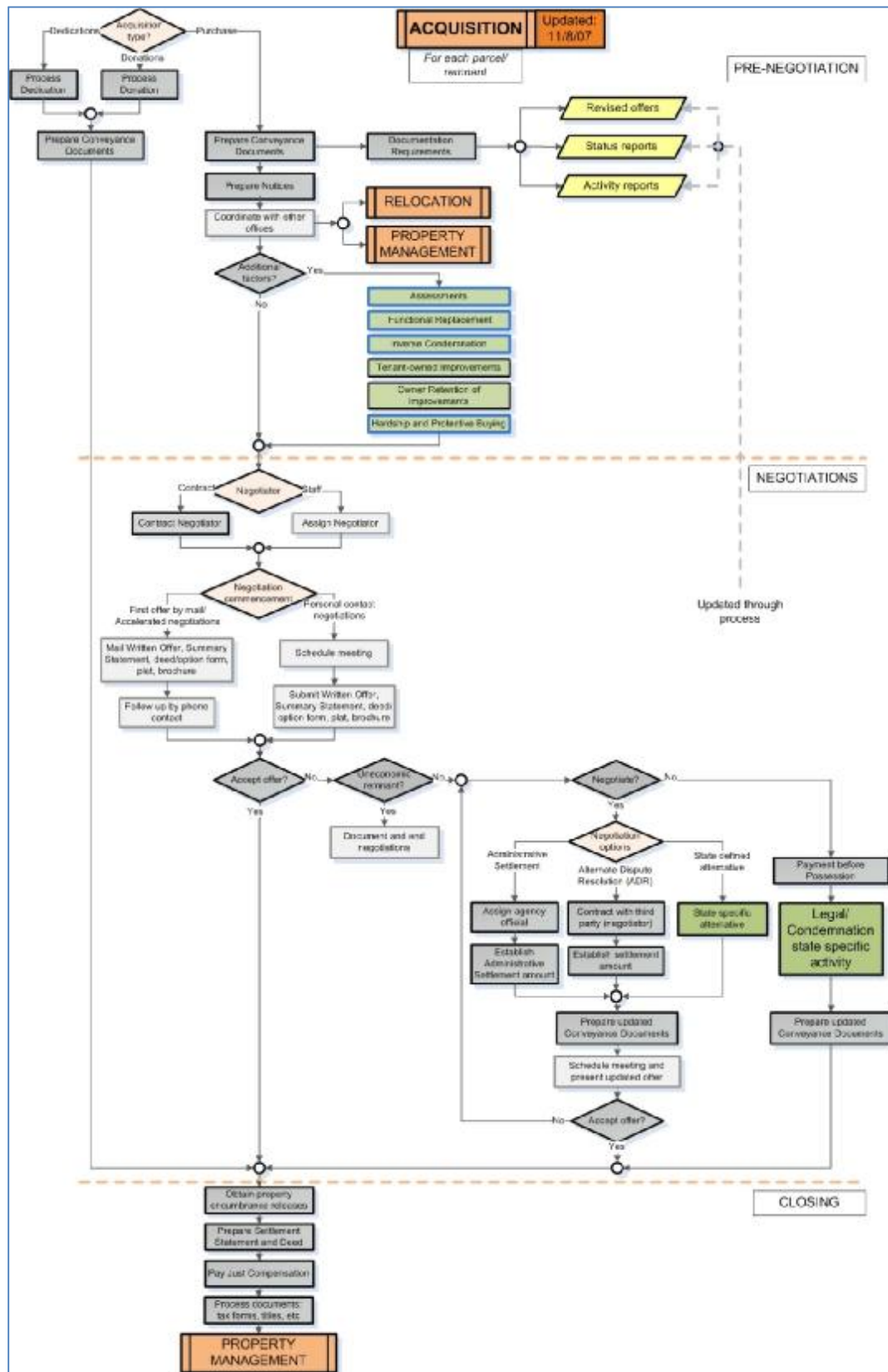


Figure B-3. Process Flow Diagram for Acquisition

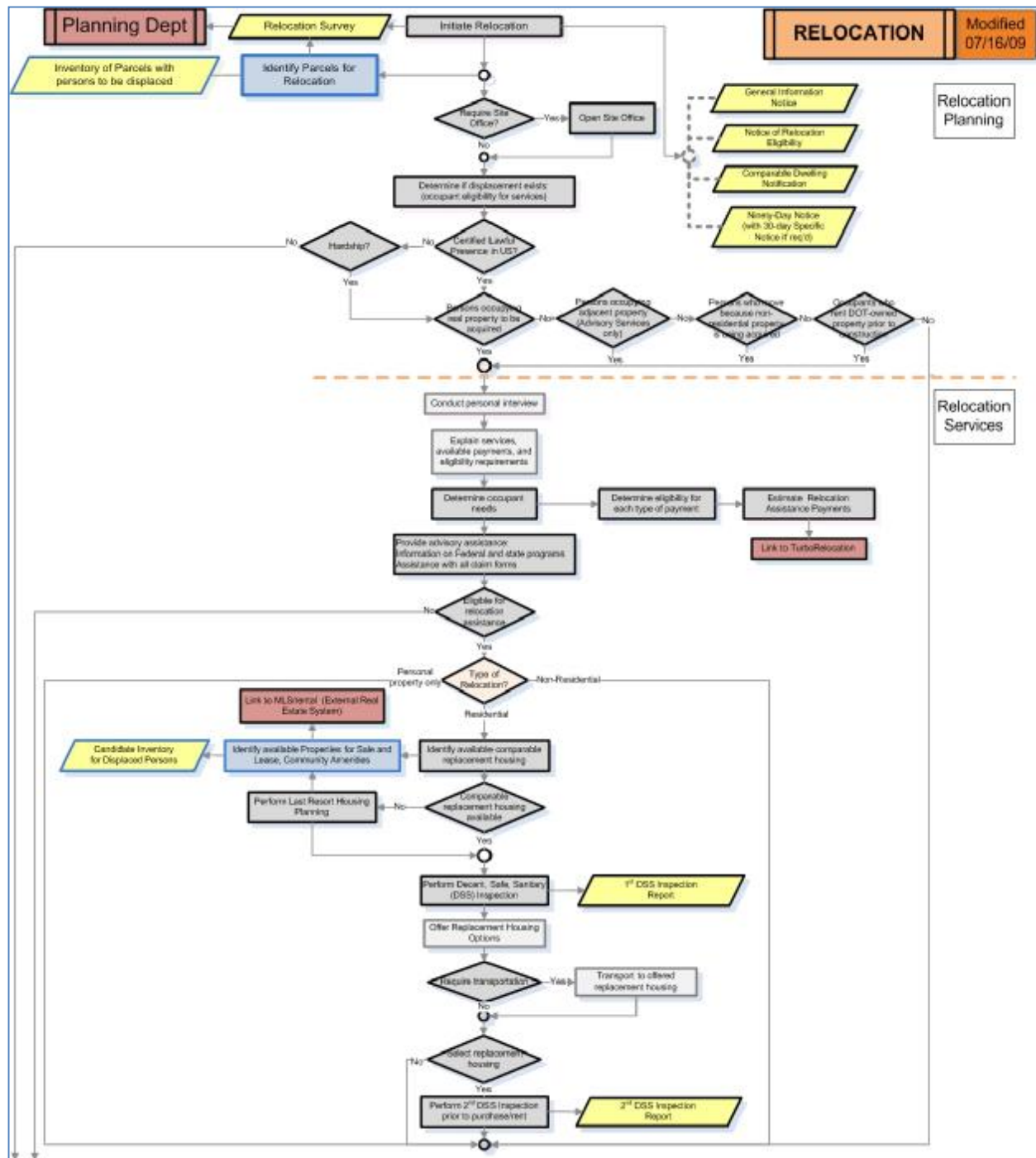


Figure B-4. Process Flow Diagram for Relocation, Part 1

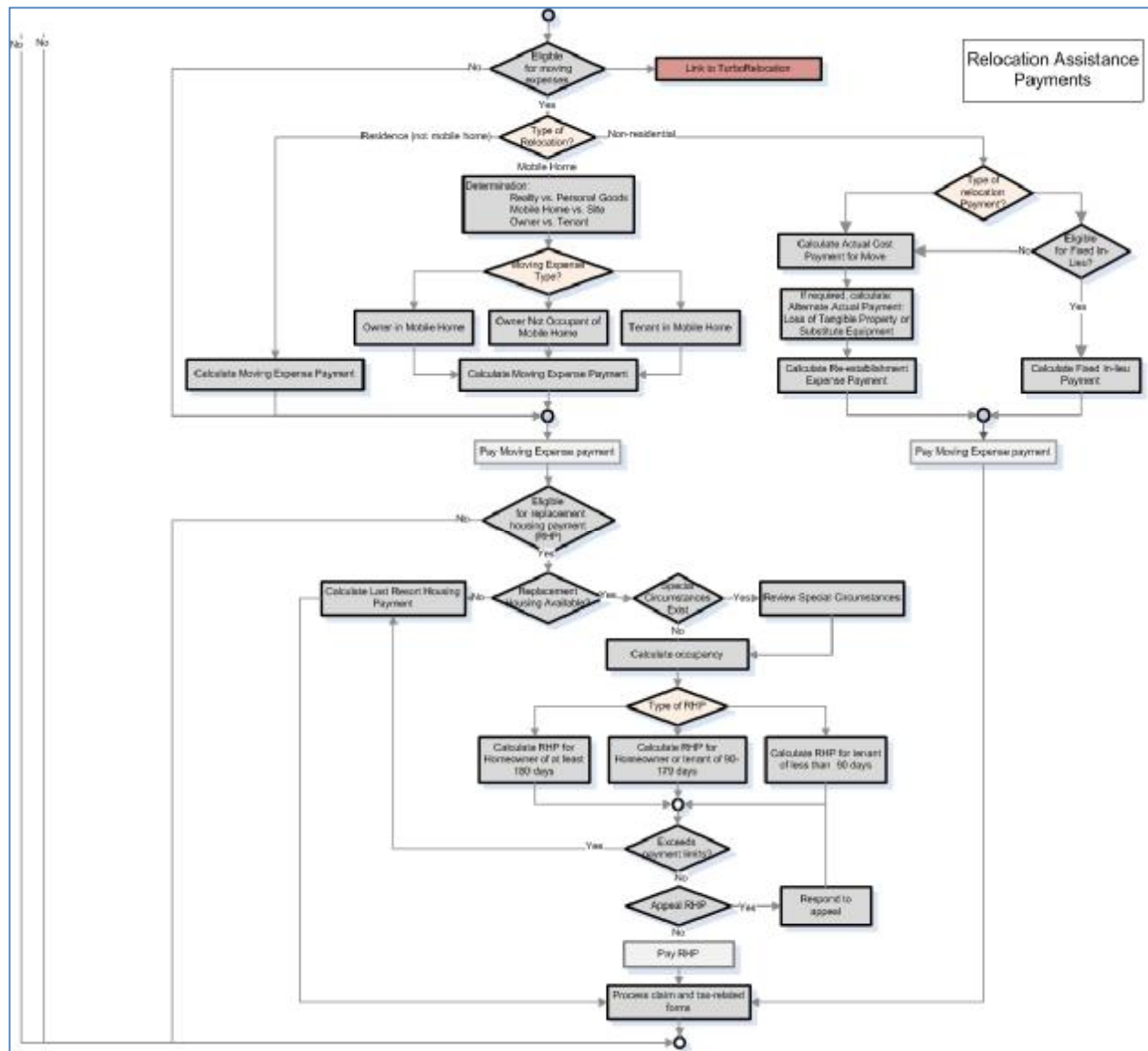


Figure B-5. Process Flow Diagram for Relocation, Part 2

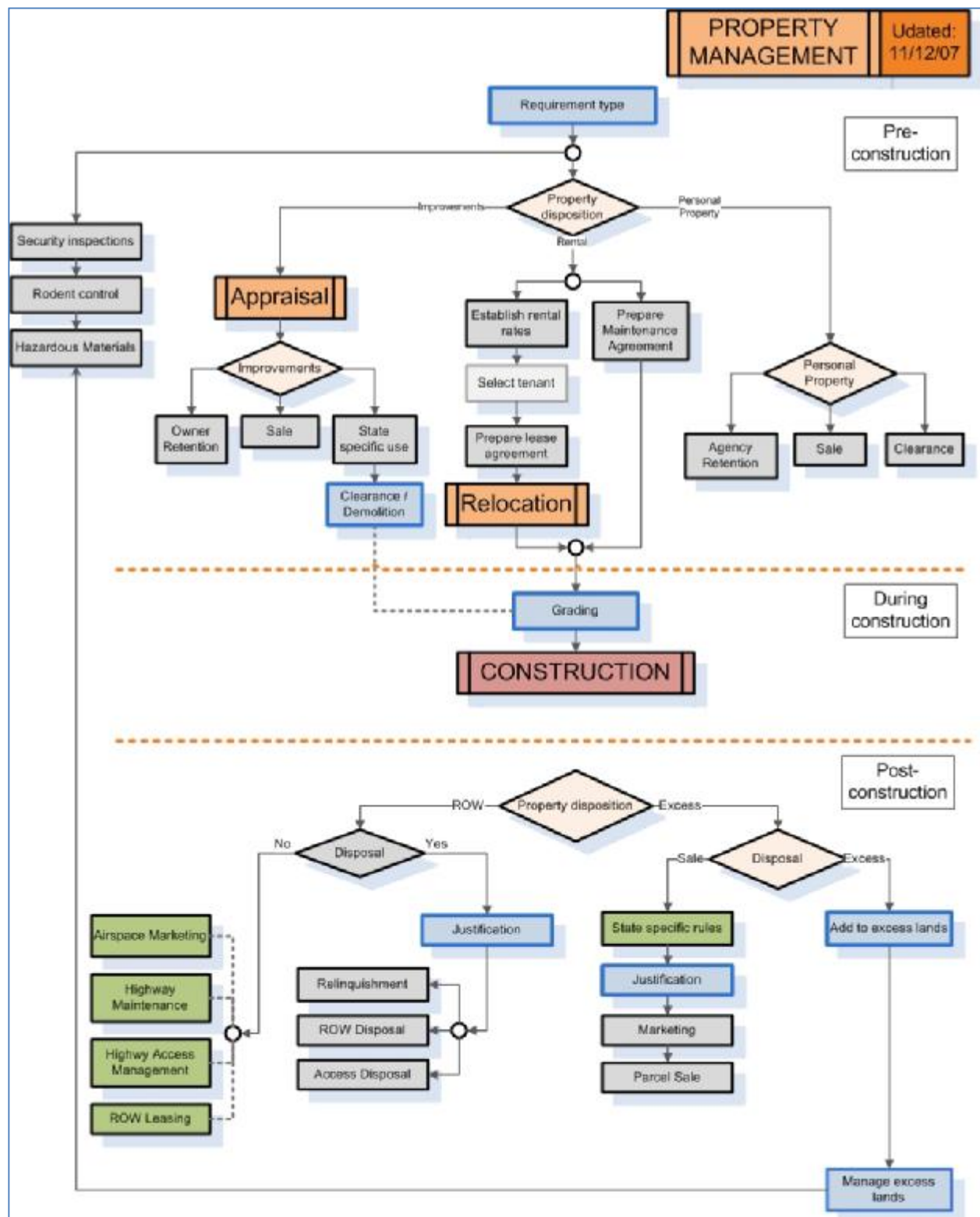


Figure B-6. Process Flow Diagram for Property Management

Overall Logical Model Design Description

In the terminology of software and information systems, the design and implementation of an information system primarily consists of Conceptual, Logical and Physical Data Modeling prior to actual system development [Nicewarner 2004, Bryce 2006]. The Conceptual and Logical Modeling captures the data, processes, activities and functions of a given business for which the information system is being developed, while the Physical Modeling describes how the system is implemented in terms of computer hardware/software, database files, information system screens etc. The conceptual and logical model designs are developed prior to the Physical Model design, which in combination are used for eventual software development.

Uniform Modeling Language (UML) is an accepted set of notation techniques for visually defining, documenting and representing software intensive systems. This uniform design supports the portability of framework development for any given model and provides an appropriate platform for modeling a rigorous and traceable information system for complex business activities. The model views that are used for the right-of-way information management system and available in UML design can be divided into two sets; Behavioral Model Views and Structural Model Views, as shown in Figure B-7.

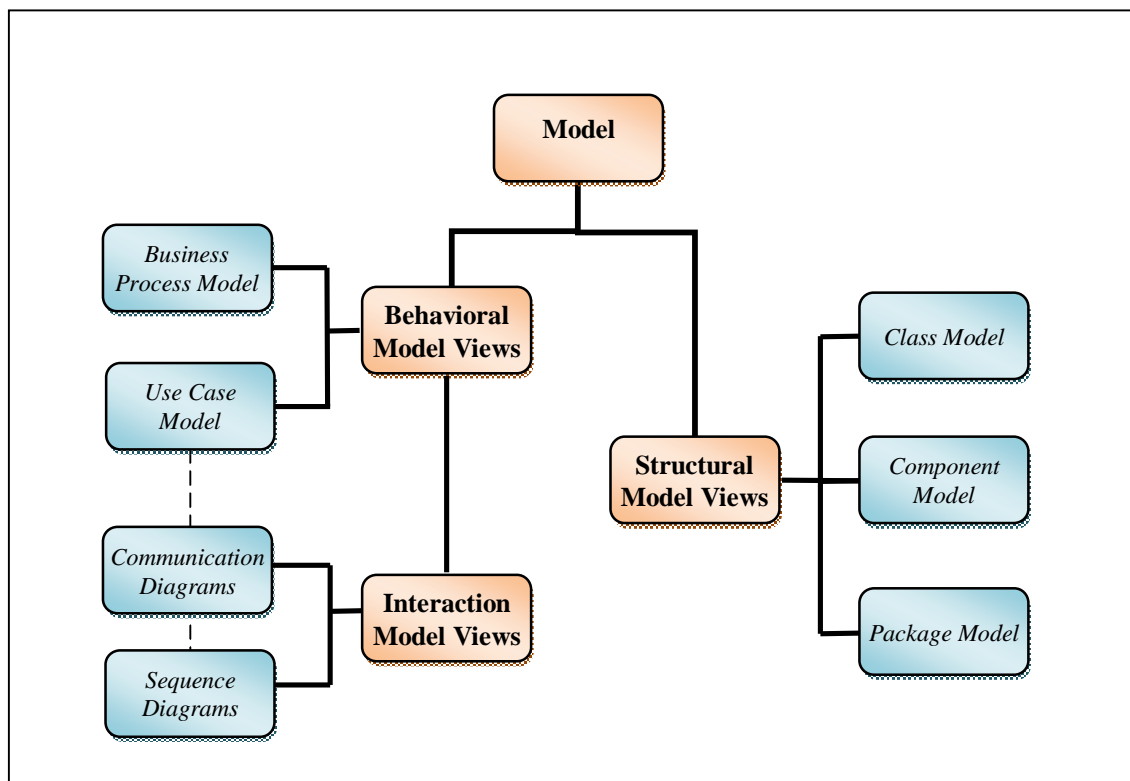


Figure B-7. UML diagrams included in the model and their classification

The Behavioral Model Views capture the dynamic behavior of the system over time and are demonstrated by four UML models or series of diagrams:

- The *Business Process Model* (or Analysis model) captures the broad outline of procedures and the sequence of activities that drive the business.

- The *Use Case Model* defines the features or requirements that are expected to be provided by the system and captures the interactions within the system and with entities that are external to the system.
- *Sequence Diagrams* and *Communication Diagrams* are forms of Interaction Model Views, and are encompassed in the individual use cases and illustrate communication between objects and the messages that trigger those communications.

The Structural Modeling View defines the static architecture of a model and identifies the elements that constitute the system and the relationships and dependencies between the elements. The Structural Modeling View consists of three models:

- *Class Model Diagrams* reflect the logical structure of the system by capturing the attributes and behavior of the model in its static view and illustrating the relationships between the classes and interfaces.
- *Component Model Diagrams* depict how a system is decomposed into various components that can illustrate the structure of arbitrarily complex systems.
- *Package Model Diagrams* demonstrate the organization of packages and their elements, helping to organize use case diagrams, class diagrams, or other UML diagrams.

The 8-55A *logical model* captures right-of-way information and activities, which then facilitates the design of a comprehensive right-of-way information management system using these UML Model Views. Each individual model depicts explicit yet complimentary perspectives of the overall model. Further discussion and the application of these UML modeling views for designing the right-of-way system logical model are described in the following sections.

Model Architecture

In addition to project management, the four functional areas in the 8-55A *logical model* consist of appraisal or property valuation, acquisition, relocation, and property management. The enterprise also includes activities related to land being considered during early project development and post construction management.

The major governing actors include both individual human and agency actors that are expected to interact with the system. This helps in identifying roles and establishing responsibilities of the actors prior to model development. This, in turn, helps in establishing enterprise-wide right-of-way activities associated with these actors, ensuring interoperability across the enterprise system and helps in reducing conflicts that might arise in building the model, providing further clarity to right-of-way activities included in the logical model. Figure B-8 and Figure B-9 illustrate the actors and their relationships in UML notation.

Interoperability with the larger transportation enterprise is incorporated in the system design by identifying discrete external systems and including these interactions with right-of-way activities. Figure B-10 outlines the major systems in UML representation that interact with the overall right-of-way system.

From Figure B-7, the initial component of the architecture consists of capturing activities that make up the business of right-of-way offices as described in the Project Development Guide (FHWA 2004). This initial business modeling was fundamental to conceptualizing the right-of-way project processes and served as the base for modeling the system in UML.

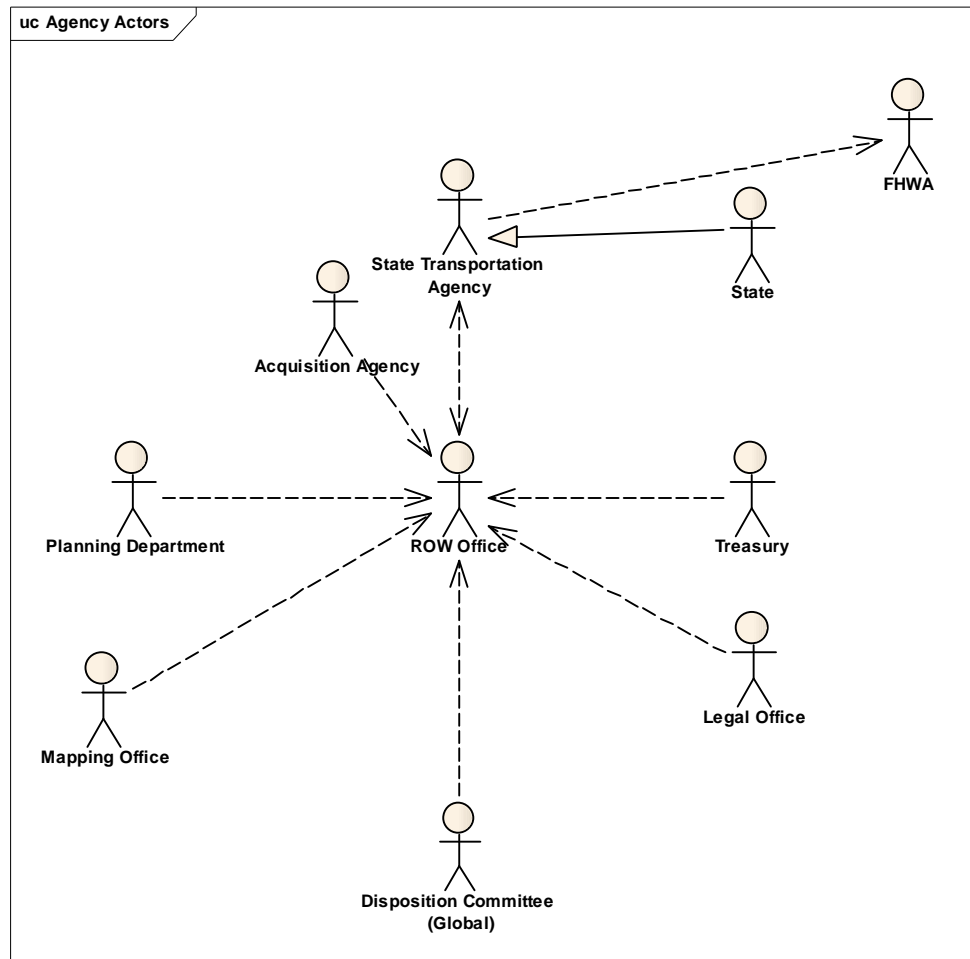


Figure B-8. Agency actors identified in the right-of-way system

Behavioral Model Views

Based on the process flow diagrams, the detailed model was built using the components defined in the previous section and shown in Figure B-7.

Business Process Model

The Business Process Model, also called the analysis model, is a simplified form of an activity model that captures the broad outline and procedures that govern the business processes, in this case, activities in a right-of-way office. The business process model helps in clearly mapping the scope of the entire system through different activities. For this purpose *activity* organizes and specifies the participation of subordinate behaviors, such as sub-activities or actions, to reflect the control and data flow of a process.

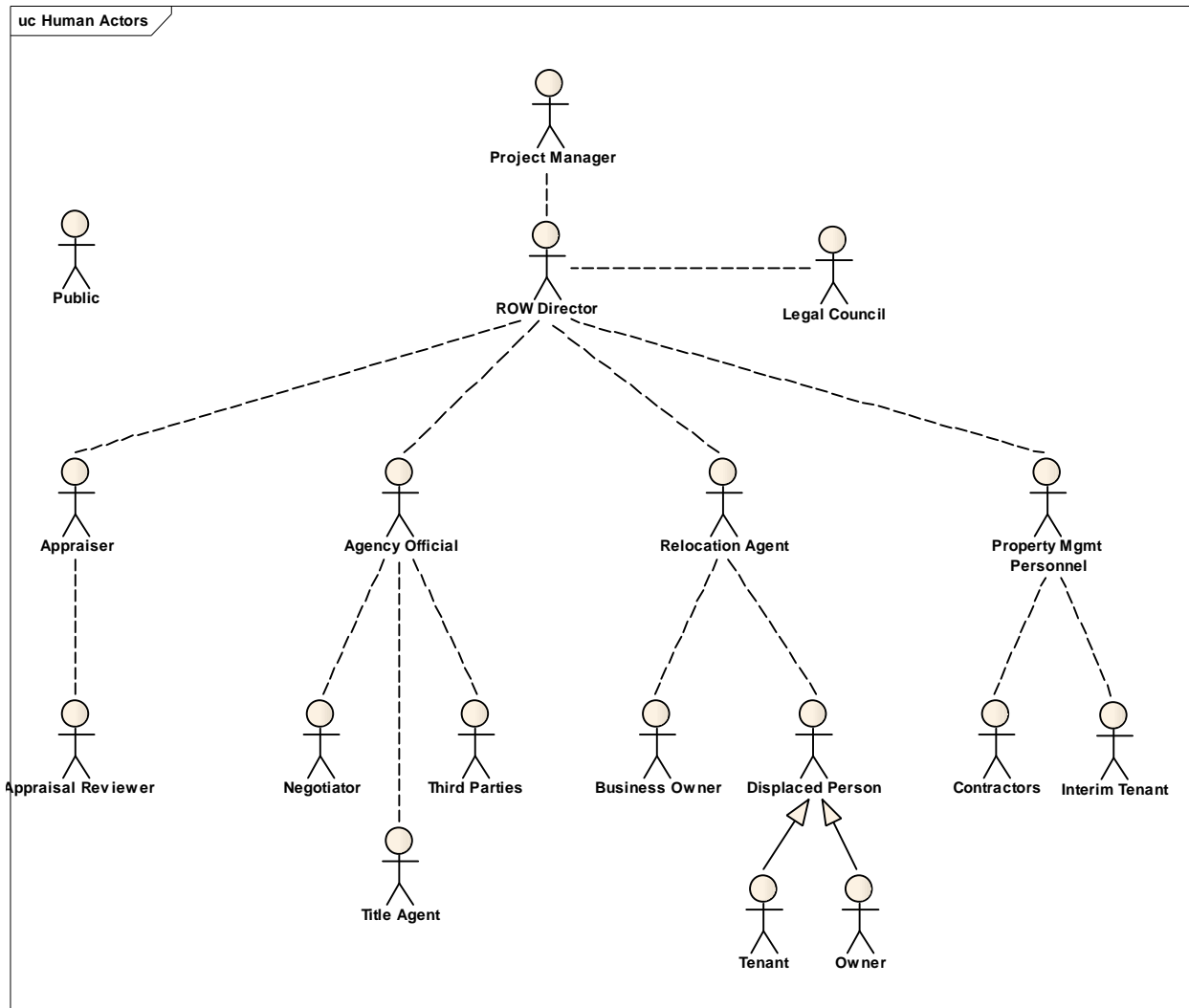


Figure B-9. Human actors identified in the developed right-of-way system logical model

This model provides the primary form of the proposed system design and is instrumental in capturing significant activities, events, resources, inputs and outputs that are associated with the right-of-way business processes. As an example, the upper half of Figure B-11 shows the Business Process Model for “relocation planning”, which focuses on recognizing, at an early stage, any problems associated with the displacement of individuals, families, or businesses before the commencement of actions that cause these displacements. The primary actors in the relocation planning process, identified as a part of the model architecture, consist of the Relocation agent and the Displacing agency.

The relocation agent first identifies parcels with people or businesses that require relocation assistance from the available list of parcels to be acquired. This is modeled as the activity labeled “REL_parcel for relocation”. Relocation notices specified by the Guide are distributed to potentially displaced individuals/businesses, to help in resolving any identified problems, minimize the adverse impacts on the displaced persons, and expedite the overall progress. The activity “REL_Notices” is modeled as a composite activity in the UML design, as denoted by the ∞ symbol in the activity box, and consists of several sub-activities related to each of the

individual notices. The individual activities associated with “REL_Notices” are executed and the status of the affected parcels is updated to reflect the activity.

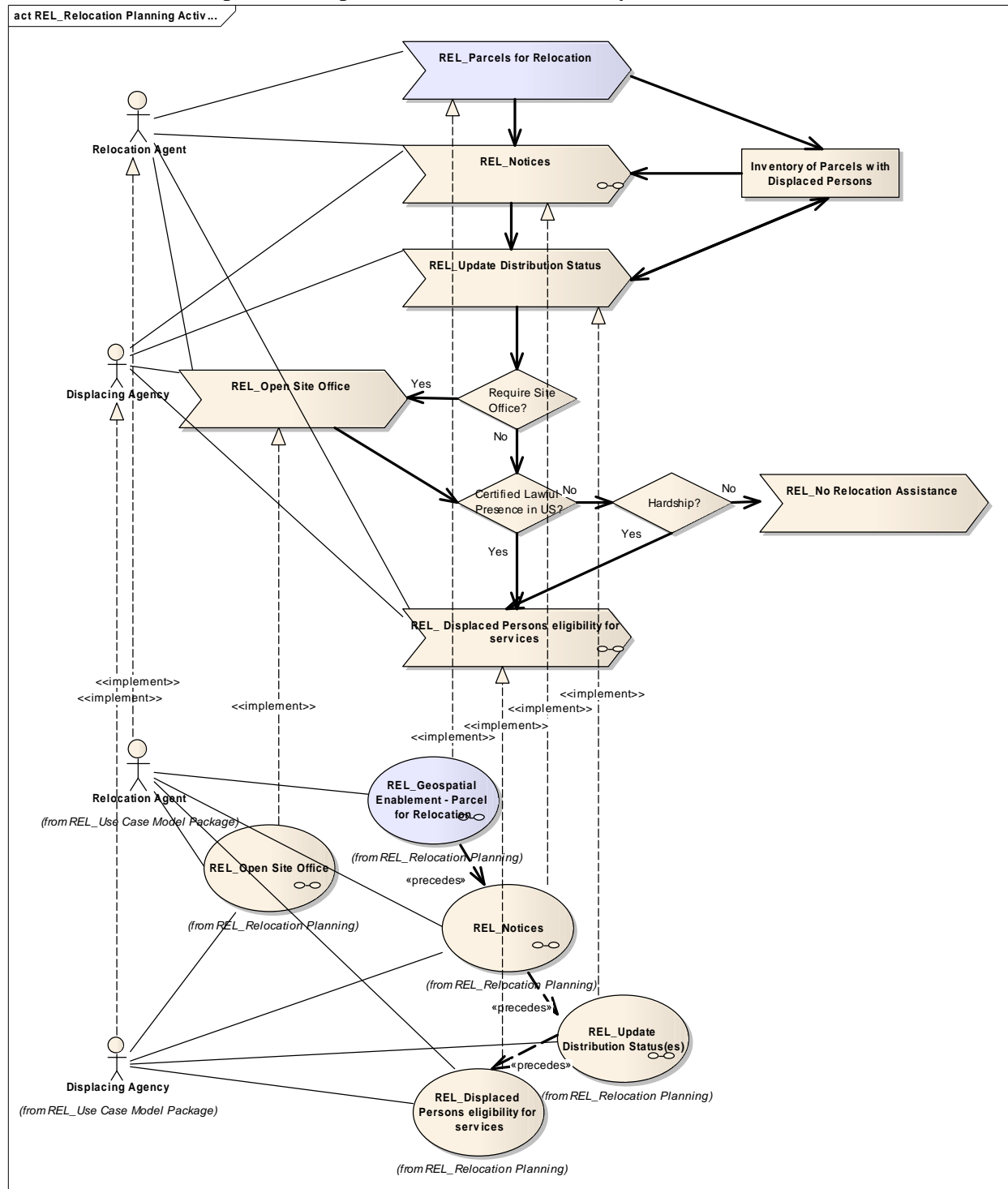


Figure B-11. Business Process Model diagram for Relocation Planning

Table B-1 through Table B-3 provide a summary of all activities included in the Business Process Model.

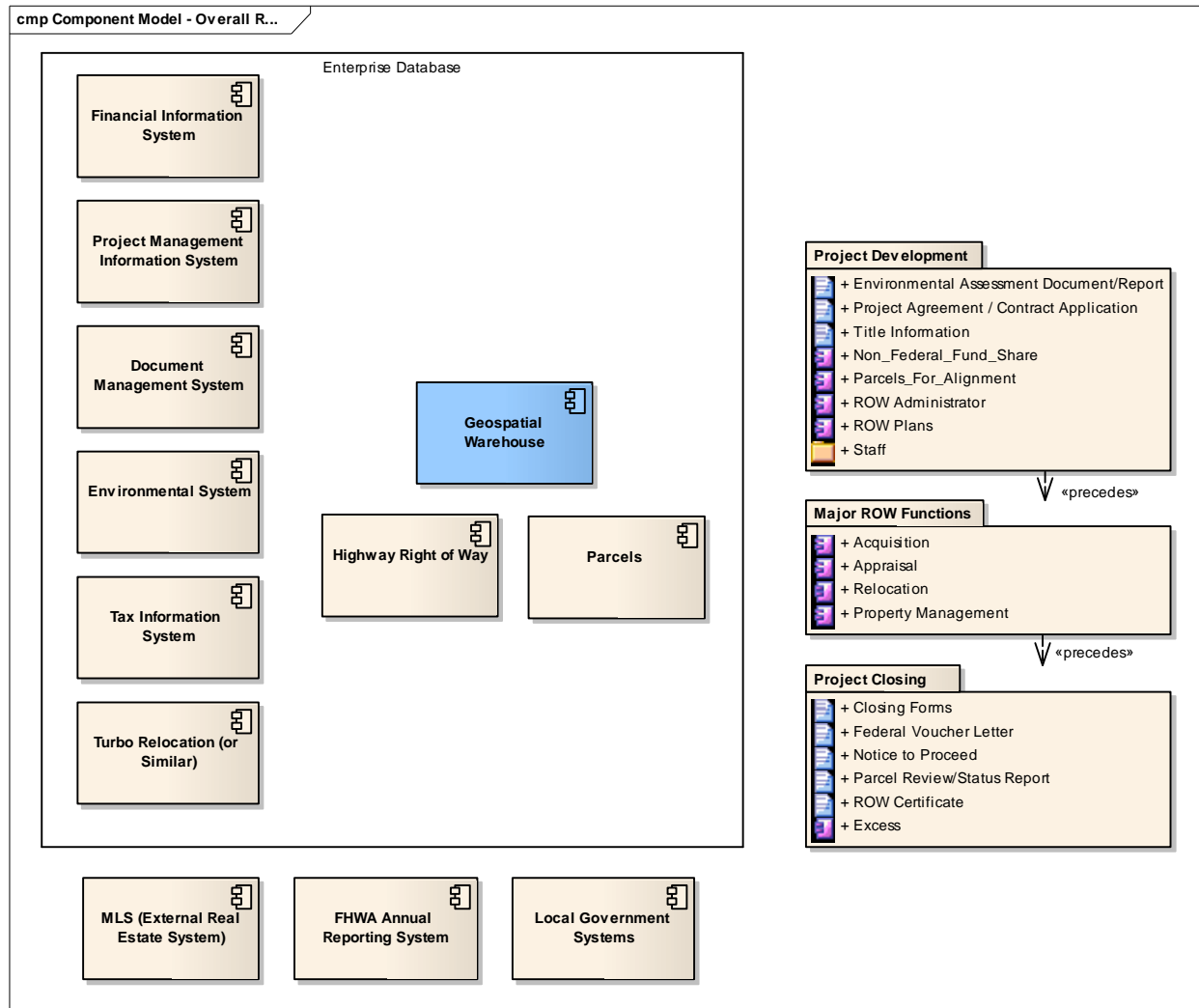


Figure B-10. Component model view of the overall right-of-way system in UML depicting the other integrated external systems

Use Case Model

The second component of the Behavioral Modeling Diagrams is the Use Case Model. While the Business Process Model describes both the behavior and the information flows within the right-of-way system, the Use Case Model provides the system's functionality in terms of actors, use cases, and the relationship between them. A use case denotes a collection of actions performed by a user (or sub-system) of an enterprise system. This helps in establishing the roles of the actors by exclusively identifying the functions within the system that are performed by that specific actor.

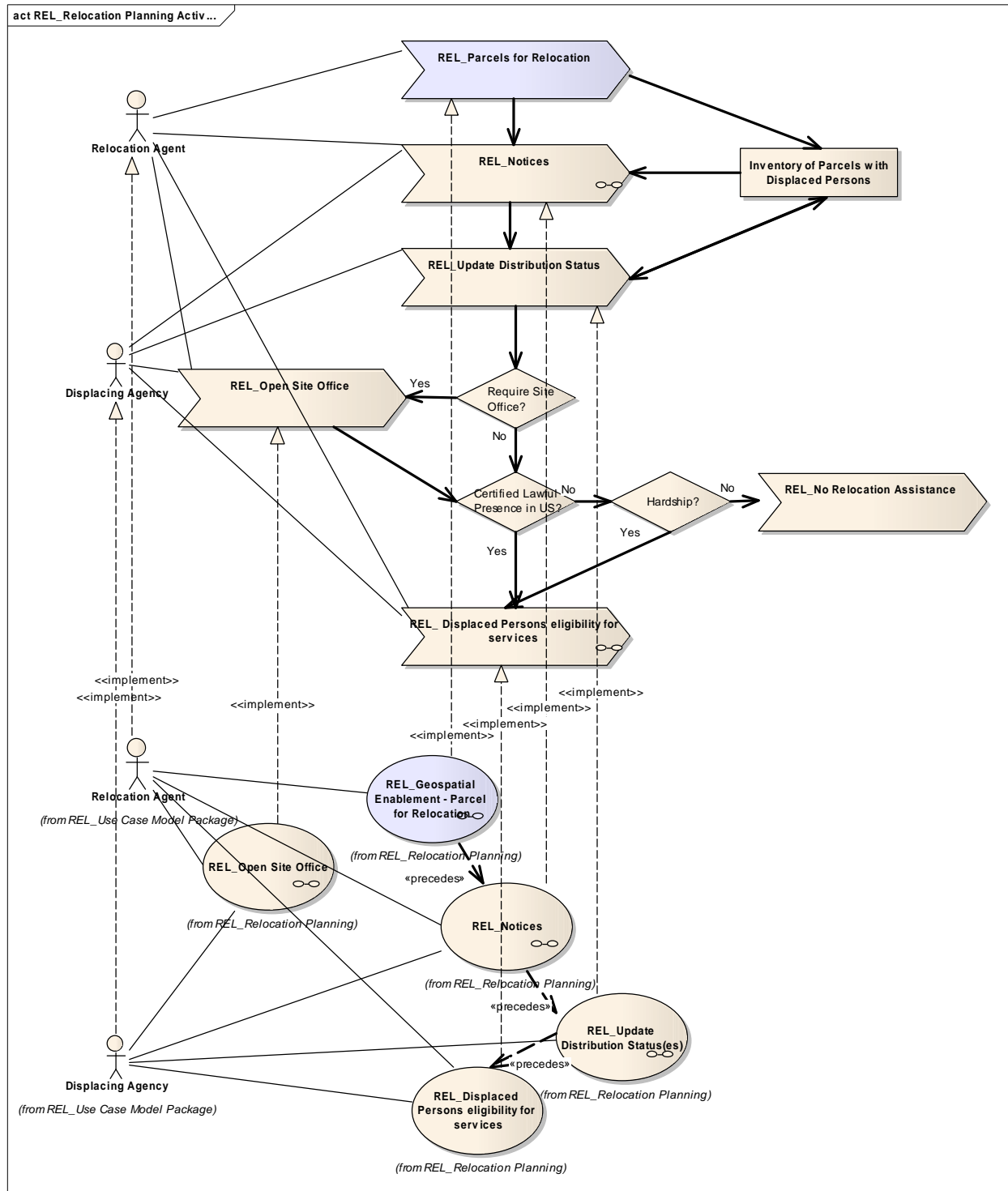


Figure B-11. Business Process Model diagram for Relocation Planning

Table B-1. List of activities captured in the Business Process Model of the right-of-way system

* Activities in bold indicate those that have further levels that are not shown in the table

LEVEL I	LEVEL II	LEVEL III	LEVEL IV*
Project Development	Project Establishment		
	Initial Planning	<ul style="list-style-type: none"> • Planning • Alignment Evaluation • Parcel Identification • Identification of Environmental impacts • Acquisition cost estimation • Relocation Survey and cost estimation • Environmental study • Hazardous Waste Site Evaluation • Final Alignment Selection 	
	Early Acquisition		
	Project Authorization		
	Project Agreement		
	Encumber Funds		
	ROW Mapping and Engineering		
	Utility Relocation and Management		
	Staff Identification	<ul style="list-style-type: none"> • Analyze Resources • Identify Staff Requirements 	
	Staff Identification	<ul style="list-style-type: none"> • Initiate Contracts • Hire Staff • Assign Staff 	
	Parcel Identification & Cost Estimation	<ul style="list-style-type: none"> • Type of acquisition • Parcel Alignment Inspection • Total Parcel • Partial Parcel • ROW Cost Estimate • Current & Completed Project Displacement Analysis • Relocation Problems Analysis • Relocation Survey • Survey of Replacement Properties 	
	Title Documents	<ul style="list-style-type: none"> • Alternate Recommended Techniques • Title Search • Title Assurance • Title Insurance • Title Abstract and Title Opinion • Certificate of Title • Temporary and Permanent Easements • Minor Acquisitions • Low Value Parcel Acquisitions 	
	Identification of Parcel Type		

Table B-2. List of activities captured in the Business Process Model of the right-of-way system (cont.)

* Activities in bold indicate those that have further levels that are not shown in the table

LEVEL I	LEVEL II	LEVEL III	LEVEL IV*
Major ROW functions	Corridor Management		
	Appraisal	APP_Parcel for Appraisal	
		APP_Initial Review	
		APP_Assign Appraiser	
		APP_Contract Appraiser	
		APP_Value Donation	
		APP_Waiver	<ul style="list-style-type: none"> • APP_Waiver of Regulation(\$10K or \$25K) • APP_Low Value Appraisal • APP_Minimum Payment Method
		APP_Process	<ul style="list-style-type: none"> • APP_Determination of Appraisal Technique • APP_Parcel Evaluate • APP_Minimum Standards Appraisal • APP_Detailed Appraisal
		APP_Appraisal Review	<ul style="list-style-type: none"> • APP_Appraisal Review • APP_Develop a new appraisal • APP_Perform Deficient Appraisal by Appraiser • APP_Prepare Review Appraisal Certificate • APP_Update Appraisal • APP_Arrange Appraisal Reviewer
		APP_Appraiser Certificate	
		APP_Establish Just Compensation	
	Acquisition	ACQ_Pre-negotiation	<ul style="list-style-type: none"> • ACQ_Additional Factors for Consideration and Processing • ACQ_Assign Negotiator • ACQ_Contract Negotiator • ACQ_Coordinate with Other Offices • ACQ_Prepare Conveyance Documents • ACQ_Prepare Notices • ACQ_Process Dedication • ACQ_Process Donation • ACQ_Start Closing Process • ACQ_Start Negotiation Process • ACQ_Transfer Federal Lands (DOD, DVA, BIA) • ACQ_Update Parcel Record
			<ul style="list-style-type: none"> • ACQ_Accelerated Negotiations/negotiations by mail • ACQ_Commencement of personal contact negotiations • ACQ_Attach Negotiator Log • ACQ_Detailed Negotiation Process • ACQ_Document and End Negotiation • ACQ_Follow up by Phone Contact • ACQ_Mail Written Offer and Acquisition Related Documents • ACQ_Obtain Property Encumbrance releases • ACQ_Prepare Documents and Update Parcel Records • ACQ_Provide Written Offer and Acquisition Related Documents • ACQ_Schedule Meeting
			<ul style="list-style-type: none"> • ACQ_Pay Just Compensation • ACQ_Prepare Settlement Statement and Deed • ACQ_Process Documents: Tax Forms, Titles, etc
		ACQ_Closing	

Table B-3. List of activities captured in the Business Process Model of the right-of-way system (cont.)

* Activities in bold indicate those that have further levels that are not shown in the table

LEVEL I	LEVEL II	LEVEL III	LEVEL IV*
Major ROW functions	Relocation	REL_Relocation Planning	<ul style="list-style-type: none"> REL_Check on the Displaced Persons eligibility for services REL_No relocation Assistance REL_Update Distribution Status(es) In the Inventory of Parcels with Displaced Persons REL_Parcels for Relocation REL_Notices REL_Open Site Office
		REL_Services	<ul style="list-style-type: none"> REL_Available Properties for Sale and Lease , Community Amenities REL_Last Resort Housing Planning REL_Link to MLS (External Real Estate System) REL_Conduct Personal Interview REL_Determination of Occupant Needs REL_Determine Eligibility for Each Type of Payments REL_Explanation of Services, Available Payments and Eligibility Requirements REL_Provide advisory assistance (Assistance with Claim forms) REL_Replacement Dwelling Assignment
		REL_Assistance Payments	<ul style="list-style-type: none"> REL_Moving Expense Process REL_Replacement Housing Payment Process REL_Claim and Tax-Form Process
	Property Management	PM_Pre-Construction Property Management	<ul style="list-style-type: none"> PM_Improvement Disposition PM_Personal Property PM_Rental PM_Requirement Type
		PM_During Construction Property Management	Grading
		PM_Post-Construction Property Management	<ul style="list-style-type: none"> PM_Excess PM_ROW Disposal PM_ROW Management PM_Sale
		PM_Rodent Control	
		PM_Security Inspection	
		PM_Hazardous Materials	
		PM_Acquired Property	
		PM_Construction	
Project Closing	Update Excess to Inventory		
	Review Project Plans		
	Accumulate and Store Records		
	Status Report		
	ROW Certification		
	State defined Processes		
	Final Claims		
	Close Accounting		
	Re-open if necessary		
	Encroachment Cleaning		
	Excess Property		
	Construction		

This model is usually represented as one or more actors associated with one or more use cases, as shown in the second half of Figure B-11. Each of the actors in the use case model represents a role that is played either by a person or sub-system engaged in the reasonable functioning of the main system; and each use case represents a discrete unit of work to be implemented by the main system in collaboration with one or more actors. For example, the use case diagram for “relocation planning” outlines five goals or use cases to be realized by the system, as required by the identified actors: displacing agency and relocation agent. These use cases are summarized in Table B-4.

Table B-4. Summary of Use Cases for Relocation Planning

Functional area (or sub-system)	Use Case(s)
Relocation Planning	REL_Geospatial Enablement – Parcel for Relocation
	REL_Open Site Office
	REL_Notices
	REL_Check on displaced persons eligibility for services
	REL_Update Distribution Status(es) in the Inventory of Parcels with Displaced Persons

Use Case Models also help in providing traceability or the manner of implementation in the proposed system for the defined business processes. The use cases identified in the model are linked back to the business process model with <<*implementation*>> links to symbolize the dependant relationship between the models. This feature is used to link model elements or sets of elements that represent the same idea across model views. For example, Figure B-11 illustrates how the business processes of relocation planning are implemented by the corresponding use cases. To elaborate further, the activity “Parcels for relocation” that is defined as identifying the parcels required for relocation, is implemented by the use case “REL_Geospatial Enablement – Parcel for Relocation” identified in the use case model. Thus, as the model is developed and all the functional processes and activities are designed and linked to the use cases, accountability for each element in the model is established through traceability.

Interaction Model Views

The use case model is further enhanced through the interaction model which is composed of sequence and communication diagrams. These diagrams are “embedded” in the use case diagrams and describe the steps taken to carry out the use case.

Sequence Diagrams

Sequence diagrams graphically portray the workflow of the implementation of a use case. These diagrams are primarily composed of objects and the messages dispatched between the objects that helps in capturing a dynamic view of the system. They typically illustrate the interaction of the user with the objects and components in the order required to execute a use case. For example, a sequence diagram anchored under the use case “Open Site Office” is illustrated in Figure B-12.

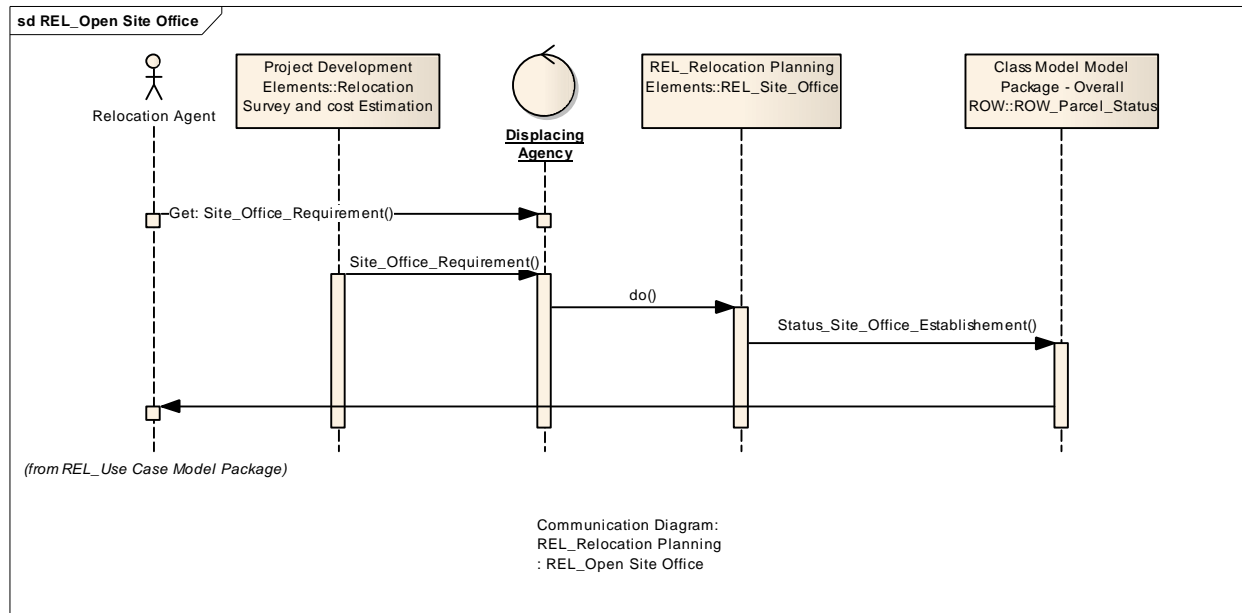


Figure B-12. Sequence Diagram for the use case ‘REL_Open Site Office’

The diagram depicts the sequence of steps implemented to realize the goal of “REL_Open Site Office”. The decision about “Site_Office_Requirement” is first made during project development prior to acquisition. This requirement is addressed by the Relocation Agent to open the site office or implement the current use case with the Displacing Agency acting as the controller. Thus, site office is opened by the displacing agency according to this requirement and the attributes of the “REL_Site_Office” class, which are described under the Class model, are updated. Simultaneously, as the decision for “Site_Office_Requirement” is made, the status of site office for the corresponding parcel file is updated. As the goal of the use case is achieved, and the attribute “Status_Site_Office_Establishment” of an instance of the class: “REL_Site_Office” is updated indicating its completion.

Similarly, the sequence diagrams for other use cases are modeled in relation to the methods and events supported by the corresponding classes.

Communication Diagrams

Communication diagrams represent a combination of information taken from Class, Sequence, and Use Case model diagrams describing both the static structure and dynamic behavior of a system. While sequence diagrams model the time ordering of messages, communication diagrams model the organization of messages, i.e., while sequence diagrams show the order in which the interactions take place, communication diagrams represent which elements interact with one another. The communication diagrams are also “embedded” in the corresponding use cases.

Figure B-13 shows the communication diagram for the use case “REL_Open Site Office”. Though semantically it provides the same information as that of the sequence diagram in Figure B-12, it depicts the inter-object relationships and the exchange of messages among Relocation Agent, Displacing Agency, Status_Site office and the instance of the class “REL_Site Office”. The exchanged communications are labeled in the diagram as 1.1, 1.2, 1.3, and 2.1 to illustrate the order of the messages exchanged.

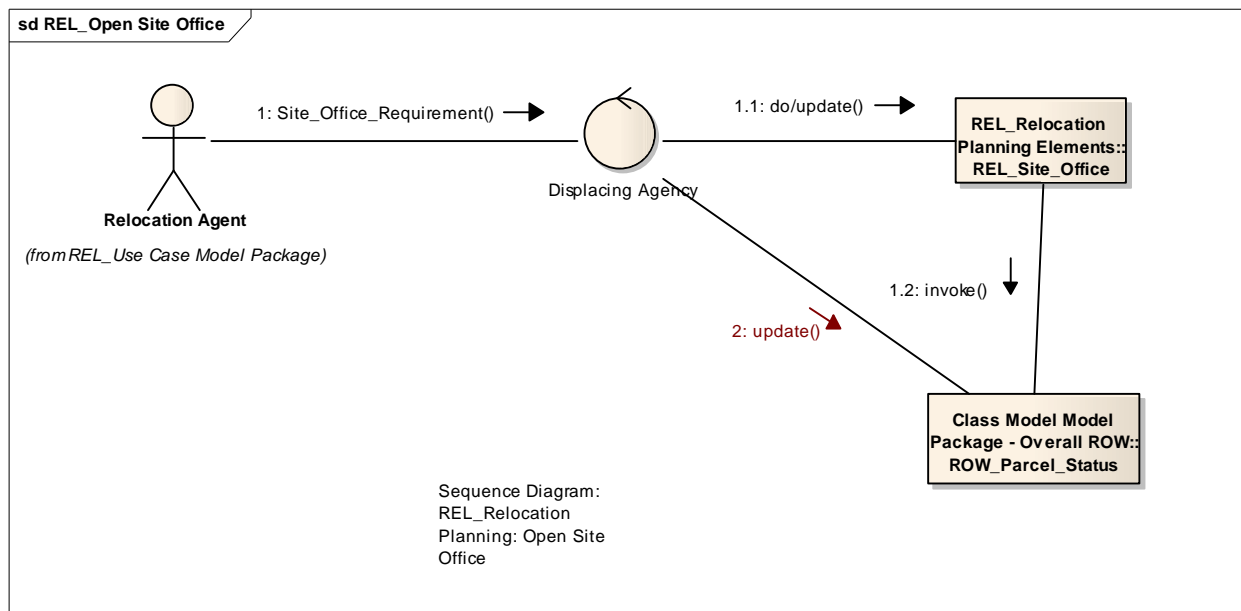


Figure B-13. Communication Diagram for the use case 'REL_Open Site Office'

Structural Model Views

Class Model

A class is defined as an element or an entity of a given system that captures certain unique features and functionalities of the entity in the form of attributes and methods. A class model provides an overview of these classes, attributes and their relationships. These diagrams reflect a static view of the system by depicting what classes interact but not what happens with their interaction. Class models are the basis for the system's data model.

For the right-of-way 8-55A *logical model*, the class model has been developed in reference to the Business Process Model. The class model for the current system is developed in a way that is independent of any language/platform. The classes in this model are comprised of three elements, the class name, attributes of the class and their behavior. Figure B-14 illustrates the class diagram for "relocation planning", which is a part of the class model for relocation. The class diagram in the figure depicts the following classes:

- REL_Notices
- REL_Site_Office
- REL_Relocation_Planning_Information
- REL_Additional Relocation information

Realization and association connectors are used to capture the relationships between these classes. REL_Relocation_Planning_Information and REL_Additional Relocation information classes are connected with a realization, which is used when the source object implements or realizes the destination. Since class diagrams provide a static view of the system, not all classes are modeled to have relationships with other elements in the model, like the REL_Site_Office shown in Figure B-14.

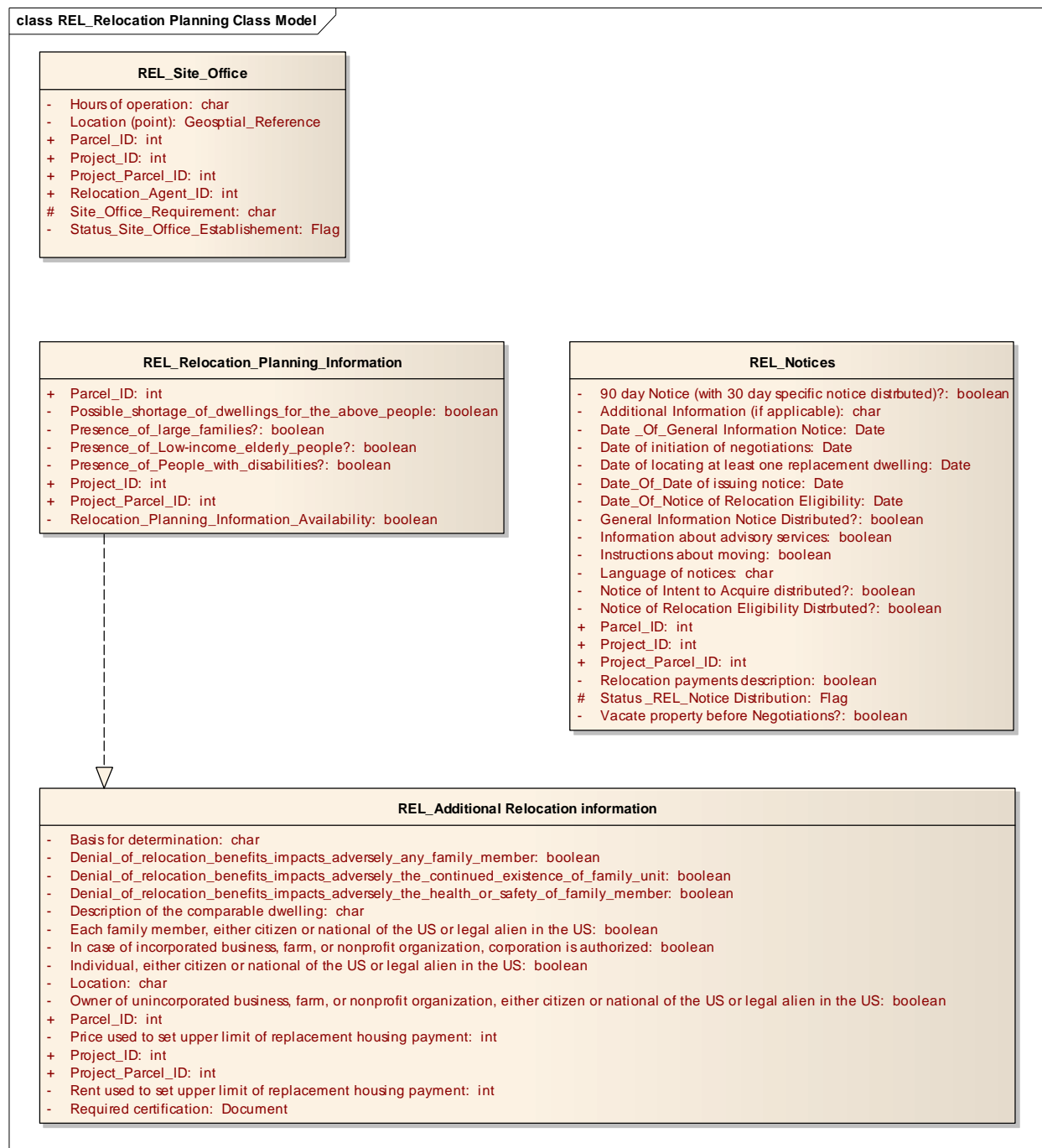


Figure B-14. Class Model diagram for Relocation Planning

Separate compartments are used in the representation of classes to illustrate the class name, attributes, and operations. For the classes depicted in Figure B-14, the compartment below the class name lists their respective attributes. The notation that precedes the attribute indicates the visibility of the element according to the following:

- + Symbol indicates public level of visibility
- Symbol indicates the attribute is private
- # Symbol indicates the attribute is protected

Data elements identified in NCHRP Research Results Digest 310 for Integrating Geo-Spatial Technologies into Right-of-Way Data Management Process (Hancock 2006) helped in providing the necessary knowledge base for modeling the classes and their attributes for the enterprise-wide right-of-way logical model.

Component Model

The component model shows the structural components of a software system along with the organization and dependencies among these components. This model, like the class model, represents a static view of the system depicting the components that contain one or more classes or interfaces. The components act as the building blocks for the actual information system. Thus, the component model diagrams help provide a higher level view of the structure of the large and complex right-of-way 8-55A *logical model*.

Figure B-15 shows the component model diagram for relocation planning linked with different UML “connectors”. The five planning components shown in Figure B-15 include:

- Displacing Agency
- Notices
- Site_Office
- Parcel
- Planning Department

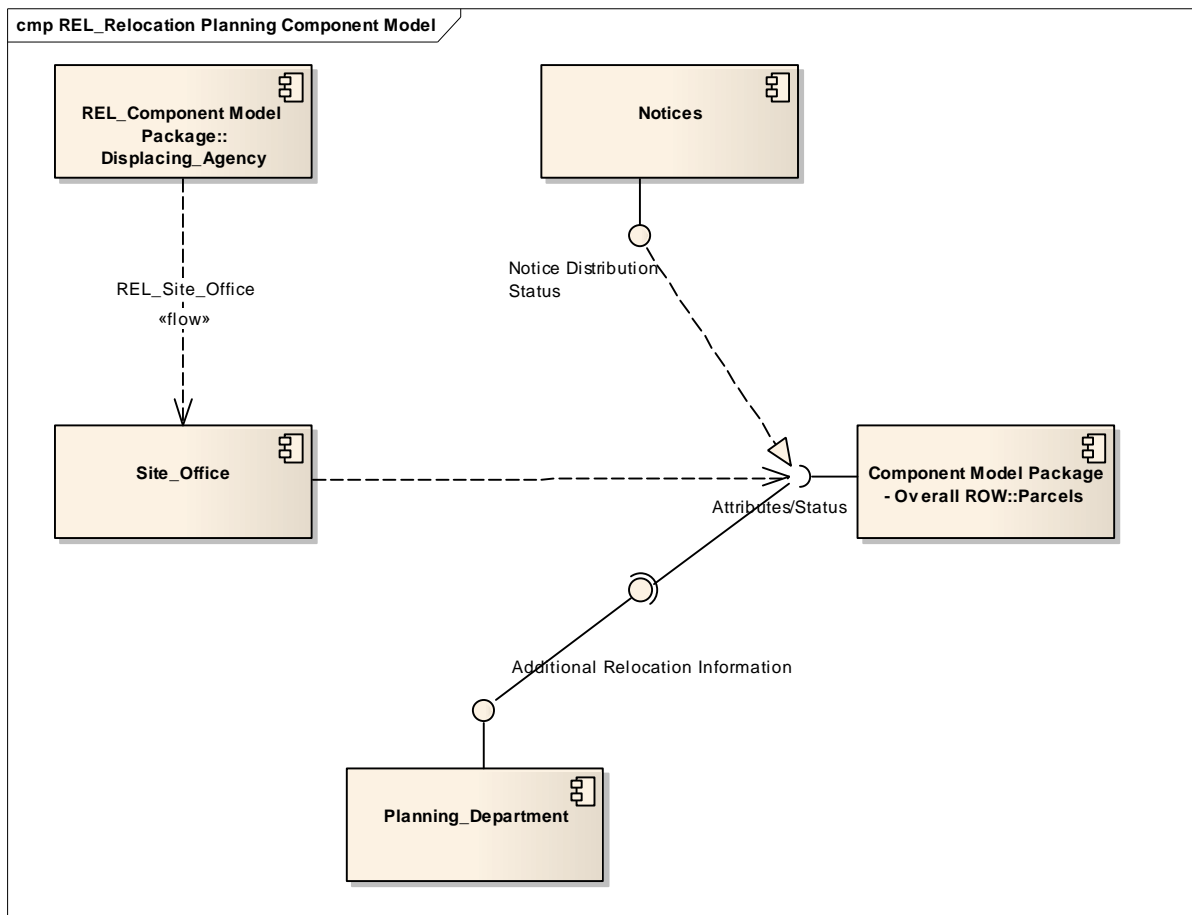


Figure B-15. Component Model diagram for Relocation Planning

The names of those components that are derived from another package in the overall model are preceded with the deriving package name, as seen for the components `Displacing_Agency` and `Parcel` which are derived from the primary `REL_Component Model Package` and `Component Model Package-Overall ROW`, respectively. The inter-relationships between the components are illustrated with different connectors as shown in Figure B-15. The “assembly connector” links the providing interfaces supplied by the `Planning_Department` to the required interfaces specified by the `Parcel`. A lollipop symbol indicates an implemented interface and a socket symbol indicates a required interface as shown in the Model Documentation. Additional Relocation Information from the planning department acts as the providing interface to update the required interface of the `Parcel: Attributes/Status`. Similarly, notice distribution status acts as the provided interface for the `Notices` component. Information flow is used to model the flow of information between elements, and is used in Figure B-15 to map the flow between the `Displacing Agency` and `Site_Office` and `Site_Office` and the `Parcel`.

Package Model

The package model helps in establishing localized system boundaries within the enterprise by grouping coupled activities within the system. It helps in semantically providing a structure to all UML model views, includes the larger system engineering issues, and illustrates how the system is decomposed into categories that represent the logical relationships and dependencies among those categories.

Each of the use case, class, and component models is grouped by their related behavior or state into packages. For example, as shown in the Figure B-16, the use case model for relocation has been grouped into three packages:

- `REL_Relocation Planning`
- `REL_Relocation Services`
- `REL_Relocation Assistance Payments`

The dependencies between the three packages is captured through the connectors labeled as `<<precedes>>`, indicating the order of implementation of these packages. As shown in the diagram, use cases grouped under `REL_Relocation Planning` package model are implemented prior to both the `REL_Services` and `REL_Relocation Assistance Payments`.

Interactions between the major actors and packages are also illustrated in the package diagram. The dependency connector with the labels `<<invokes>>` and `<<trace>>` between the `Relocation Agent`, `Displacing Agency` and the packages in Figure B-16, illustrate the role of the actors in these packages either as directly invoking or tracing the implementation of the corresponding use cases in the package.

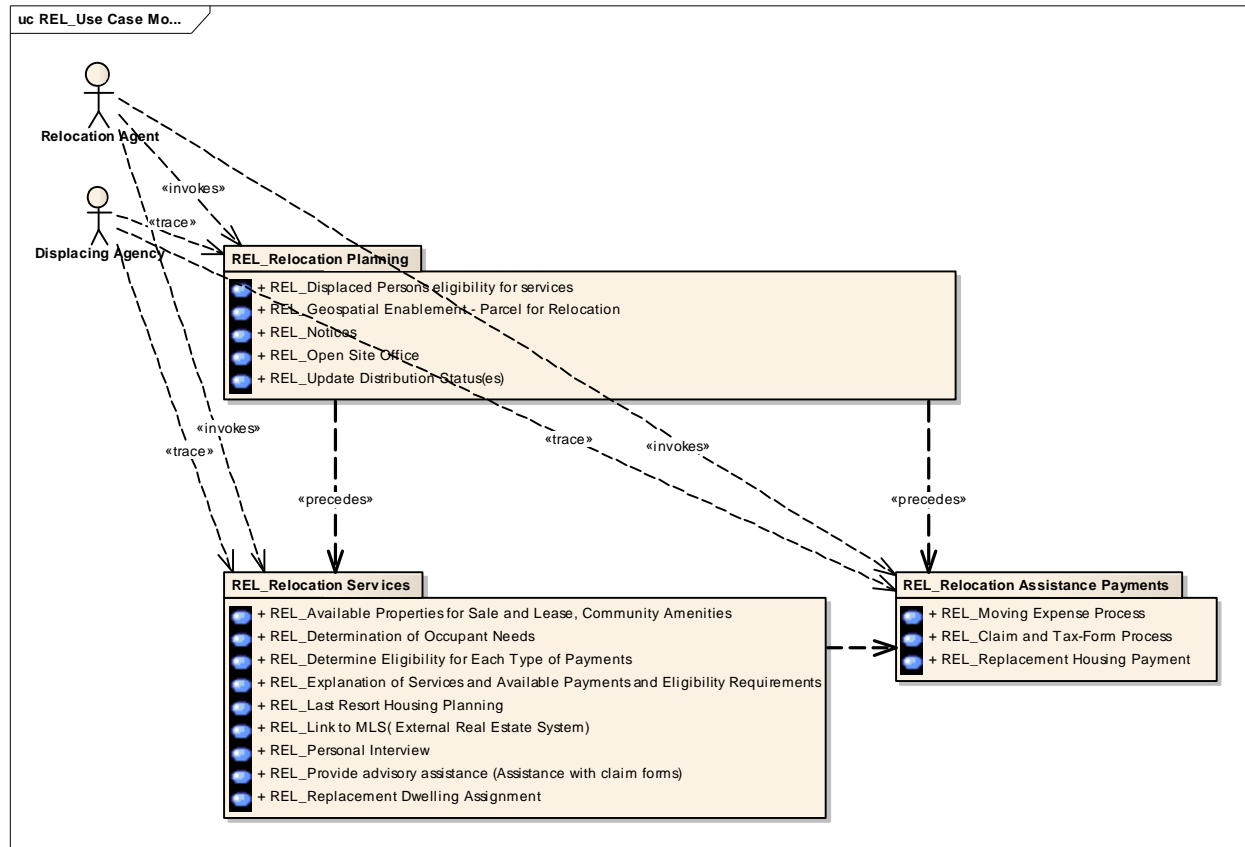


Figure B-16. Package model diagram illustrating Relocation Use Cases packages

Geospatial Model

This section describes the model designed for integrating a right-of-way business and information system with geospatial tools through a framework called ‘Geospatial Decision Making Activities’ (GDMA). This framework has been structured in two sub-components, Parcel Tracking (PT) and Geospatial Enablement (GE). Parcel Tracking tracks the detailed state of a parcel, as it is managed through the right-of-way project. Geospatial Enablement identifies the potential right-of-way activities that could benefit from geospatial enablement. The GDMA framework, through the combined Parcel Tracking and Geospatial Enablement, is expected to serve as a knowledge base for right-of-way offices in state transportation agencies for integrating geospatial capabilities to better manage the right-of-way business process.

The two sub-components of GDMA, are modeled in UML using State Machine and Data Flow Diagram Models, respectively, using Enterprise Architect.

Parcel Tracking

The primary objective of parcel tracking is to provide a visual method to track activities associated with parcels, manage resources, and provide right-of-way personnel with a tool for improving efficiency and timely project delivery. Information associated with Parcel Tracking indicates status of a key process, availability of important information for future right-of-way activities, or occurrences of certain right-of-way decisions. This information is divided into three categories; *milestones*, *flags*, and *values*. Milestones represent critical activities in right-of-way project management and act as project checkpoints. Milestones can either take a *value* or a *flag*, and serve as progress markers. For example, the identified milestones for parcel appraisal include, Appraisal Technique, Status: Appraisal Review, and Just Compensation. These three milestones indicate, respectively, the decision on the appraisal technique for parcel, status of completion of appraisal review, and the availability of just compensation value, which are critical to monitor the progress of appraisal. *Flags* capture the status of activities or processes within each functional area of right-of-way business, and help to monitor the project’s progression. For example, the parcel tracking attribute “Status: Appraiser Assignment” captures the state of progress or completion of the task of assigning an appraiser for the parcel. *Values* capture important information about parcel features that support project scheduling, and which help to visualize and evaluate parcels in a geospatial environment. For instance, “Appraisal type” is an important decision during parcel appraisal, and is captured as a value in Parcel Tracking.

Figure B-17 shows the representation of attributes or states of the parcel tracking framework in a logical process flow chart, and Table B-5 through Table B-8 summarize these modeled states including a brief description. The states or attributes of parcel tracking correspond to the activities modeled in the overall logical model as described in the previous section, in accordance with the Project Development Guide (FHWA 2006).

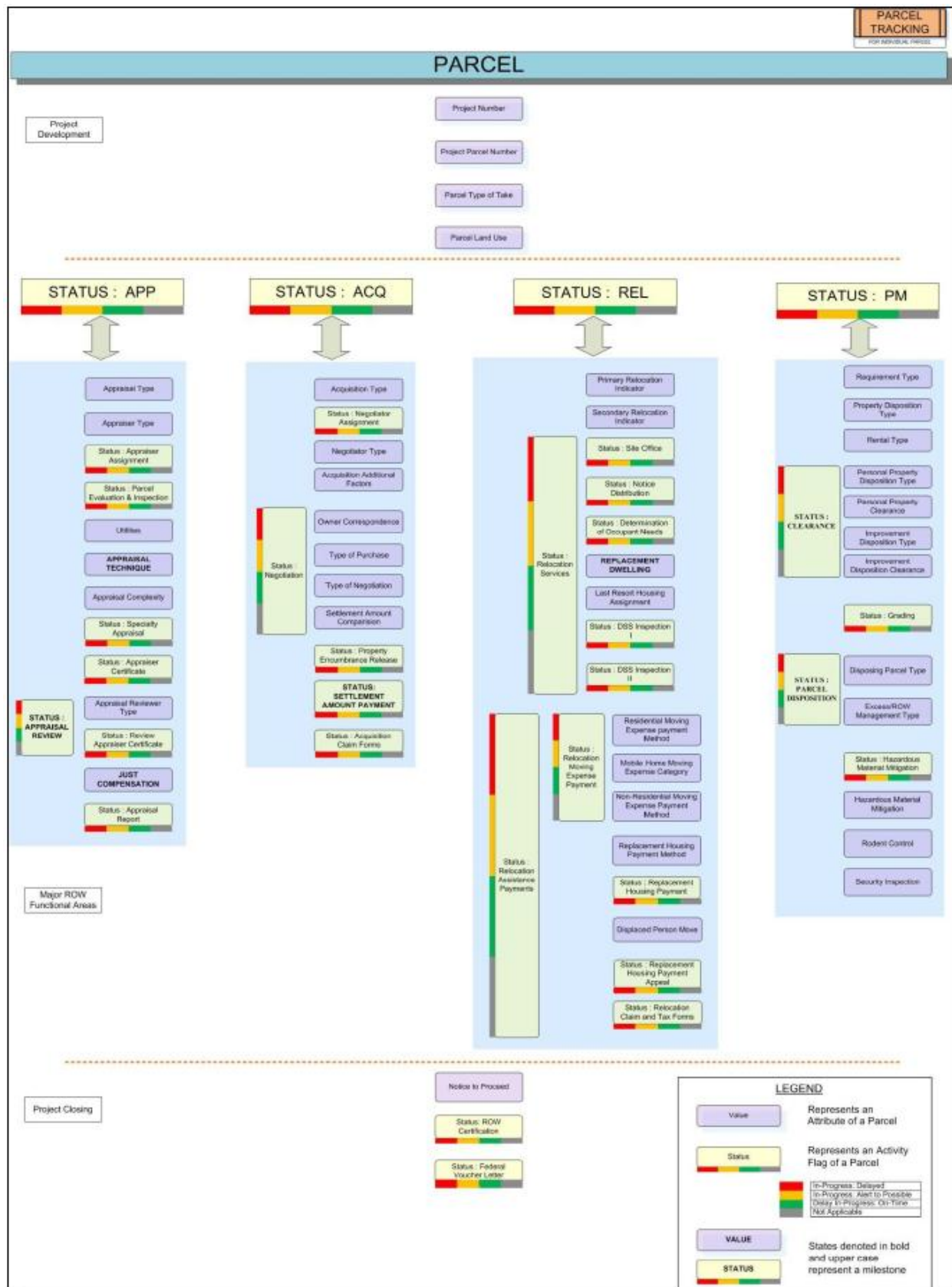


Figure B-17. Logical flow chart for Parcel Tracking

Table B-5. Attributes or States in Parcel Tracking: Project Development and Appraisal

**Attributes/States in bold represent milestones for parcel tracking*

	Attribute/State*	Type	Description
Project Development	Project Number	Value	Project associated with parcel. Number generated by the Project Management System.
	Project Parcel Number	Value	Unique parcel number that is project specific. Parcel status is tracked through the right-of-way project process using this number.
	Parcel Type of Take	Value	Identifies whether whole take or a partial take. May take the values: Whole/Partial.
	Parcel Land Use	Value	Identifies the highest and best use of parcel. Available land use or zoning classification for parcel obtained from primary parcel cadastre database. Parcel land use types could include: Residential, Industrial, Commercial, Recreational, Special purpose, Agricultural, Undeveloped.
Appraisal	Status: APP	Flag	Indicates progress of parcel appraisal. Activated at initiation of appraisal process.
	Appraisal Type	Value	Indicates type of parcel valuation as: Donation; Waiver; or Appraisal. The type of appraisal can also be defined as the 'format required' for appraisal based on these three types.
	Appraiser Type	Value	Identifies type of Appraiser employed. May take the value: staff / fee (contract) appraisers.
	Status : Appraiser Assignment	Flag	Indicates appraiser assignment progress. Is activated at initiation of assignment.
	Status : Parcel Evaluation & Inspection	Flag	Initiated when parcel is evaluated after the parcel visit
	Utilities	Value	Identifies if any utilities have been identified on the parcel. May take a value describing the specific utility, or N/A if none identified.
	Appraisal Technique	Value	Identifies the method employed for appraisal or valuation. May take the value: Minimum Standards Appraisal-Short Appraisal, Minimum Standards Appraisal-Value Finding Appraisal, Detailed Appraisal-Cost Approach, Detailed Appraisal-Sales comparison, Detailed Appraisal-Income Approach or others as defined by agency.
	Appraisal Complexity	Value	Identifies the complexity of appraisal process for parcel. May take a value that captures a categorical or relative value based on factors that affect the time and resources required to appraise parcel. This state can also help in tracking parcel assignment load of individual appraisers.
	Status : Specialty Appraisal	Flag	Is activated if a specialty appraisal is warranted.
	Status : Appraiser Certificate	Flag	Is activated when the preparation of the certificate is initiated by the appraiser.
	Status : Appraisal Review	Flag	Is activated at the initiation of the Appraisal Review process.
	Appraisal Reviewer Type	Value	Identifies type of appraisal reviewer employed for the parcel. May take the value: staff / fee (contract).
	Status : Review Appraiser Certificate	Flag	Is activated when preparation of the certificate by the review appraiser is initiated.
	Just Compensation	Value	Identifies the progress of establishing just compensation. May take the value: Established / Approved.
	Status : Appraisal Report	Flag	Is activated when preparation of appraisal report is initiated.

Table B-6. Attributes or States in Parcel Tracking: Acquisition

**Attributes/States in bold represent milestones for parcel tracking*

	Attribute/State*	Type	Description
Acquisition	Status: ACQ	Flag	Indicates progress of parcel acquisition. Activated at initiation of acquisition process.
	Acquisition Type	Value	Identifies type of acquisition. May take the value: Federal, Dedication, Donations or Purchase.
	Status : Negotiator Assignment	Flag	Is activated when negotiator is assigned.
	Negotiator Type	Value	Identifies the type of negotiator employed. May take value: staff / contract.
	Acquisition Additional Factors	Value	Identifies additional factors that might affect the negotiation/acquisition process. May take values: assessments, functional replacement, inverse condemnation, uneconomic remnants, tenant-owned improvements, owner retention of improvements, Hardship and protective buying, railroad parcels, N/A.
	Status : Negotiation	Flag	Is activated at commencement of negotiations.
	Owner Correspondence	Value	Identifies correspondence to the owner. May take the value: personal contact, accelerated mail, other means.
	Type of Purchase	Value	Identifies category of parcel for acquisition. May take values: ROW / Uneconomic Remnant.
	Type of Negotiation	Value	Identifies the negotiation method employed. May take values: Administrative Settlement, Alternate Dispute Resolution (ADR), Legal/Condemnation, or methods defined by the state.
	Settlement Amount Comparison	Value	Compares the final settlement amount with the established just compensation. May take values: Same as Just Compensation, More than just compensation.
	Status : Property Encumbrance Release	Flag	Is activated when efforts are initiated to obtain property encumbrance releases on the parcel.
	Status: Settlement Amount Payment	Flag	Is activated when closing documents and other tax related forms are processed. Status is completed when final payment is made available to the owner.
	Status : Acquisition Claim Forms	Flag	Is activated when final acquisition claim forms are processed.

Table B-7. Attributes or States in Parcel Tracking: Relocation

**Attributes/States in bold represent milestones for parcel tracking*

	Attribute/State*	Type	Description
Relocation	Status : Site Office	Flag	Indicates if parcel has associated site office, as identified during project dev
	Status : REL	Flag	Activated when parcel is identified as requiring relocation services and relocation process is initiated
	Primary Relocation Indicator	Value	Identifies type of relocation based on property or person to be displaced. May take values: Residential, Non-Residential, Personal Property, state defined, N/A
	Secondary Relocation Indicator	Value	More specific identification of type of relocation. This indicator identifies categories under each general relocation indicator. May take values: <u>Residential</u> <ul style="list-style-type: none"> Persons eligible to receive advisory services Persons occupying real property to be acquired Persons occupying real property adjacent to that being acquired who are caused substantial economic injury by the acquisition; Persons who, as a result of the project, move or move personal property from real property not being acquired for the project; Persons who move into property after acquisition, aware they have to move <u>Non-residential relocation.</u> <ul style="list-style-type: none"> Business Farm Non-profit organization (NPO). Commercial sign, billboard (or similar) <u>Personal Property</u> <ul style="list-style-type: none"> Disposal Moved by Owner
	Status : Relocation Services	Flag	Is activated at the initiation of relocation service offer at interview with owner
	Status : Notice Distribution	Value	Indicates progress of distribution of notices to the displaced person
	Status: Determination of Occupant Needs	Flag	Is flagged based on the progress of the identification and establishment of the needs the displaced person(s)
	Replacement Dwelling	Value	Identifies the status of identified comparable dwelling. May take values: Assigned, Accepted, Referred, Not available, Not accepted
	Last Resort Housing Assignment	Value	Identifies LRH. May take value: Assigned, Accepted, Referred, Not available, Not accepted
	Status : DSS Inspection I	Flag	Is activated at completion of first DSS Inspection
	Status : DSS Inspection II	Flag	Is activated at completion of second DSS Inspection
	Status : Relocation Assistance Payments	Flag	Is activated at initiation of the process to provide assistance payments. Is concluded when all eligible payments are made & all relevant forms processed
	Status : Relocation Moving Expense Payment	Flag	Is activated at completion of moving expense payments
	Residential Moving Expense Payment Method	Value	Identifies method employed for establishing amount for moving eligible items for residential relocation. May take values: Actual cost method; Schedule method; Self-Move; or state defined
	Mobile Home Moving Expense Category	Value	Identifies category of moving expenses for mobile home. May take values: Owner and occupant; Owner not occupant, or Tenant
	Non-Residential Moving Expense Payment Method	Value	Identifies method employed for establishing moving and business reestablishment costs, farm, or a non-profit organization (NPO). May take values: Actual Cost Method; Fixed in-lieu Payment; Self-Move; or state defined
	Replacement Housing Payment Method	Value	Identifies method employed for establishing replacement housing payment. May take values: RHP with Home Owner for at least 180 Days; RHP Home Owner for 90-179 days, Tenants at Least 90 Days; RHP tenant less than 90 days.
	Status : Replacement Housing Payment	Flag	Indicates progress of replacement housing payment to displaced person(s).
	Displaced Person Move	Value	Status of displaced person's move. May take values: Scheduled, Moved, N/A.
	Status : Replacement Housing Payment Appeal	Flag	Is activated if an appeal is initiated.
	Status : Relocation Claim and Tax Forms	Flag	Is activated when processing is initiated for final relocation tax and claim forms. Is concluded when all forms are processed and relocation payments are made available to the displaced person or organization.

Table B-8. Attributes or States in Parcel Tracking: Property Management and Project Closing

**Attributes/States in bold represent milestones for parcel tracking*

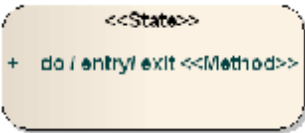


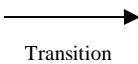
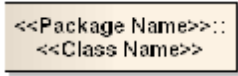
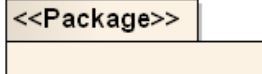
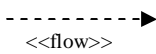
	Attribute/State*	Type	Description
Property Management	Status : PM	Flag	Is activated with the initiation of Property Management activities when parcel is acquired.
	Requirement Type	Value	Identifies parcel requirement type. May take values: Substantially excess / Substantially ROW.
	Rental Type	Value	Identifies type of property rental. May take values: Rent to original occupant, Interim Tenant, N/A.
	Property Disposition Type	Value	Identifies type of property disposition. May take values: Improvements, Personal Property, Rental.
	Personal Property Disposition Type	Value	Identifies personal property disposition. May take values: Agency Retention, Sale, Demolition, N/A.
	Improvement Disposition Type	Value	Identifies type of improvement disposition. May take values: Agency Retention, Sale, Demolition, N/A.
	Status : Clearance	Flag	Is activated when parcel is identified for clearance. Is concluded when parcel is clear or certified for construction.
	Personal Property Clearance	Value	Identifies required percentage of Personal Property Clearance.
	Improvement Disposition Clearance	Value	Identifies percentage of Improvement Disposition Clearance.
	Status : Grading	Flag	Indicates the status of grading according to the defined flag codes.
	Disposing Parcel Type	Value	Identifies type of parcel for disposition. May take values: ROW, Excess, or more specific like access point.
	Status : Parcel Disposition	Flag	Is activated when parcel (excess/row) is identified for disposition and is flagged for completion when the parcel is sold.
	Excess/ROW Management Type	Value	Identifies how the excess land or ROW, which is no longer required, is managed when it is not disposed. May take the values: Rent, Lease, Internal Maintenance, or Other.
	Status : Hazardous Material Mitigation	Flag	Is activated when parcel is identified as requiring mitigation of hazardous materials. Is concluded when hazardous materials have been mitigated.
	Hazardous Material Mitigation	Value	Identifies type of required Hazardous Mitigation.
	Rodent Control	Value	Identifies rodent control activities. May take values: Single occurrence, Under contract, NA
	Security Inspection	Value	Identifies security inspection activities. May take values: Single occurrence, Under contract, NA
Proj	Notice to Proceed	Value	Identifies type of notice to proceed which is issued prior to the construction. May take values: Outstanding, Conditional, Final Notice.
	Status : ROW Certification	Flag	Is activated when ROW certificate is issued.
	Status : Federal Voucher Letter	Flag	Is activated when final federal voucher letter is submitted.

Parcel Tracking State Machine Model

State Machine diagrams, also referred to as State Diagrams, illustrate states of an object and the transitions between those states, along with the source or triggering events that cause state changes (Ambler 2004). State machine diagrams provide a dynamic modeling technique to capture the behavior of an instance of a single class within a system. In its broad sense, a state represents a particular stage in the behavioral pattern of an object. In a state diagram, these states are represented in rounded rectangles labeled with their name. Transitions between states are

triggered from events. These triggering events invoke the corresponding methods of a state that result in the change of state of an object. These methods are displayed in the compartment below the name of a state, and are preceded by the reserved words “do/entry/exit” indicating the action of the operation. Table B-9 provides an overview of the elements used in this State Machine Model.

Table B-9. State Machine Diagram Elements Representation Description

Representation	Description
	<ul style="list-style-type: none"> State : Represents a stage in the behavior pattern of an entity Method : Represents a UML operation (Captured in the compartment below the state name)
	<i>Initial element</i> : Represents a pseudo-states indicating the start of flow
	<i>Exist Point</i> : Represents a pseudo-states indicating where the flow is exited
	<i>Transition</i> : Defines logical movement from one state to another
	<i>Class</i> : Represents an object that reflects its structure and behavior within the system through its <i>attributes</i> and <i>methods</i> . Class name precedes the source package name in the class model
	<i>Package</i> : Contains a collection of classes grouped under a common name.
	<i>Information flow</i> : Represents flow of information between two elements in the diagram

The Parcel Tracking (PT) State Machine Diagram captures the states of a parcel to assist in visually following its status through the ROW project process. A parcel undergoes several state changes during its lifecycle, from identification as a right-of-way parcel to project closing, and allocation as excess or right-of-way. These changes are based on corresponding ownership details, property valuations, legal procedures, and relocation activities, which are triggered by different personnel and, in some cases, by contractors. The State Diagram Model for Parcel Tracking, shown in Figure B-18, maps parcel data across the enterprise and captures the appropriate attributes from the right-of-way data or class model that triggers the state changes.

The initial transition for parcel tracking is denoted by the *Initial* element, representing the default state of parcel at the start of parcel tracking or a right-of-way project. In most right-of-way offices this initial state could be triggered by the right-of-way activity start date. An event that enables the parcel transition from one state to another state is reflected through the triggered operation, and captured under the *state method*. For example, the *state* “Project Number” is controlled by the *method* “entry/Project_ID”. Methods within the states are controlled by the attributes of *classes* modeled in the overall right-of-way system. The triggering methods for each

parcel *state* are captured in the model using an *information flow* directed from the source *classes* or *packages*. Tracing the information from the overall class model maintains the integrity of Parcel Tracking model with the overall right-of-way logical model.

A triggered *method* may not always readily obtain the necessary information from the overall logical class model in the right-of-way system. Sometimes the actions are abstracted to derive the relevant information from one or more related *classes* and/or *class packages* of the overall logical model. Such states are identified in blue text in Figure B-18. For example, for the *state* “Appraisal Type”, the *attribute* “Appraisal_type” is derived from the “APP_Appraisal Process Elements” *package* and “APP_Waiver_Establish_Value” *class*.

The states in the model represent the attributes of the parcel class which are categorized as milestones, flags, and values. Milestones are highlighted in yellow *states*, while flags are shown in red text, to provide visual clarity to the model. All parcel attributes that include flags, values and milestones, are linked to the overall class model with the *information flow* connector. Attributes categorized as flags, may have a value or be updated to denote progress or completion stage based on timestamps governed by the start and end dates of associated composite activities. With this understanding of *flag*, various states in the PT model, categorized reflect the progress of a corresponding activity for the parcel, allowing the parcel to be accordingly visualized in a geospatial environment. For example, the *state* “Status : Parcel Evaluation & Inspection”, reflects the progress of the activity for parcel evaluation. This flag state can take multiple values or status based on when contact is made with the owner or when the parcel is evaluated after the parcel visit. Along with other parcel *states*, these flags are described accordingly in Table B-9, but are not modeled at a greater level of detail due to diverse protocols that govern the implementation and execution of flags for each individual activity.

Four major states “Status_APP, Status_ACQ, Status_REL and Status_PM”, are designed as Composite states, with enclosed sub-states. These composite states model more complex behavior of the system when there is more than one hierarchical level. For example, these states are updated as the parcel traverses through related activities within the individual functional areas for Appraisal, Acquisition, Relocation and Property Management, respectively. The complete PT State Diagram Model is illustrated in Figure B-18 to Figure B-23.

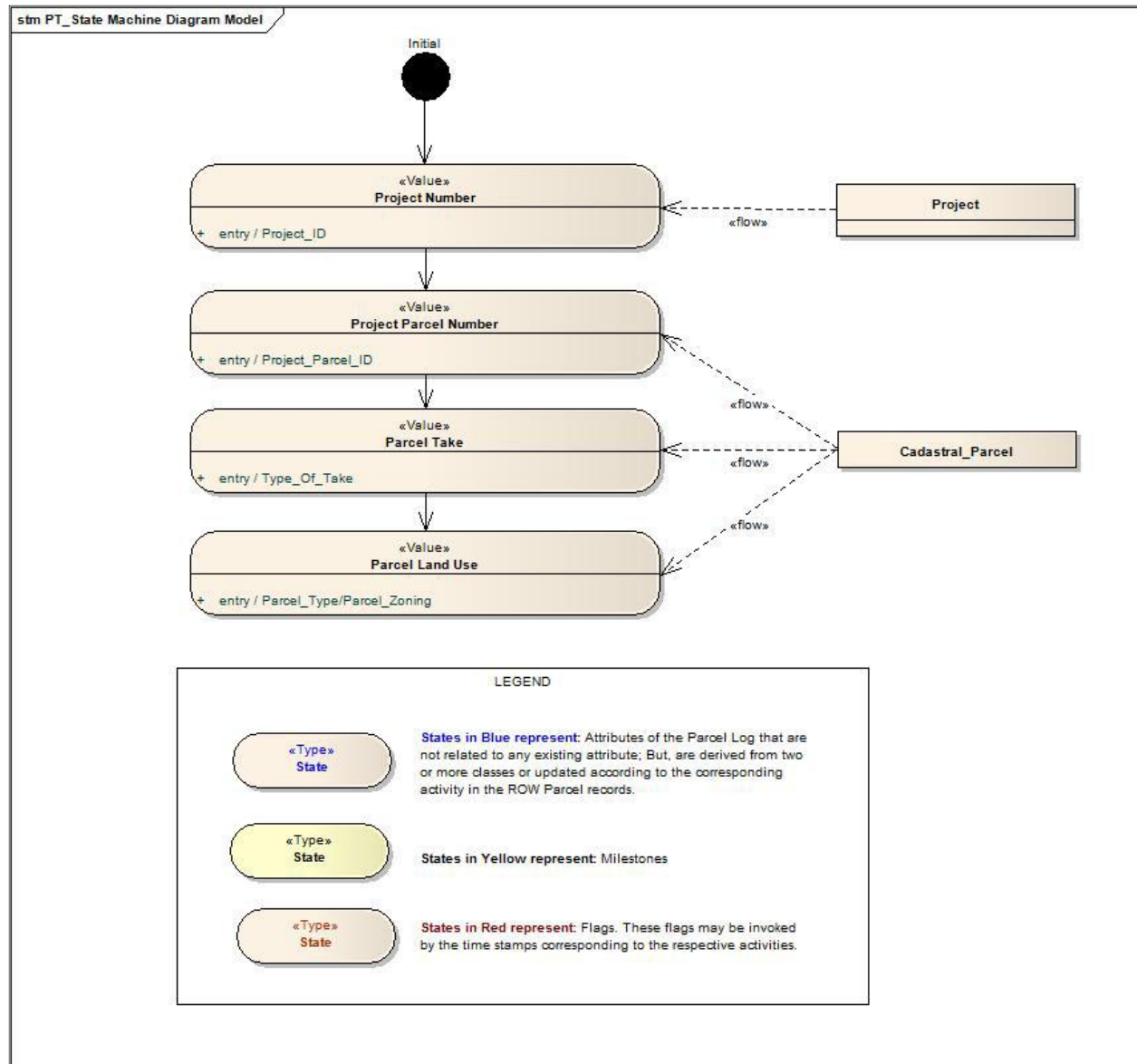


Figure B-18. Parcel Tracking State Machine Model Diagram

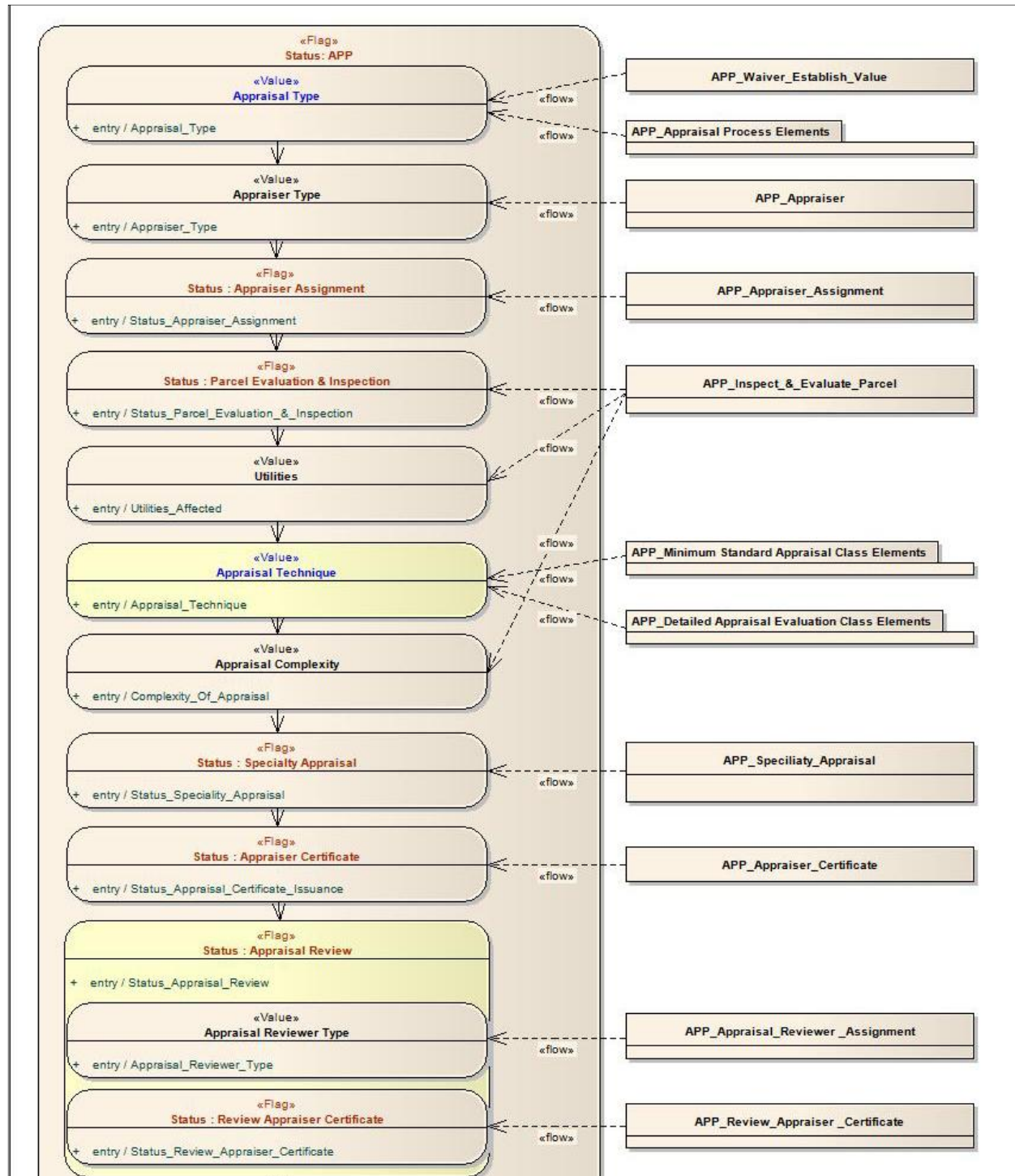


Figure B-19. Parcel Tracking State Machine Model Diagram (Cont.)

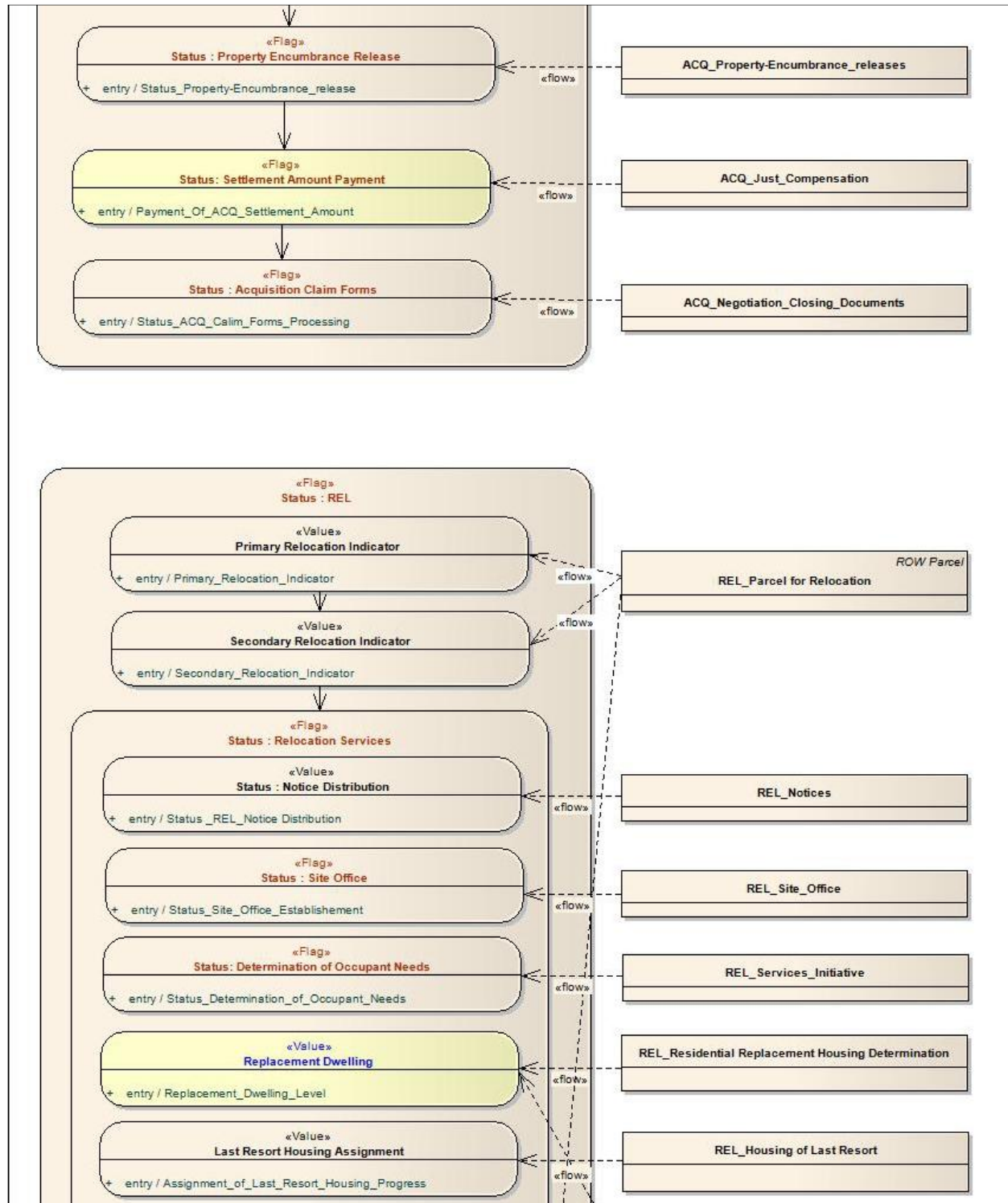


Figure B-20. Parcel Tracking State Machine Model Diagram (Cont.)

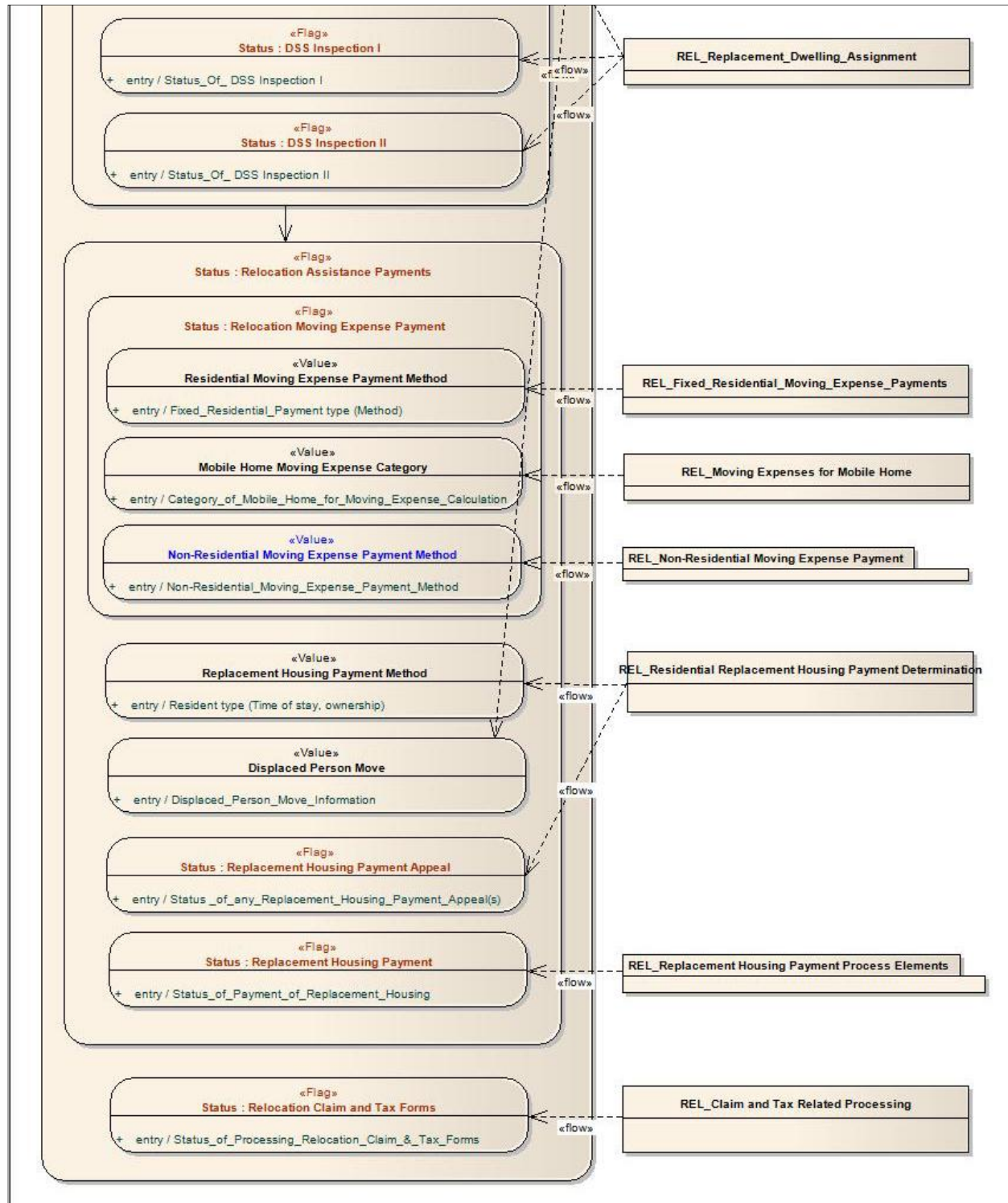


Figure B-21. Parcel Tracking State Machine Model Diagram (Cont.)

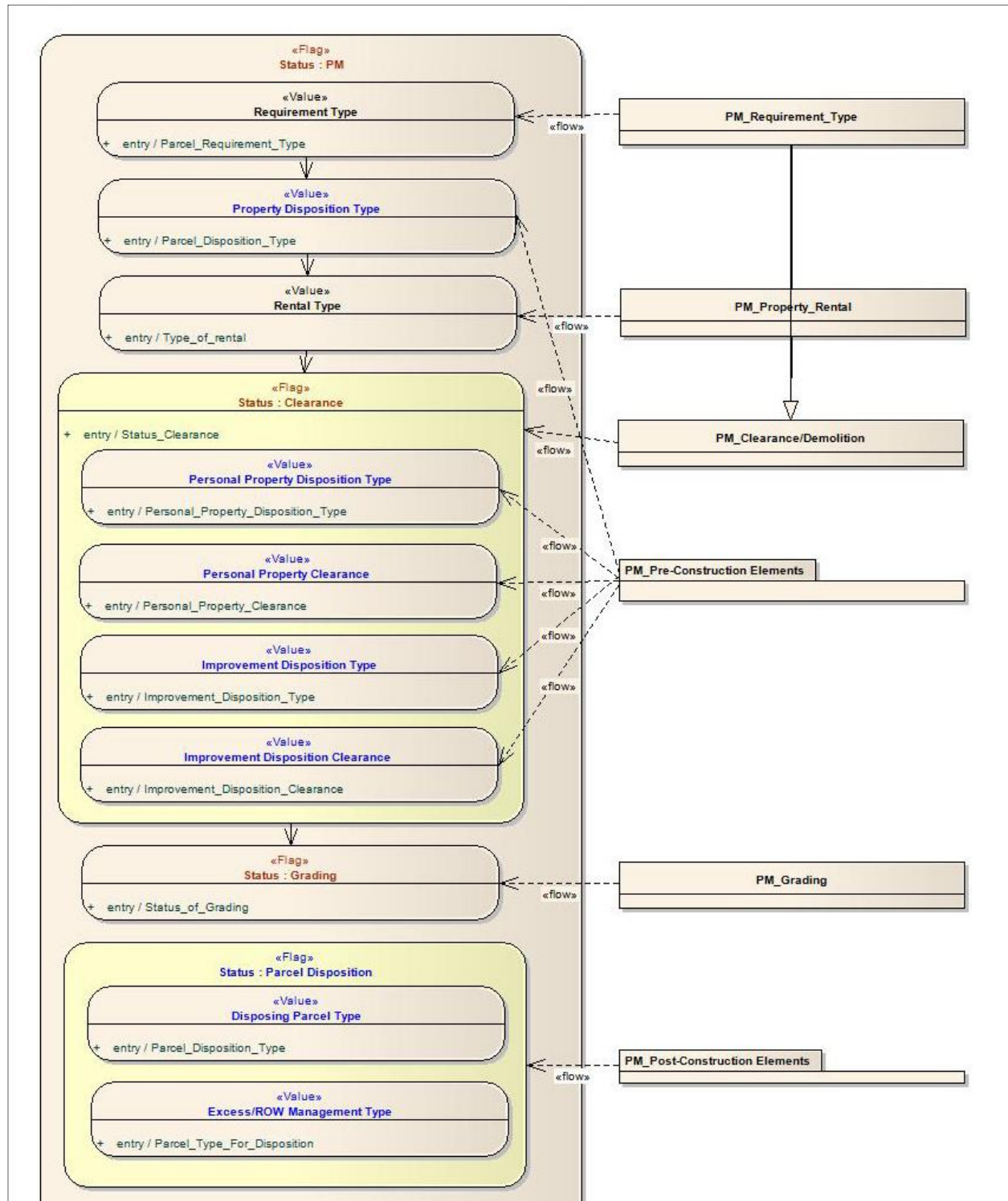


Figure B-22. Parcel Tracking State Machine Model Diagram (Cont.)

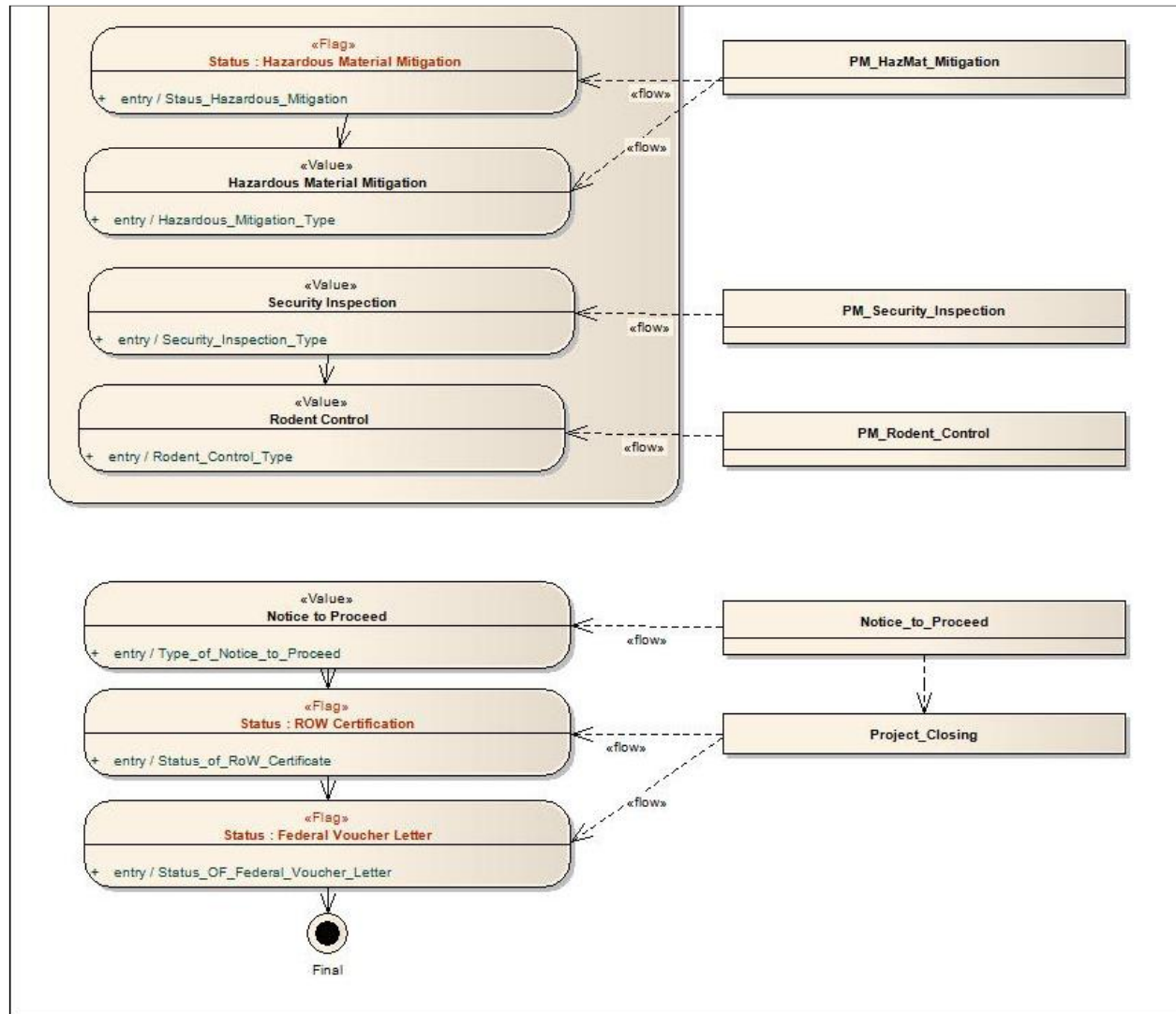


Figure B-23. Parcel Tracking State Machine Model Diagram (Cont.)

Geospatial Enablement

Geospatial Enablement models activities that could benefit from geospatial visualization and analysis within the right-of-way office. In addition to specifying the activity, it also identifies the required geospatial data, other external resources, and components required to accomplish that activity in a geospatial environment.

Activities that could benefit from geospatial enablement along with possible geospatial layers are summarized in Table B-10 while Table B-11 describes the enablement of these activities in greater detail.

Table B-10. Activities That Can Be Geospatially Enabled

	Activity	Geospatial Layers
Project Development	Alignment selection	<ul style="list-style-type: none"> the parcel cadastre layer maintained by the state or exclusively by the right-of-way office on a project-by-project basis existing road centerline layer new right-of-way layer or ROW plans
	Environmental studies	
	Evaluating hazardous waste sites	
	Parcel identification	
	Parcel take classification	
	Parcel take complexity	
Appraisal	Parcel review for complexity	<ul style="list-style-type: none"> imagery utilities demographic information wetlands and other layers from environmental management
	Elevation changes for adjoining property	
	Appraisal technique evaluation	
	Parcel valuation	
	Parcel identification for specialty appraisal	
	Parcel identification for utility relocation	
Relocation	Parcel identification for relocation	<ul style="list-style-type: none"> historic districts 3-D buildings topography
	Identification of available property for relocation	
	Identification of property for utility relocation	
Property Management	Parcel requirement type for disposal	<ul style="list-style-type: none"> soil data vegetation historic parcel sales records
	Clearance/demolition analysis	
	Grading analysis	
	Parcel disposal justification	
	Excess land identification and evaluation	

Geospatial Enablement Data Flow Model

Data Flow Diagrams (DFD) help to model the system as a network of processes illustrating the way in which data flows between elements in a system and with other external entities.


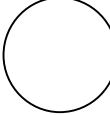



Components of a typical data flow include: entity, process, data store, flow connectors, and the diagram gate (Ambler 2004). Table B-12 gives an overview of these elements used in the modeling of data flow diagrams.

Table B-11. Identified Right-of-Way Activities for Geospatial Enablement

	Geospatial Activity	Description
Project Development	Identify parcels during alignment selection	Overlay and analyze multiple layers affecting alignment selection. Estimate right-of-way cost for alignment selection.
	Identify Environmental Impacts	Overlay and analyze multiple layers that could support identification of environmental impacts during the roadway alignment selection.
	Perform environmental studies and hazardous waste sites evaluation	
	Identify parcels for right-of-way	Identify parcels by overlaying the Parcel Cadastre layer with the Road Design layer.
	Define parcel type of take and divide parcel to ROW/Excess	Analyze each selected parcel to determine if it is a Whole or Partial take.
	Identify complexity	Analyze each selected parcel for complexity (See Geospatial Activities under Appraisal and Relocation for more detailed descriptions.)
Appraisal	Initial Parcel Review for Value/Complexity	Determine appraisal complexity by overlaying and analyzing multiple layers including elevation, utilities, land use, imagery etc.
	Elevation Changes affecting the parcel/property	Analyze the elevation that would affect the property with the new roadway.
	Determine Appraisal Technique	Determine the method of appraisal employed for the parcel by interfacing with an external appraisal system.
	Sales Comparison	Analyze and determine appraisal value for paired sales (sales comparison method), by interfacing with available historical parcel sales records.
	Specialty Appraisal	Identify and extract parcels requiring specialty appraisal by analyzing the existence of special properties on each parcel.
	Identification of Parcels with utilities	Identify and extract parcels with subsurface, surface and aerial utility facilities by overlaying and analyzing with utilities layer (electricity, natural gas, water, sewage etc.).
Relocation	Identify parcels for requiring relocation	Identify and extract parcels that require relocation assistance by analyzing each parcel's relocation indicators.
	Identify available properties for sale, lease, community amenities	Identify possible locations for relocation, by analyzing and overlaying multiple layers including demographic data and interfacing with external real estate management system or lease/sale property management system.
	Identify available areas for relocating utilities	Determine possible areas for adjusting the effected utilities by overlaying utilities layer with multiple layers including roadway ROW layer, parcel cadastre layer, and road network layer.
Property management	Parcel Requirement Type	Determine the requirement type of each parcel, either as substantially excess or substantially ROW, by overlaying ROW project parcels using the new ROW roadway layer.
	Clearance/Demolition	Analyze and identify level and type of clearance required for personal property/improvement clearance, and display the clearance status thematically.
	Grading	Determine cut and fill volumes, and total cost for the earthwork for the new roadway by overlaying and analyzing multiple layers including, topography/elevation of terrain and soil type layer.
		Display the grading status for each parcel.
	Justification of ROW / Excess Disposal	Analyze and justify right-of-way (access/relinquishment/lease) and excess land disposal by overlaying multiple layers including roadway network (for highway safety, traffic demand), soil type layer vegetation layer etc.
	Manage Excess lands	Identify and extract excess land based on the analyzed parcel requirement type, and by overlaying the new roadway right-of-way.

The Geospatial Enablement (GE) framework is captured in UML using Data Flow Diagrams. Data flows are defined for the GE model to illustrate activities that can be geospatially enabled as tabulated in Table B-10 and Table B-11. This model helps in capturing the high-level system overview for use during the initial analysis and implementation stages of developing an integrated geospatial information management system in visualizing the flow of geospatial data through the system.

Table B-12. Data Flow Diagram Components Representation Description

Representation	Description
	Entity
	Process
	Data Store
	Data Flow
	Diagram Gate

The package diagram that gives an overview of the GE data flow diagrams is shown in Figure B-24. It shows the data flow diagram packages for the four functional areas, Project Development, Appraisal, Relocation, and Property Management. No GE activities were identified for Acquisition or Project Closing. Figure B-24 also shows the major geospatial resources from a GIS warehouse that constitute common enabling infrastructure.

These layers along with other resources from the geospatial warehouse provide the required inputs for *processes* captured in the data flow diagrams for the individual right-of-way functional areas, shown in Figure B-25 through Figure B-28.

The data stores highlighted in red represent geospatial layers, while those in black denote standard databases. Red data flow connectors represent the geospatial data flow that results in the creation of new layers or databases and represent relations between critical layers in the warehouse. For example, the relation between the ROW Project Parcels and Parcel Cadastre Layer, and New Road Centerline ROW and the Road Centerline ROW layer, are illustrated through red data flow connectors. Table B-13 summarizes the resources in the GE model.

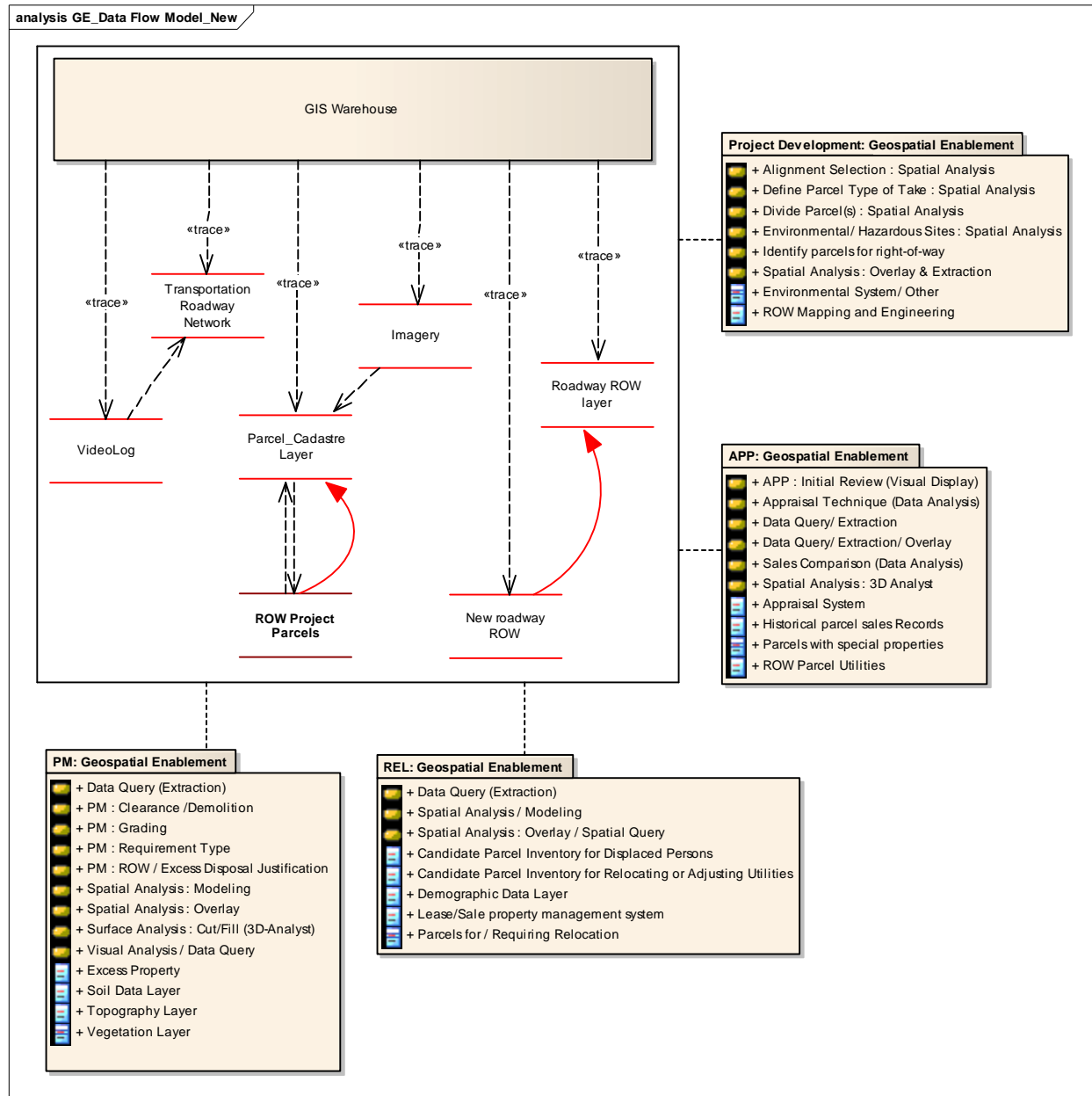


Figure B-24. Overview of Geospatial Enablement Data Flow Diagram Model

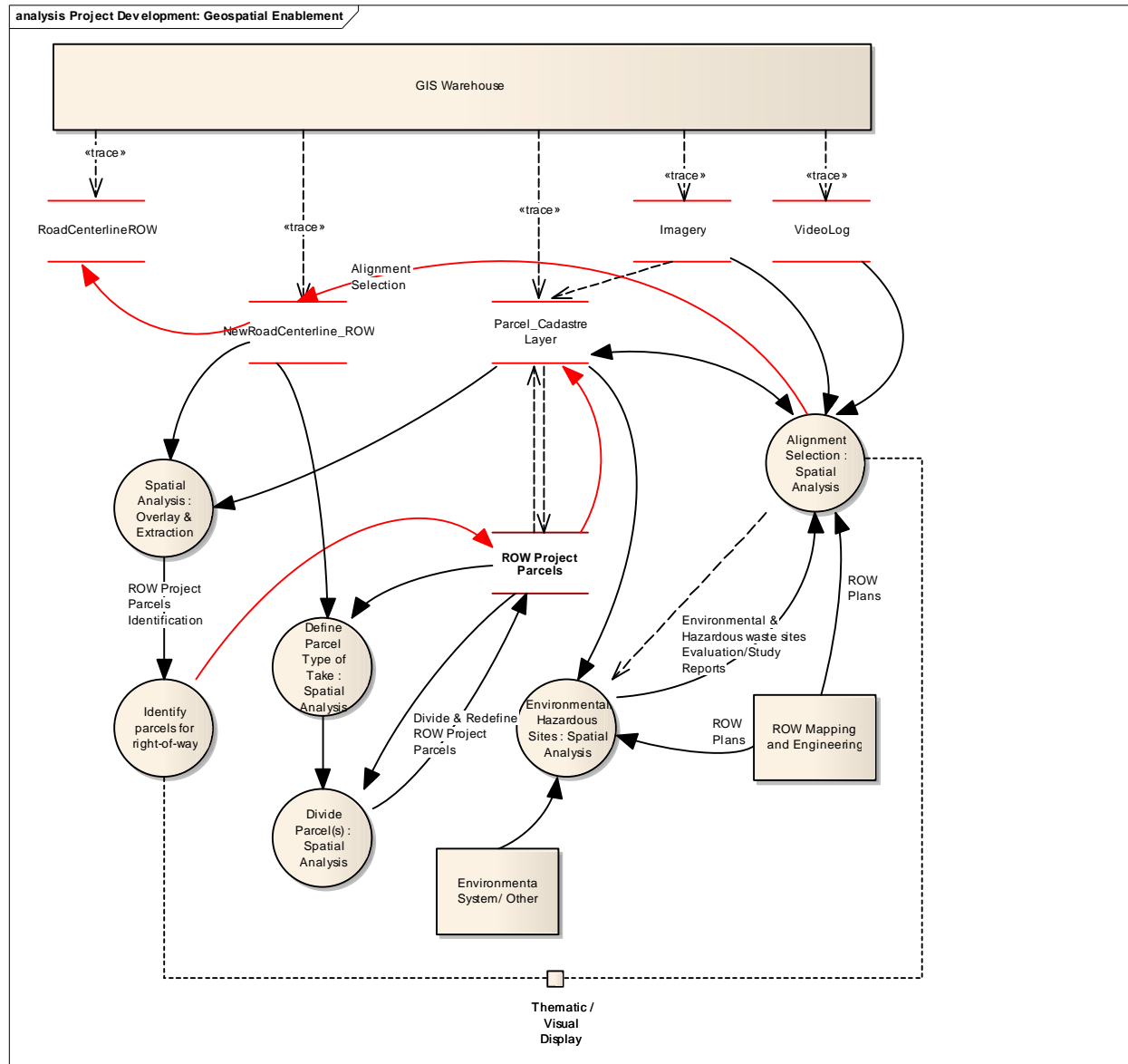


Figure B-25. Geospatial Enablement Data Flow Diagram for Project Development

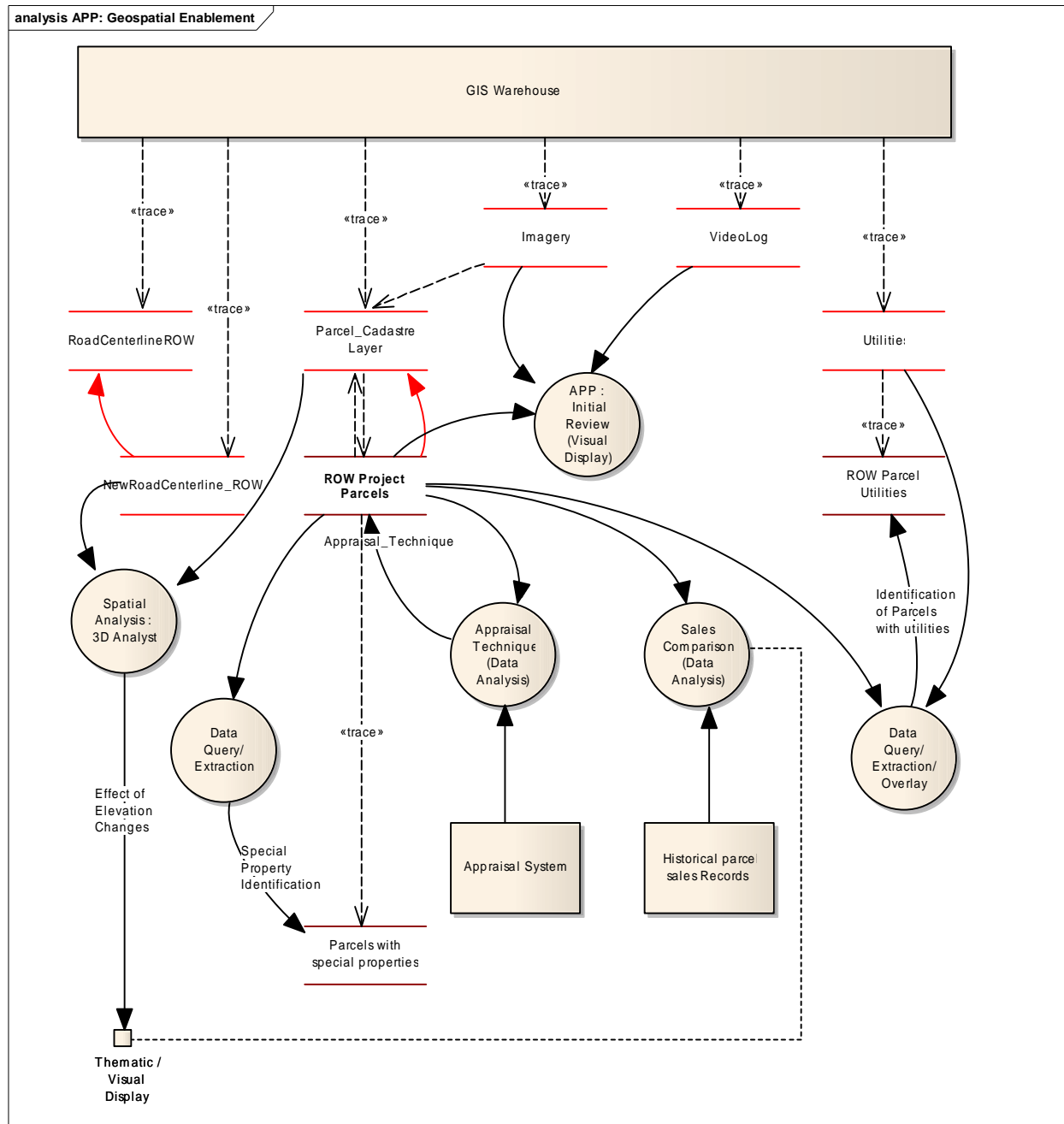


Figure B-26. Geospatial Enablement Data Flow Diagram for Appraisal

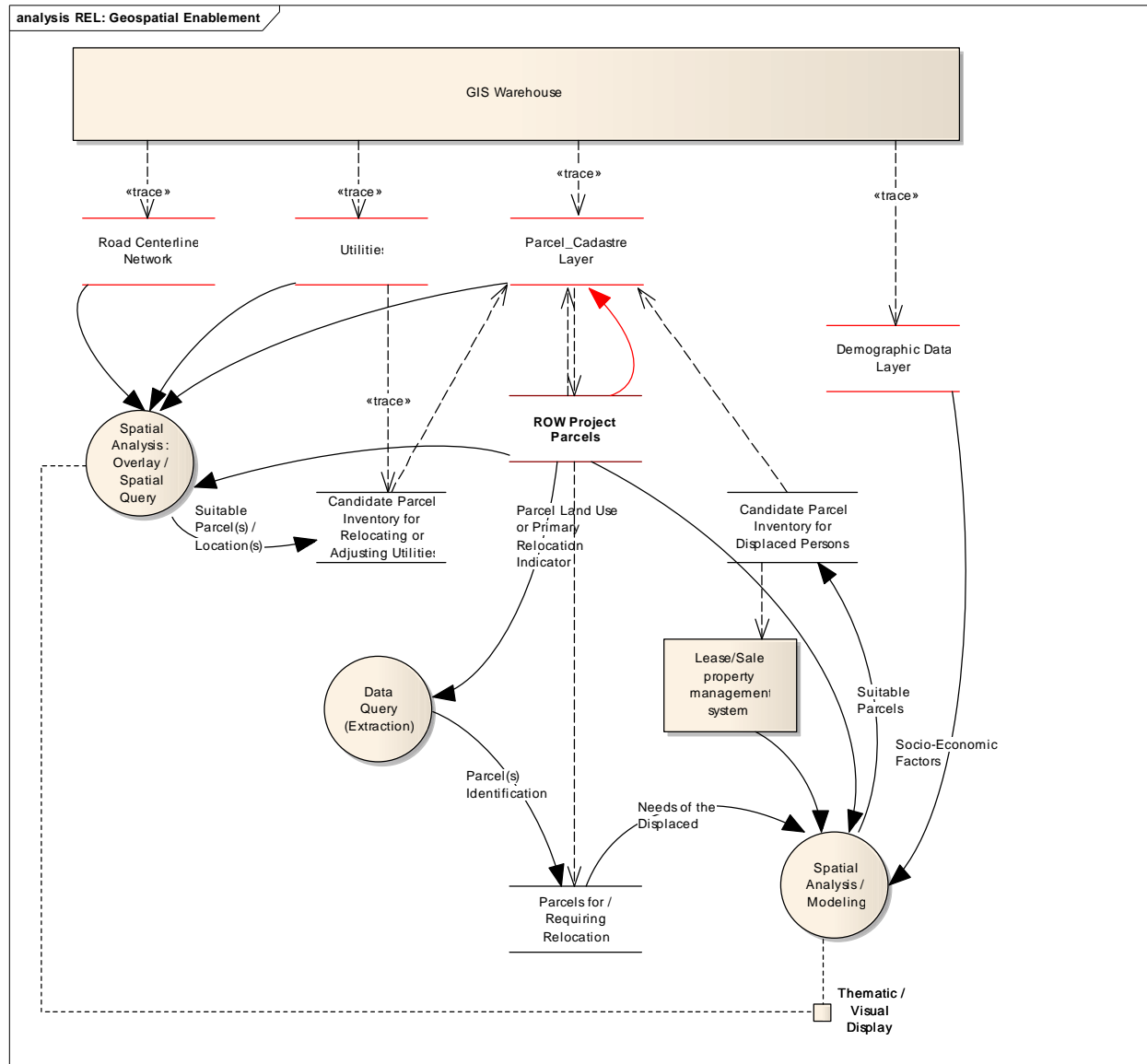


Figure B-27. Geospatial Enablement Data Flow Diagram for Relocation

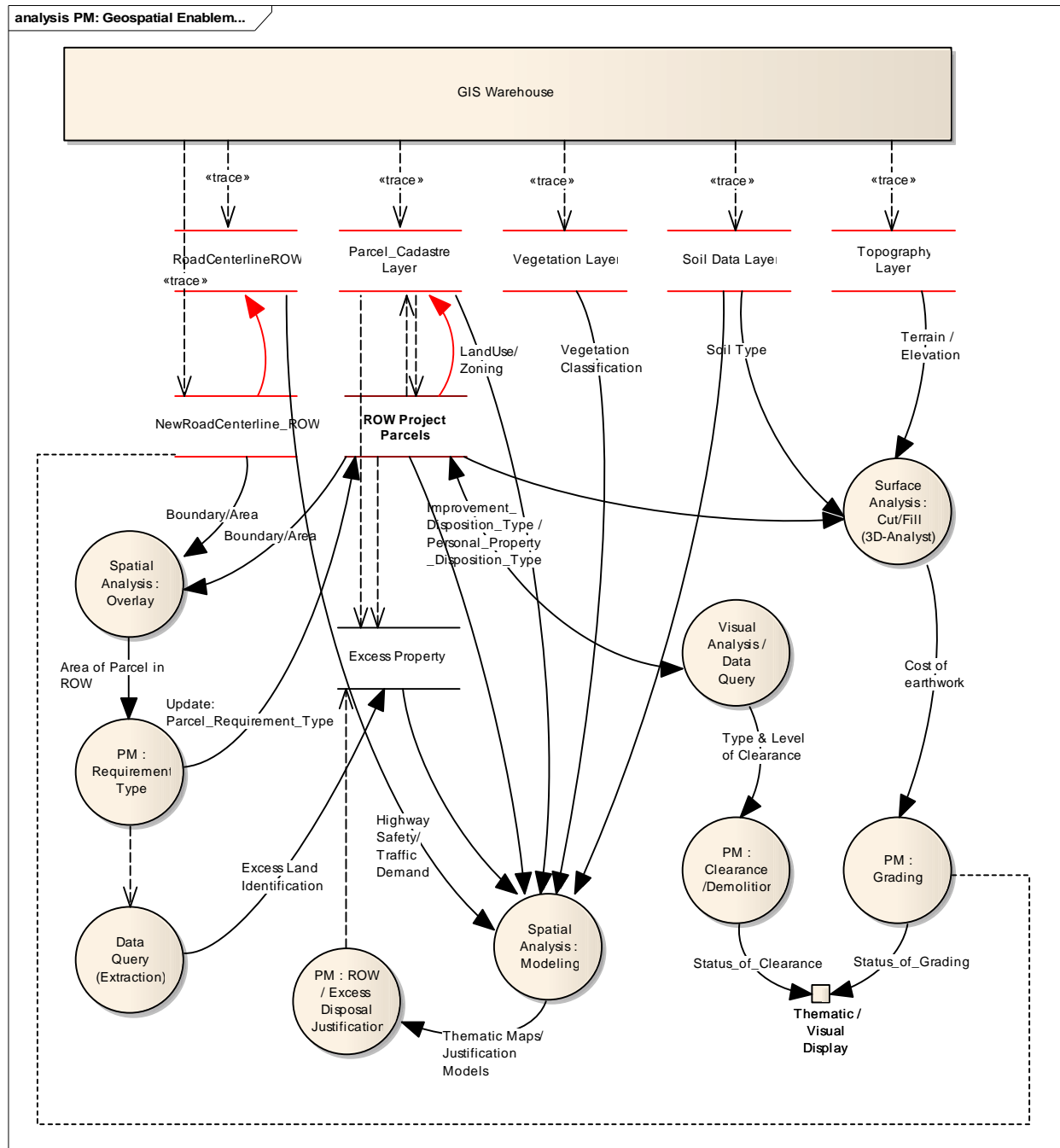


Figure B-28. Geospatial Enablement Data Flow Diagram for Property Management

Table B-13. Summary of resources for Geospatial Enablement

Type	Resource	Description
Geospatial Layer	Parcel Cadastre Layer	Statewide Cadastre layer or project-by-project generated parcel layer for use by ROW.
	Transportation Roadway Network	Statewide network of roadways layer.
	Road Centerline ROW Layer	Statewide roadway right-of-way layer.
	New Road Centerline ROW	Changes to roadway ROW layer based on new transportation project. Usually CAD drawings maintained by the state transportation agency.
	VideoLog	Photographs of continuous views from a road and associated parcels.
	Imagery	Aerial imagery of the parcel/roadway/ parcel property, and other related photographic data.
	Topography	Statewide topography layer containing topographic contours.
	Soil Data	Statewide soil layer containing 'soil types' and the related soil data.
	Vegetation	Statewide vegetation layer containing 'vegetation classification' and other related data.
	Utilities	Statewide utilities layer(s).
	Demographic Data Layer	Statewide demographic layer containing demographic characteristics.
External System	ROW Mapping and Engineering Division	Department that prepares the right-of-way plans for the project.
	External Environmental System	System facilitating the required NEPA environmental analysis and Hazardous waste sites evaluation.
	External Appraisal System	System that helps in identifying the required technique for parcel appraisal.
	External Historical Parcel Sales Records	System that provides the records for data analysis during sales comparison.
	External Lease/Sale Property Management System	Systems like Zillow, MLS or other equivalent that provides information of available property for relocating the displaced.
Database	ROW Project Parcels	Parcels identified as part of new transportation project. Total parcels may be maintained or parcels may be split into ROW and excess. Linked table to cadastral layer or a separate geospatial layer maintained by the state transportation agency or ROW office.
	ROW Parcel Utilities	Selection from statewide utilities layer(s)
	Parcels with special properties	Selection from Cadastral layer or from ROW project parcel layer.
	Candidate Parcel Inventory for Displaced Persons	Selection from the state cadastral layer or sale and/or lease property database.
	Candidate Parcel Inventory for Relocating or Adjusting Utilities	Selection from the statewide utilities layer(s).
	Excess Property	Linked table to the statewide Cadastral layer or a separate geospatial layer maintained by the state transportation agency or the ROW office.

Enterprise Architect and Using the 8-55A Logical Model

The 8-55A *Logical Model* consists of three separate models in two different .EAP files summarized in Table B-14.

Table B-14. Individual logical models as part of the 8-55A *Logical Model*

Model designation	Purpose	File name on CD
Overall ROW Business Model	For use by a state with no enterprise-level ROW land management system with no geo-spatial component	logical model.EAP
Geospatial Decision Making Activities Model	For use by a state wanting to geospatially enable an enterprise-level ROW management system or adding ROW management to an enterprise geospatial warehouse	logical model.EAP
data model	For use in establishing standardized data in an enterprise-wide system within the larger agency enterprise	datamodel.EAP

These are the underlying structures that can be used by states as blue prints for their own information management systems.

The Overall ROW Business Model

The overall model is designed as a hierarchical tree of activities which are grouped, as practical, into packets. States can evaluate each task or packet for its usefulness within their own requirements. If it does not meet their needs, it can be removed or modified. If a state has already built a system and wants to use one of the packets from this model, it can be exported into standard xmi or csv language which can then be imported into whatever development software is being used.

Geospatially Enabling an Existing System

The Geospatial Decision Making Activities Model to add GIS capabilities to an existing system has been divided into two different packages, one for tracking parcels, primarily allowing users to visualize status and information associated with parcels, and one for geospatially enabling decision making. The tracking package is structured around the data elements that would be linked to the geospatial parcel layer. Corresponding tables of attributes would be built into the underlying database and linked either dynamically or permanently to the geospatial parcel layer. The geospatial enablement package consists of Data Flow Diagrams which help to represent the system as a network of processes illustrating the way in which data flows between elements in a system and with other external entities. These can be used to modify an existing system and add the corresponding capability within the specific development environment.

Depending on the structure of the existing information management system, a separate mapping or GIS tool could be implemented that links to the database either as an independent application or as part of the reporting tool. For a more integrated approach, links to the GIS could be added to the user interface at the appropriate user interface location in the information management system.

Adding Information Management to an Enterprise GIS

Performing this activity does not provide a state with an actual information management system. Instead, personnel would use existing GIS software to incorporate, analyze, and display necessary information for the different business activities.

Attributes associated with the different functions in right-of-way offices have been identified in the data model and the parcel tracking component of the geospatial model which can be joined to a parcel layer within an Enterprise GIS. The right-of-way office can work with the GIS office or someone within the right-of-way office that has experience working with the available GIS software such as ESRI's ArcGIS. Tables of these attributes can be accessed from the agency database or from data local to the real estate office and linked to the geospatial parcel layer. Macros can be developed for most GIS software that can generate standard theme maps based on a set of selections defined in custom dialog boxes generated by the macro. These macros allow personnel to use GIS software without necessarily knowing the details of that software.

The data elements for geospatial enablement have been identified with activities in a right-of-way office and data tables can be coordinated by areas – appraisal, acquisition, relocation, or property management – or by specific activities (Table B-11). Most database systems use standard queries to extract data elements which are then formatted for the GIS software. Using XML, this can be automated making the process more transparent to right-of-way personnel. Additional development work is necessary to build analyses tools directly into the GIS framework.

Enterprise Architect (Sparx Systems)

The logical model was developed in Enterprise Architect, a comprehensive visual modeling platform developed by Sparx Systems. It provides an enterprise framework that is scalable and traceable using UML2.3. UML is a 'language' for specifying, not a method or procedure, used to define a software system; to detail the artifacts in the system, and to document and construct. It is the language that the blueprint or framework is written in. UML was used to build the logical model but it does not specify the methodology or process for the software itself.

EALite

Enterprise Architect Lite, EA Lite, is a free, read-only edition of Enterprise Architect that enables people such as project sponsors to review a project without making any changes. Users of Enterprise Architect Lite also have access to:

- The Team Review, where readers can create and respond to posts, and link their comments to elements
- The Source Code Viewer, where readers can open and review external source code files
- The File menu, where readers can copy the project or create a shortcut to access it
- The Relationship Matrix, where readers can export the matrix contents to a CSV file to be opened in a spreadsheet application
- The Default Hours tab to review project metrics.

EA-Lite is provided on the associated CD or can be downloaded from the Sparx Systems website at <http://www.sparxsystems.com/products/ea/downloads.html>. The Users Guide is also included on the CD or can be downloaded from <http://www.sparxsystems.com/bin/EAUserGuide.pdf>.

Installing EA-Lite

To use EA-Lite, you will need to install it on your computer. Double click on the EALite.exe file in the Enterprise Architect folder on the CD and follow the directions provided by the Install Wizard. If you accept the default directory during the installation, a folder entitled Enterprise Architect 8 will be created in your list of programs. The name of the application under this folder will be Enterprise Architect. Click on this program to open the viewer. Once EALite is installed, you can double click on either file name in Table B-14 to open the corresponding model. Figure B-29 shows the initial screen when Logical Model.eap is opened in EALite. The interface is the same as for the full Enterprise Architect but only viewing functions are enabled.

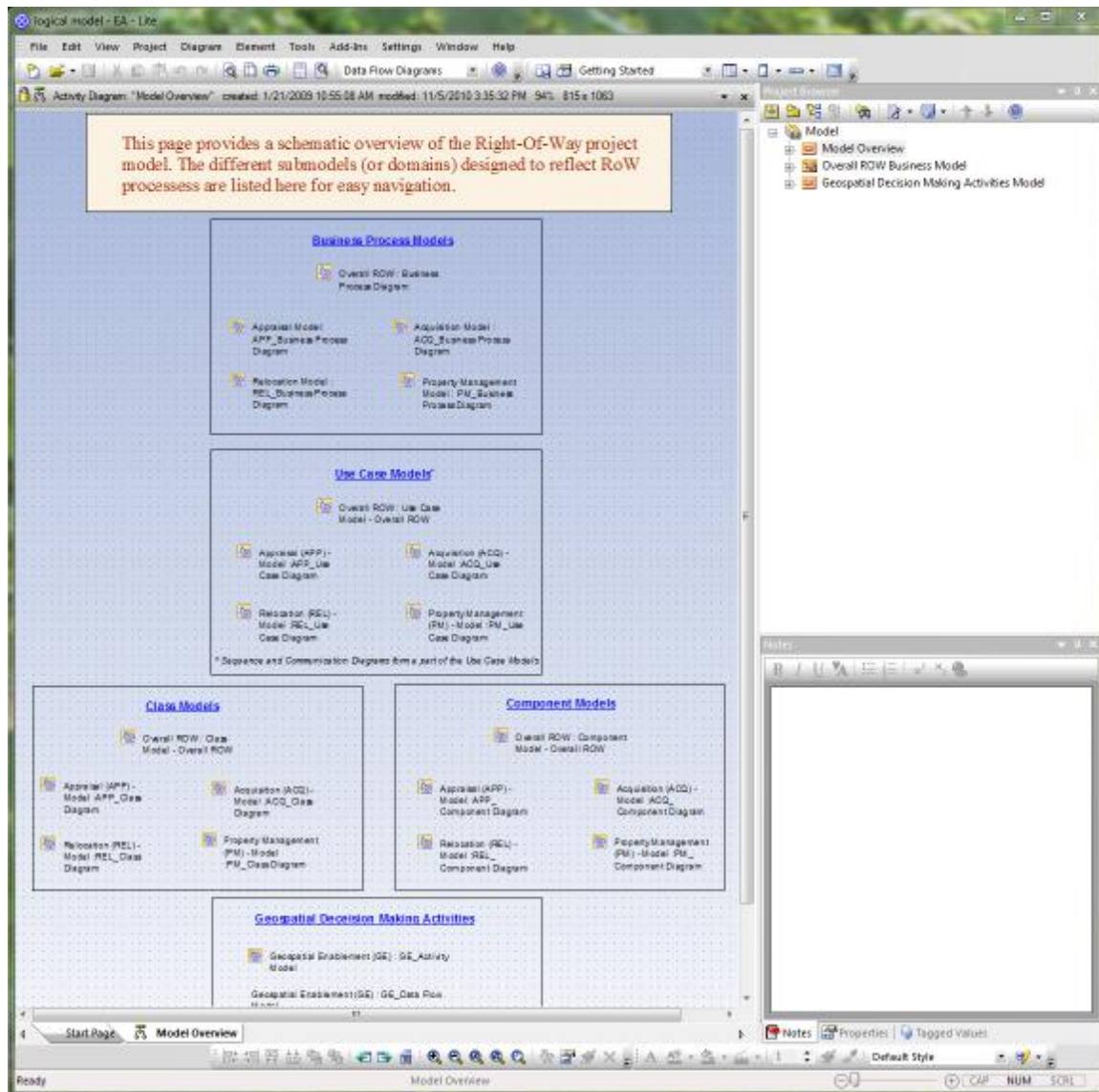


Figure B-29. Initial screen in EALite for the Logical Model

Maneuvering Through a Model in Enterprise Architect

When the overall/geospatial models are loaded into Enterprise Architect, a schematic appears in the main viewing page as shown in Figure B-30. If this page does not appear, select the tab at the bottom of the screen labeled Model Overview. This page provides links to the different model components for each of the primary right-of-way areas. Double clicking on any of the

icons will open that model. Another method to maneuver through the model is to open the Project Browser shown on the right side of Figure B-30. It should default to being open. Clicking on the plus sign next to any icon will expand the components under that item. Double clicking on the name will open a dialog box with information associated with that item. If the icon does not have a plus next to it, double clicking will either open the corresponding diagram in the viewing window along with a tab along the bottom or it will open a dialog box with information associated with the object.

As seen in the Project Browser in Figure B-29, the highest level of the model includes the Model Overview (shown in the viewing screen in Figure B-29 and acting as a top level table of contents) and the Overall ROW Business Model and Geospatial Decision Making Activities Model. The first level of expansion of the Models is shown in the Project Browser on the right in Figure B-30.

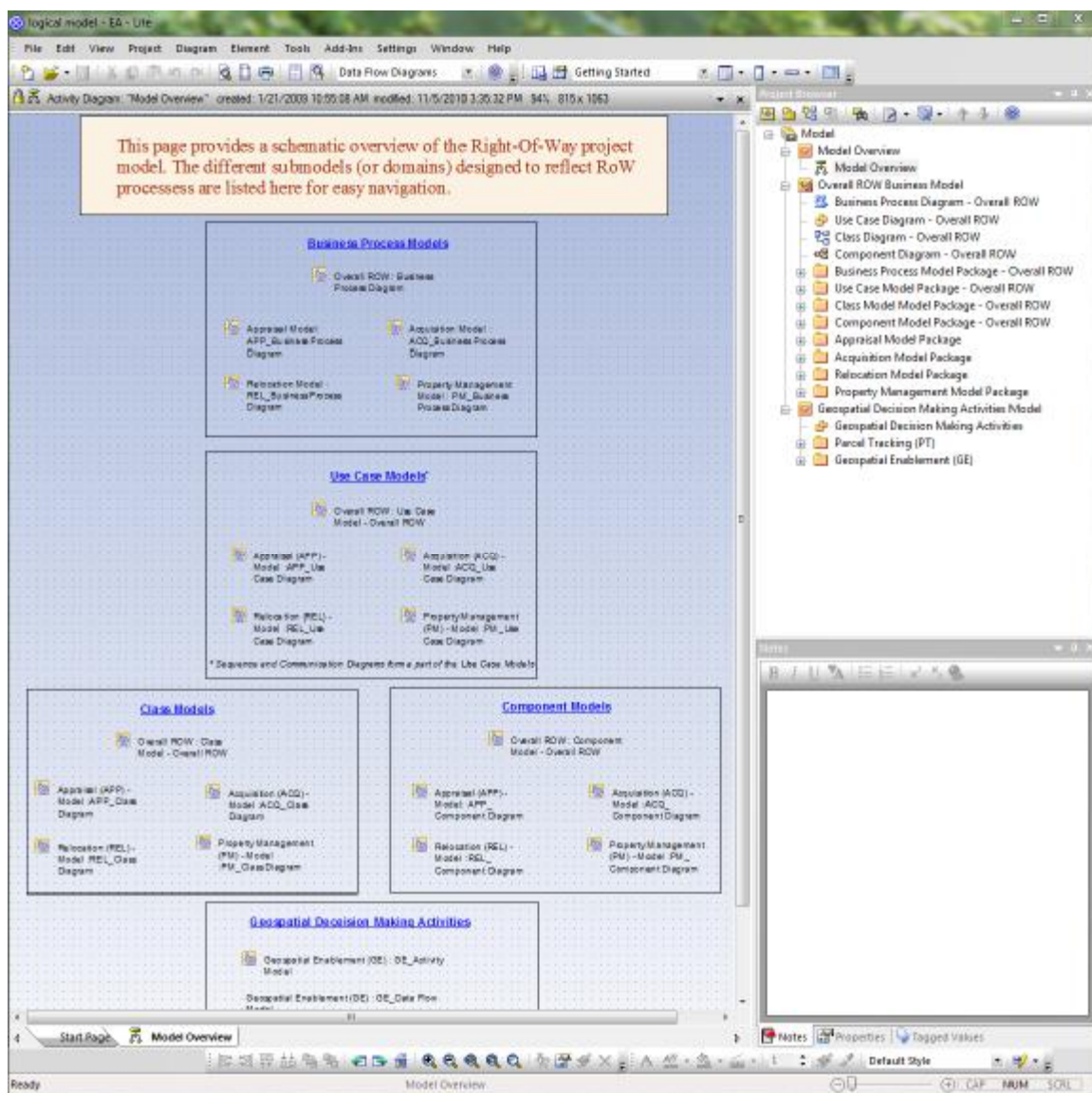


Figure B-30 Opening view of model

Once a diagram is open in the viewing window, you can double click on any component in the window. If it is linked to another diagram in the model, that diagram will open and a corresponding tab will be added to the bottom of the screen as shown in Figure B-31. If it is not linked, a dialog box will open with information about the component as shown in Figure B-32.

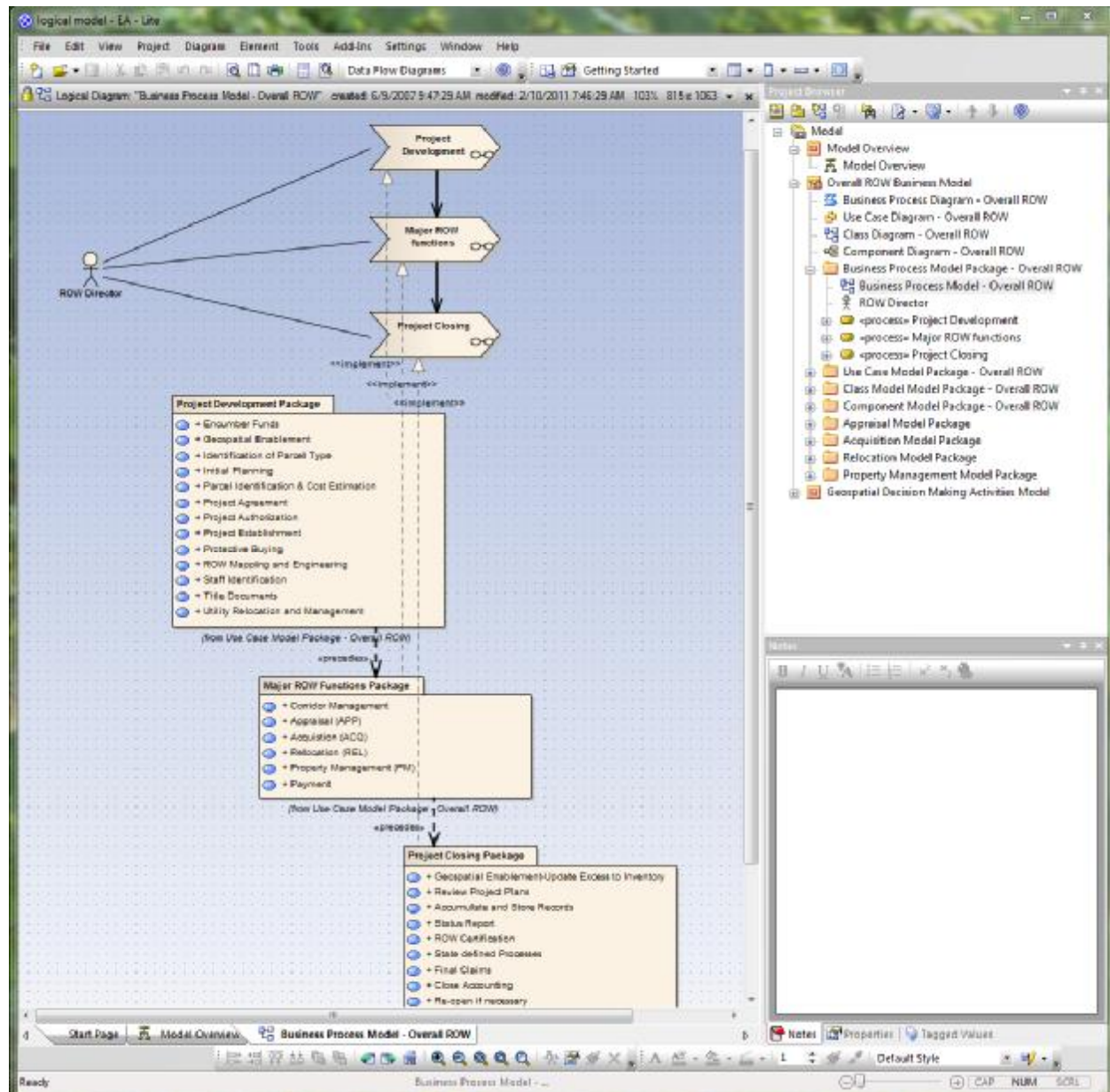


Figure B-31. Example of a Diagram

By right-clicking on any component, you can use the “find” option to locate that diagram in the Project Browser. Similarly, by right clicking on any component in the Project Browser, you can select Find in Diagrams to open the appropriate diagram.

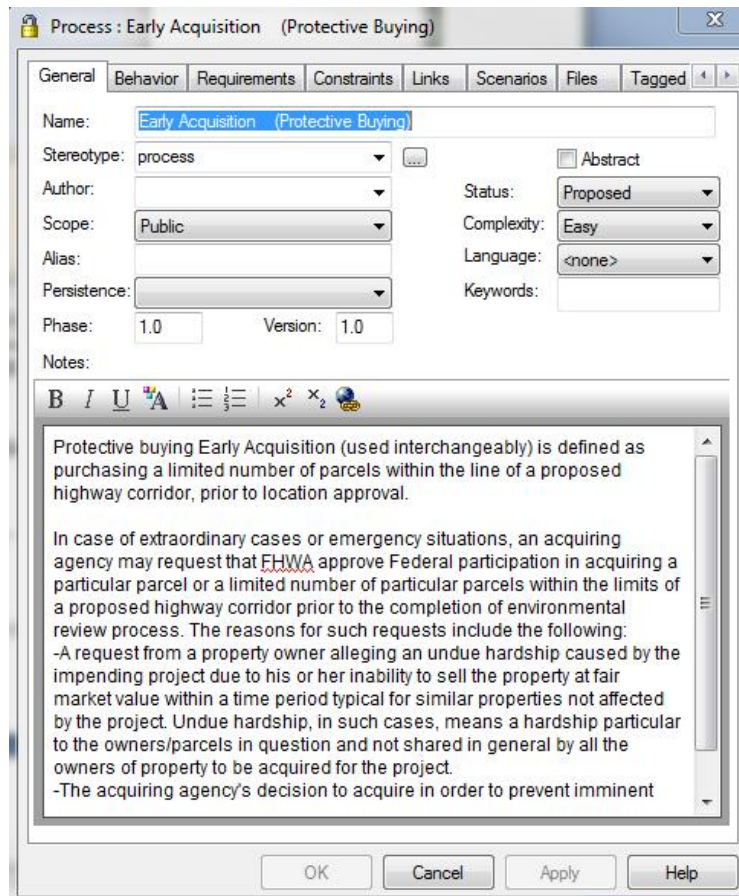


Figure B-32. Example of a Dialogue Box

More detailed instructions about Enterprise Architect are available in the Users Guide on the CD or at <http://www.sparxsystems.com/>.

Project statistics of the combined Overall and Geospatial models are provided in Table B-15. The complete set of diagrams is provided in Appendix C and the Data model diagrams are in Appendix D.

Table B-15. Model Statistics Report for **logical model.eap**

Measure	Count
Packages	93
Total Diagrams	410
Total Elements	2123
Total Connections	3452
Elements in Diagrams	2987
Element Attributes	1389
Element Operations	91
Element Operation Parameters	10
Element Testing	42
Element Scenario	159
Element Constraints	404
Element Requirement	16
Element Files	6
Activity	307
Actor	83
Artifact	21
Boundary	9
Class	178
Collaboration	3
Component	91
Decision	78
Event	12
Object	221
ObjectNode	2
Package	92
ProvidedInterface	13
RequiredInterface	10
Sequence	519
State	76
StateNode	2
Text	147
UseCase	246

APPENDIX C *NCHRP 8-44A LOGICAL MODEL UML DIAGRAMS*

Table C-1 through Table C-5 provide keys to the different types of models in the complete logical model. These are followed by UML diagrams for the Overall ROW Business Model and UML diagrams for the Geospatial Decision Making Activities Model. Both models exist in a single Enterprise Architect (logical model.EAP) file on the accompanying CD.

Table C-1. Key to Business Process Models: Entities

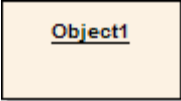



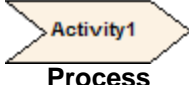

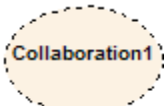
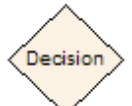
Representation	Description
 Class	Is a particular instance of a <i>Class</i> . It defines the abstract characteristics of an entity, including the entities' characteristics (its attributes or properties) and its corresponding functionalities (its behaviors or methods or features). Objects are often used in analysis to represent the numerous artifacts and items that exist in any business, such as pieces of paper, faxes, information etc.
 Receive	Is used to define the acceptance or receipt of a request, in an Activity diagram. Indicates that an event occurs in the system due to some external or internal stimulus. Typically this will invoke further activities and processing.
 Send	Is used to model the generation of a stimulus in the system and the passing of that stimulus to other elements within the system or external to the system.
 Actor	Is a user of a system; <i>user</i> can mean a human user, a machine, or even another system or subsystem in the model. Anything that interacts with the system from the outside or system boundary is termed an Actor.
 Process	Is an activity element comprising a set of well established tasks which expresses the concept of a business process. Typically a process involves inputs, outputs, work flows, goals and connections with other processes.
 Composite Process	Is a Business processes that involve sub-processes are composite processes. Such processes are depicted by an additional infinity symbol on the right.
 Collaboration	Defines a set of cooperating roles and their connectors. These are used to collectively illustrate a specific functionality.
 Decision	Indicates a point of conditional progression. It is a point where subsequent activities vary based on the choice made.

Table C-2. Key to Business Process Models: Connectors

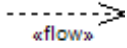
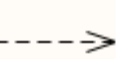
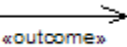


Representation	Description
 Information Flow	<p>Indicates that the information or object linked to the process is viewed in the processing phase without alteration and / or exhaustion.</p>
 Dependency	<p>Is used to model a wide range of dependent relationships between model elements. Signifies that a single or a set of model elements requires other model elements for their specification or implementation.</p>
 Object Flow	<p>Links an output object, and two elements, with specific data passing through it</p>
 Control flow Link	<p>Links another process that represents the sequence of activities and the direction of work flow. It generally connects two business processes.</p>
 Association Link	<p>Indicates that processes attached by this link work together on some activities to achieve the goals of the organization.</p>

Table C-3. Key to Use Case Model

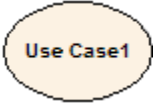



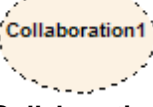


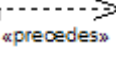
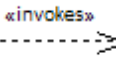

Representation	Description
 Use Case	Represents a discrete unit of interaction between an actor (human or machine) and the system. It is a single unit of meaningful work.
 	<p>Represents use case with embedded Sequence and/or Communication Diagram(s). Such use cases are depicted by an additional infinity symbol on the right.</p> <p>Represents Use Case with composite diagram (containing coupled use cases).</p>
 Actor	Is a person, machine, another systems, current system, sub-system that triggers events or processes. An actor might be used to perform a business process (use case) or invoke a use case or just be associated with a use case.
 Collaboration	Defines a set of cooperating roles and their connectors. These are used to collectively illustrate a specific functionality.
 Extend Link	Denotes alternative flow (scenario) in this system. Extend connection is also used to indicate that one use case (optionally) extends the behavior of another.
 Association	Is the general relationship type between elements.
 Precede link	Represents some mandatory sequence of use cases .
 Invoke Link	Depicts the cases where use case is triggered only by the presence of a specific element.
 Dependency Link	Shows dependency of one use case over another use case or actor for the completion of task.

Table C-4. Key to Sequence Diagrams


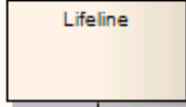
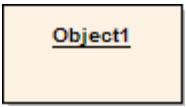






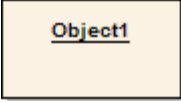




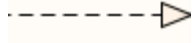
Representation	Description
 Actor	Is a Person, machine, another systems, current system, sub-system that triggers events or processes. An actor might be used to perform a business process (use case) or invoke a use case or just be associated with a use case.
 LifeLine	Is an individual participant in an interaction. It represents a distinct connectable element
 Class	Is a particular instance of a <i>Class</i> . It defines the abstract characteristics of an entity, including the entities' characteristics (its attributes or properties) and its corresponding functionalities (its behaviors or methods or features). Objects are often used in analysis to represent the numerous artifacts and items that exist in any business, such as pieces of paper, faxes, information etc.
 Boundary	Is a stereotyped Object that models some system boundary. It is used in the conceptual phase to capture users and external systems interacting with the current system through some boundary interface type.
 Control	Is a stereotyped Object that models a controlling entity or manager. A Control organizes and schedules other activities and elements.
 Entity	Is a stereotyped Object that models a store or persistence mechanism that captures the information or knowledge in a system.
 Diagram Gate	Is a connection point for relating a Message outside an InteractionFragment with a Message inside the InteractionFragment. It is a simple graphical way to indicate the point at which messages can be transmitted into and out of the fragments.
 Message	Indicate a flow of information or transition of control between elements.

Table C-5. Key to Communication Diagrams

Representation	Description
 Actor	Is a person, machine, another systems, current system, sub-system that triggers events or processes. An actor might be used to perform a business process (use case) or invoke a use case or just be associated with a use case.
 Class	Is a particular instance of a <i>Class</i> . It defines the abstract characteristics of an entity, including the entities' characteristics (its attributes or properties) and its corresponding functionalities (its behaviors or methods or features). Objects are often used in analysis to represent the numerous artifacts and items that exist in any business, such as pieces of paper, faxes, information etc.
 Boundary	Is a stereotyped Object that models some system boundary. It is used in the conceptual phase to capture users and external systems interacting with the current system through some boundary interface type.
 Control	Is a stereotyped Object that models a controlling entity or manager. A Control organizes and schedules other activities and elements.
 Entity	Is a stereotyped Object that models a store or persistence mechanism that captures the information or knowledge in a system.
 Association	Is the general relationship type between elements.
 Realize/ Implements	Implements or Realizes its destination object. Realize Used in a Use Case, Component or Requirements diagram to express traceability and completeness in the model.

Overall ROW Business Model Diagrams

The following diagrams are in alphabetical order according to the method used by Enterprise Architect. It is **STRONGLY** recommended that you open the model in EALite and use the Project Browser to maneuver through the different diagrams since they are hyperlinked within the software.

Diagram: Business Process Diagram - Overall ROW

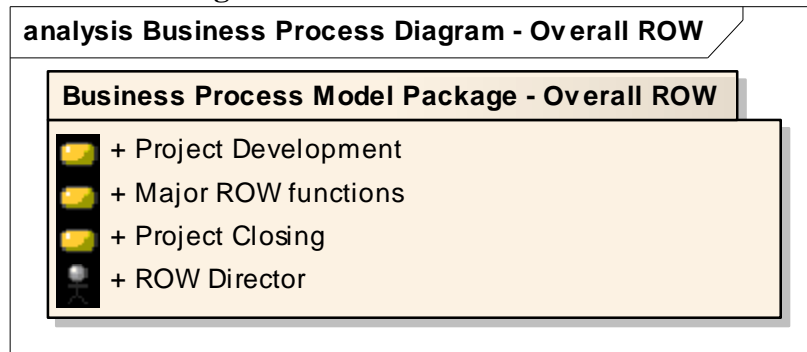


Diagram: Class Diagram - Overall ROW

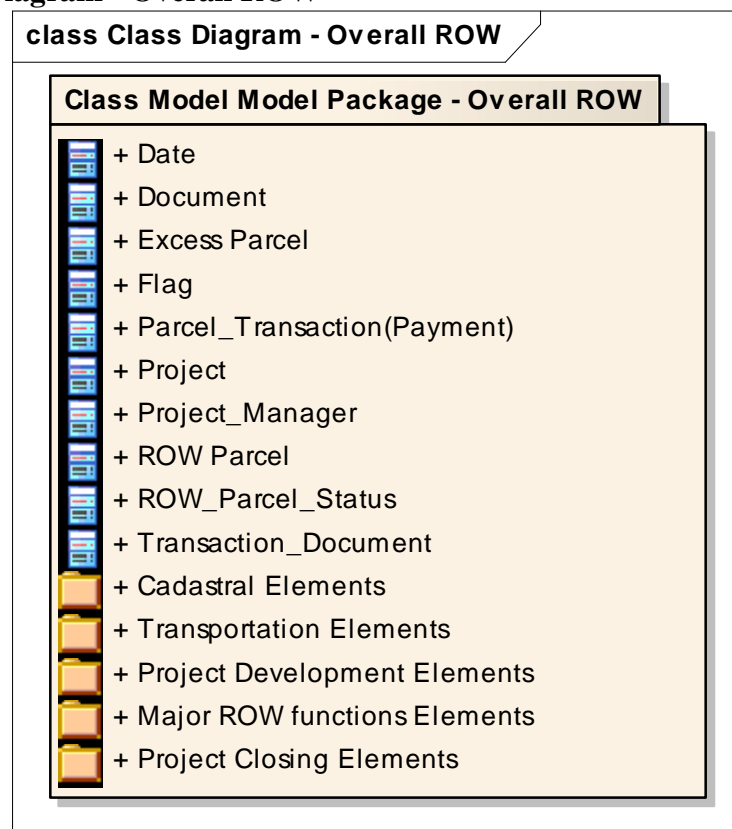


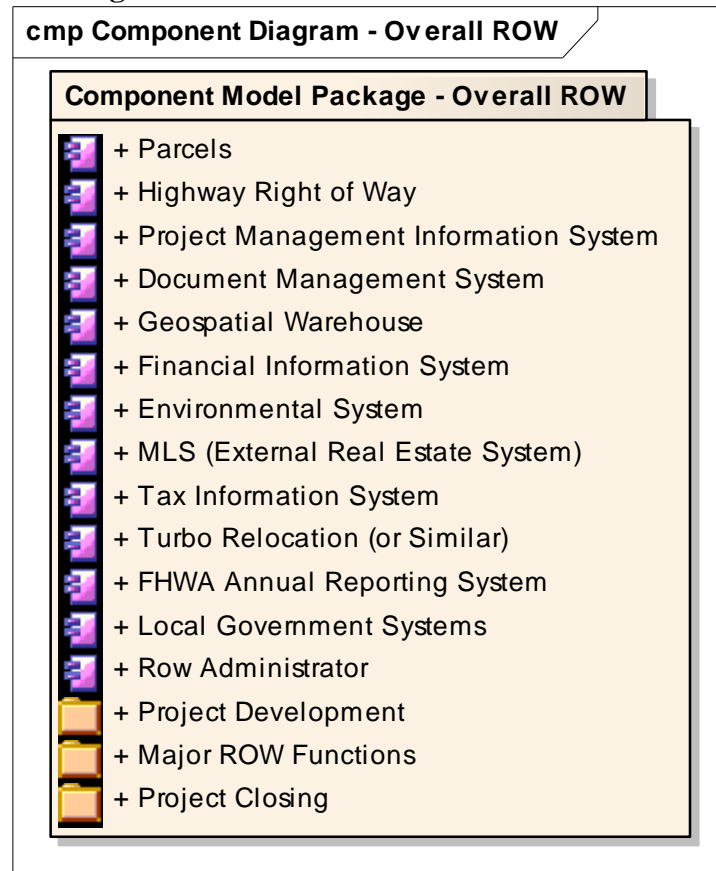
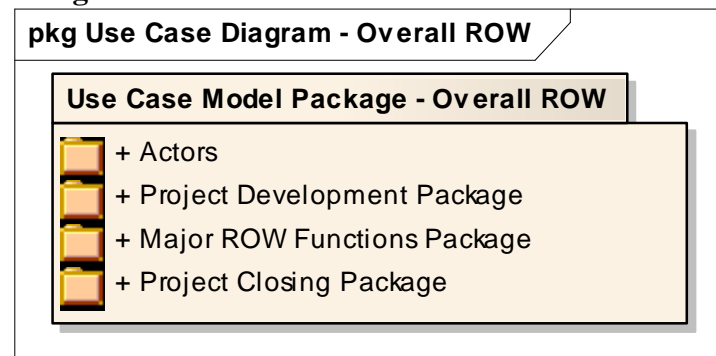
Diagram: Component Diagram - Overall ROW**Diagram: Use Case Diagram - Overall ROW**

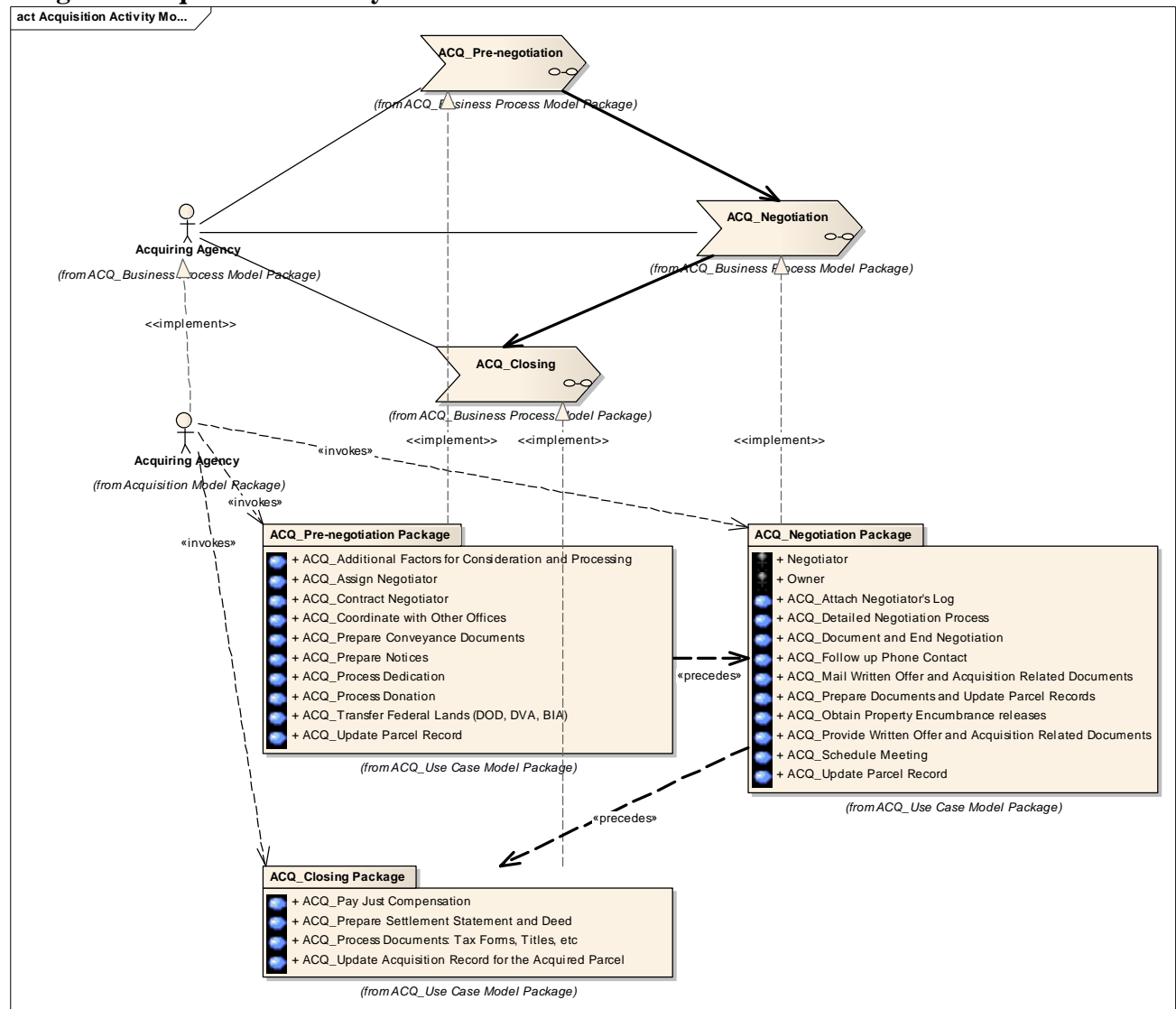
Diagram: Acquisition Activity Model

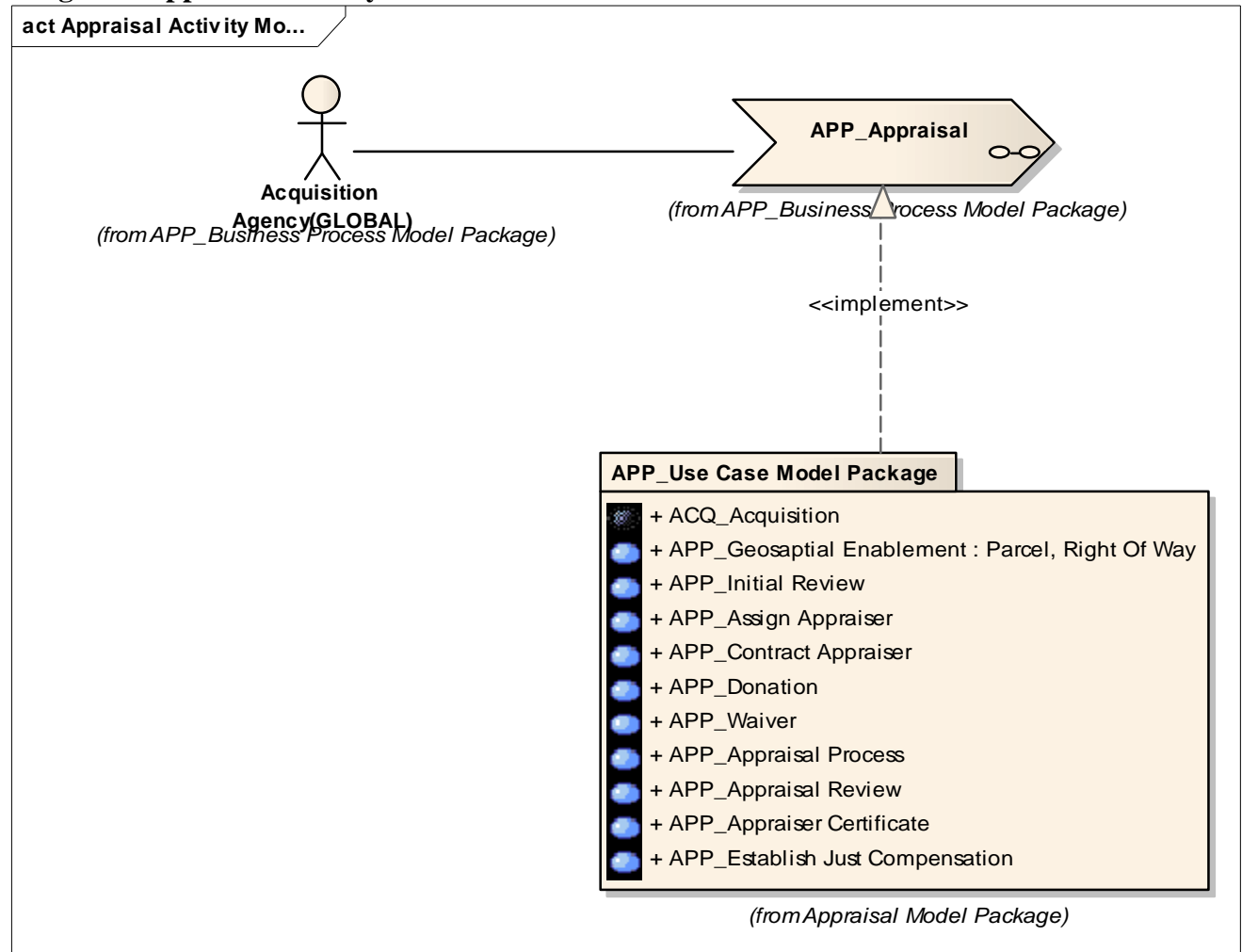
Diagram: Appraisal Activity Model

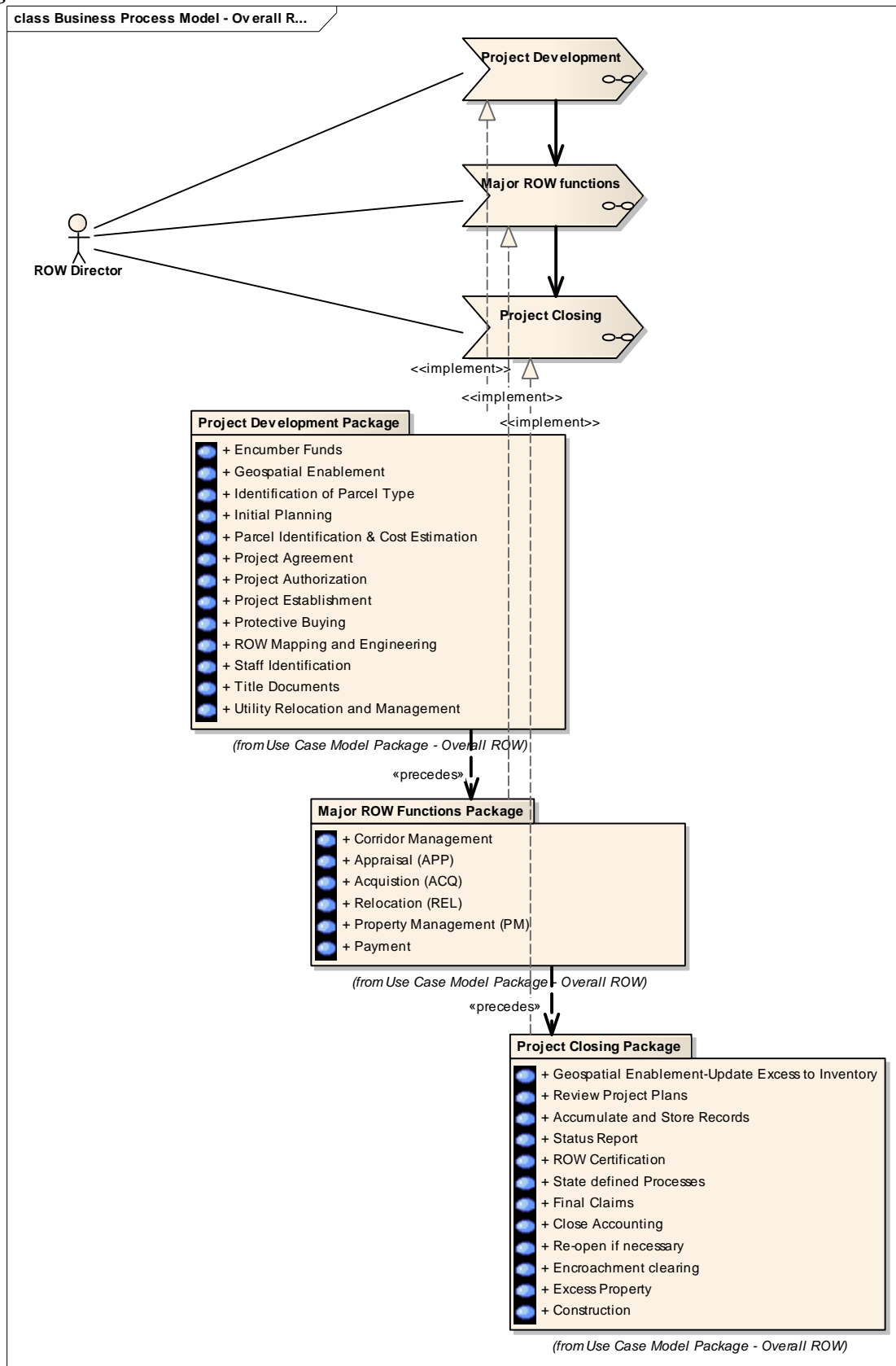
Diagram: Business Process Model - Overall ROW

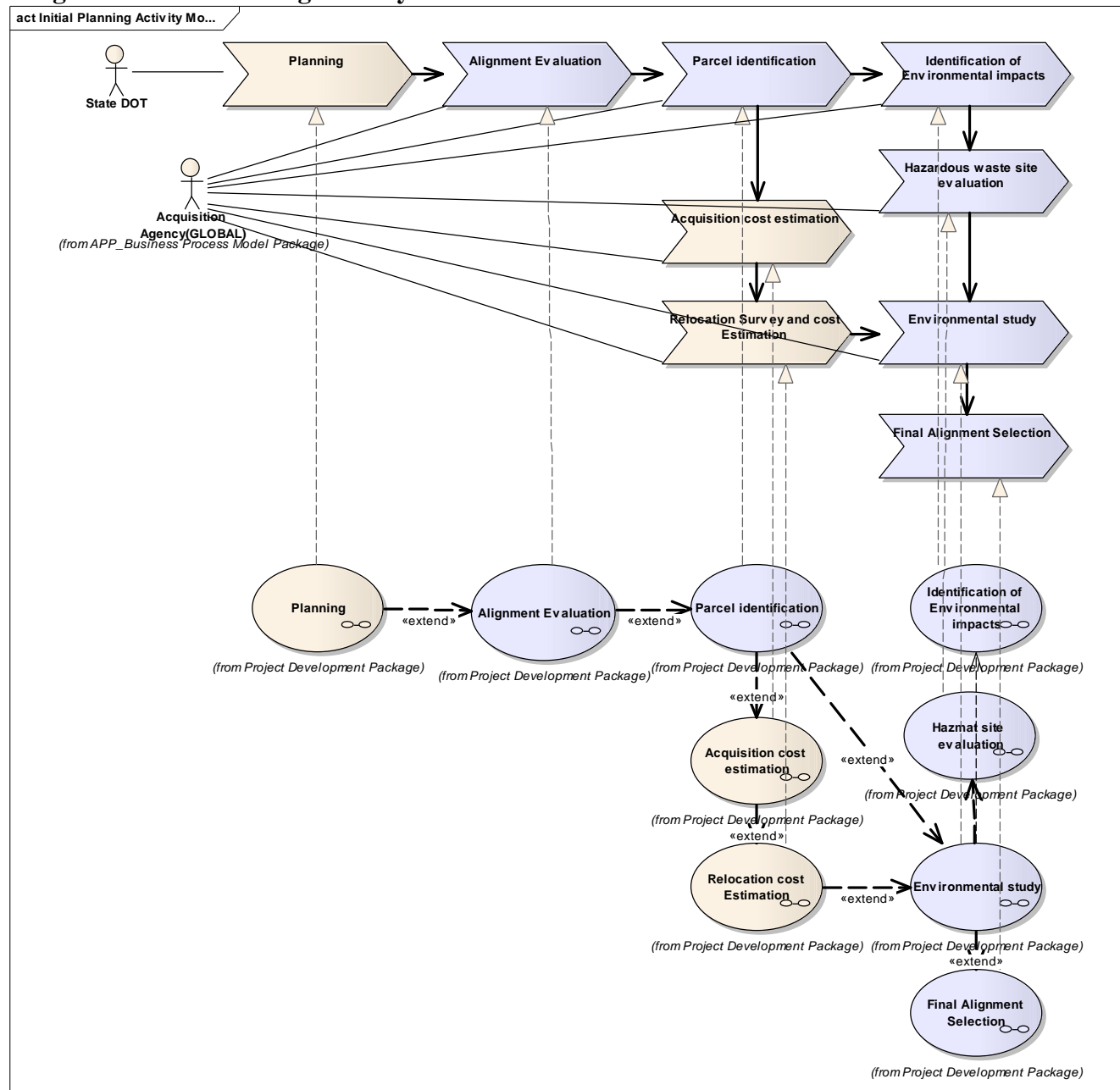
Diagram: Initial Planning Activity Model

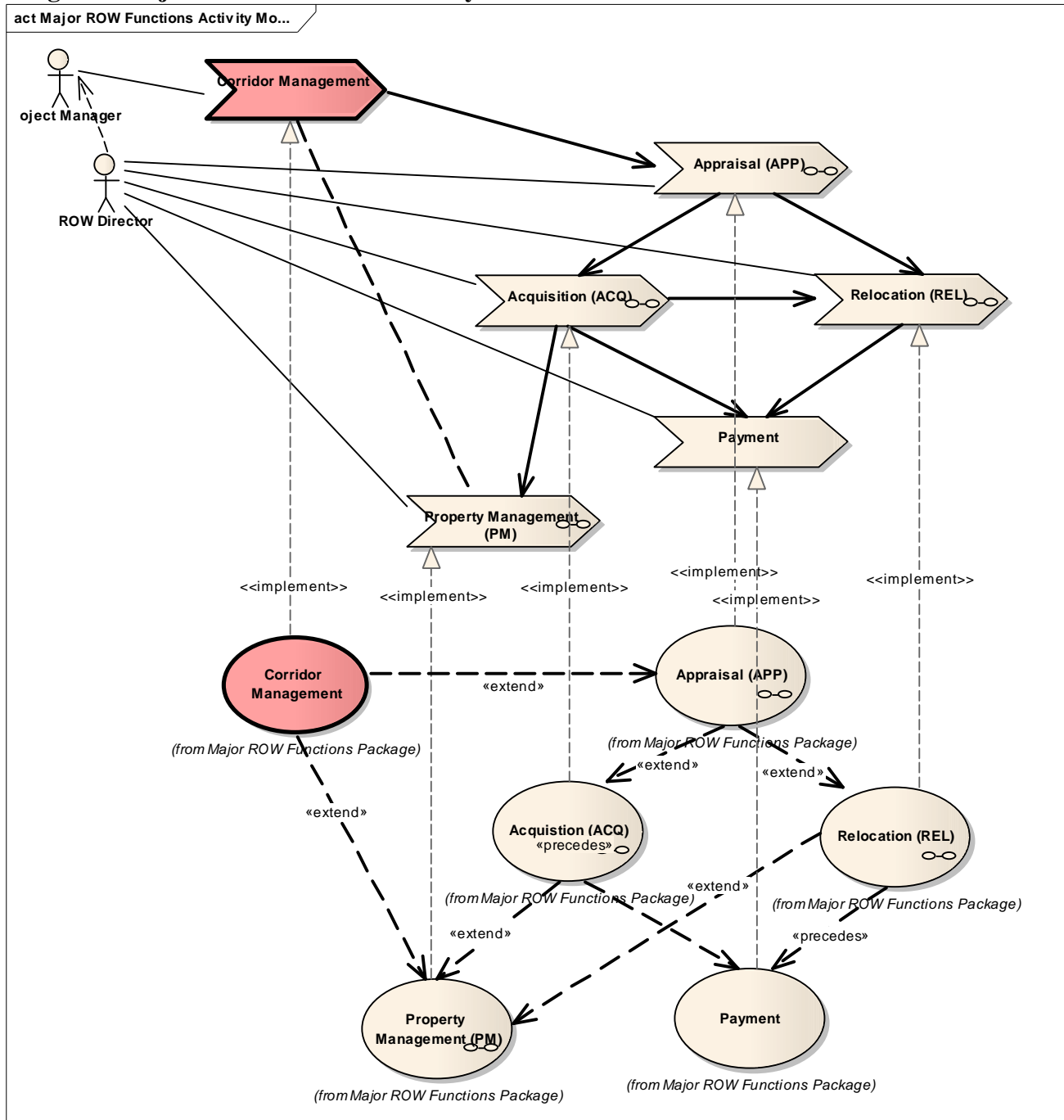
Diagram: Major ROW Functions Activity Model

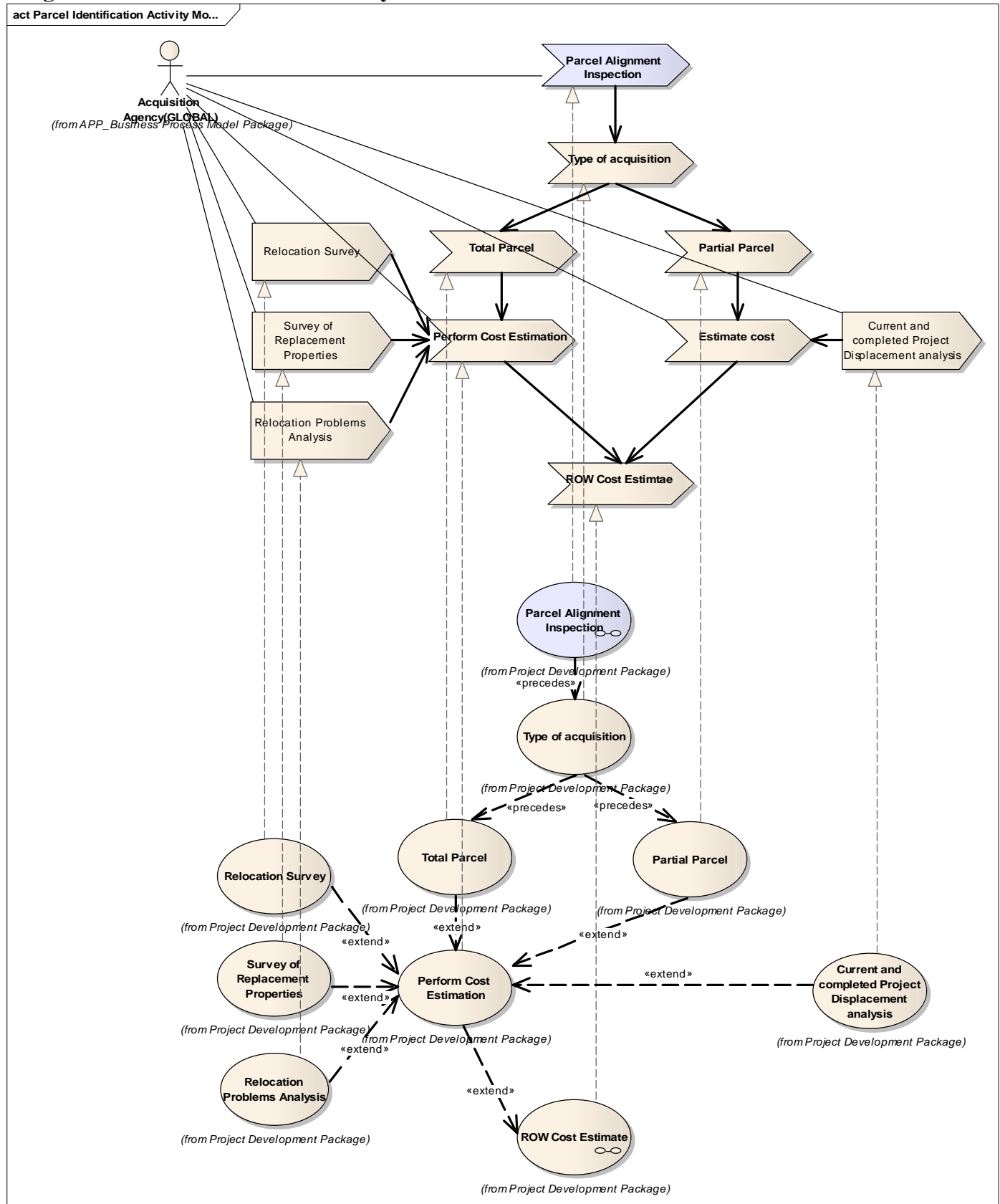
Diagram: Parcel Identification Activity Model

Diagram: Project Closing

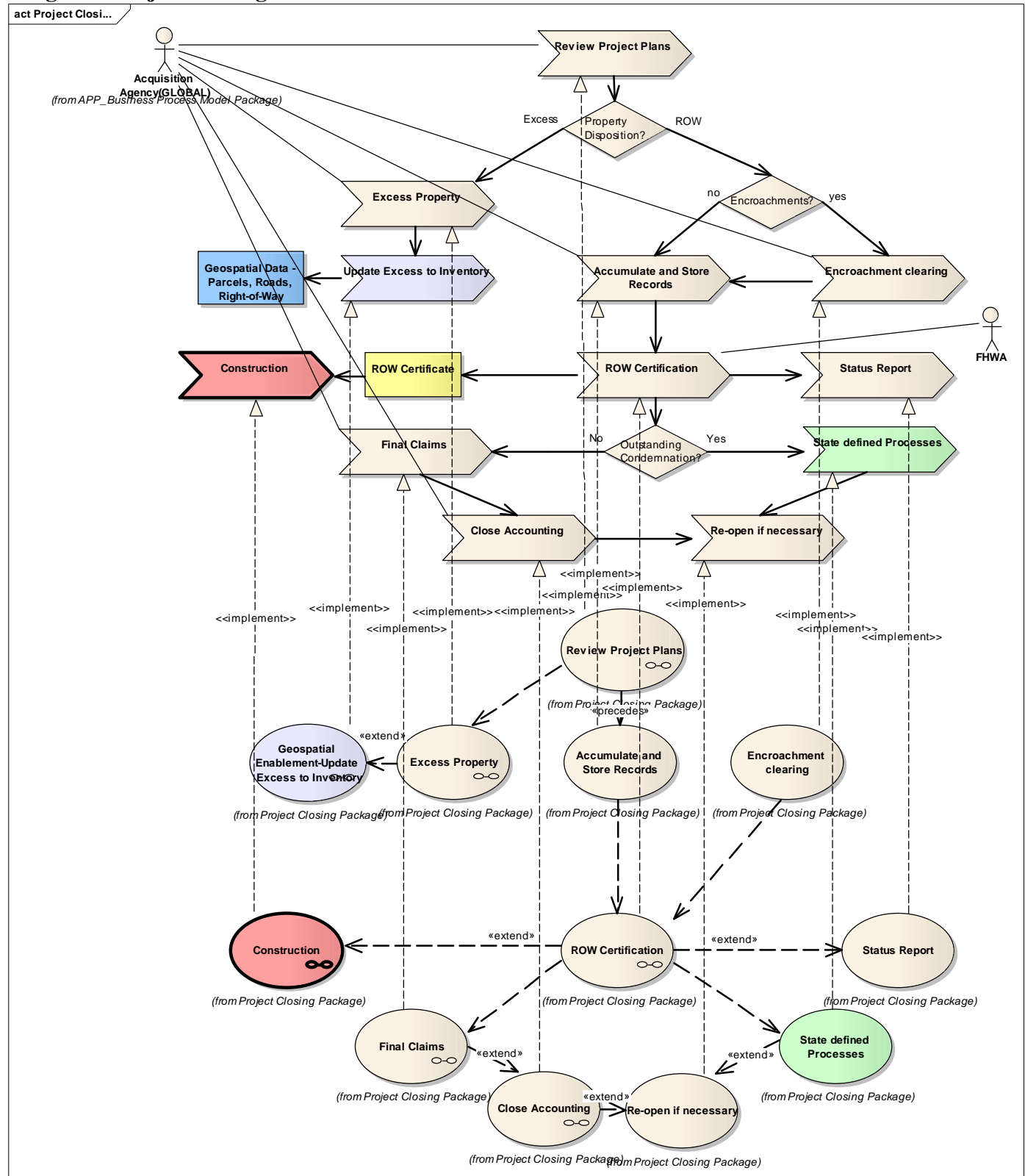


Diagram: Project Development Activity Model

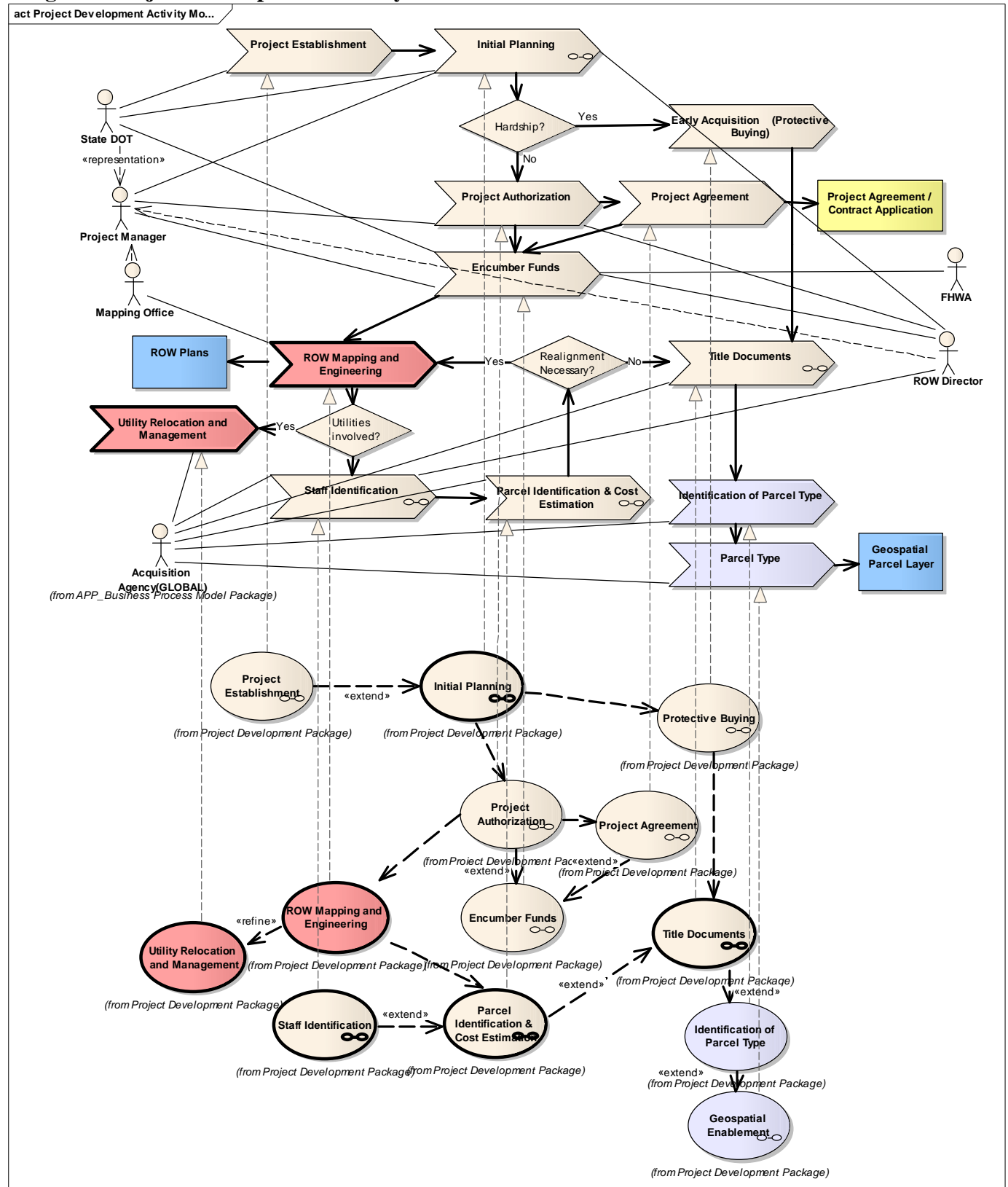


Diagram: Property Management Activity Model

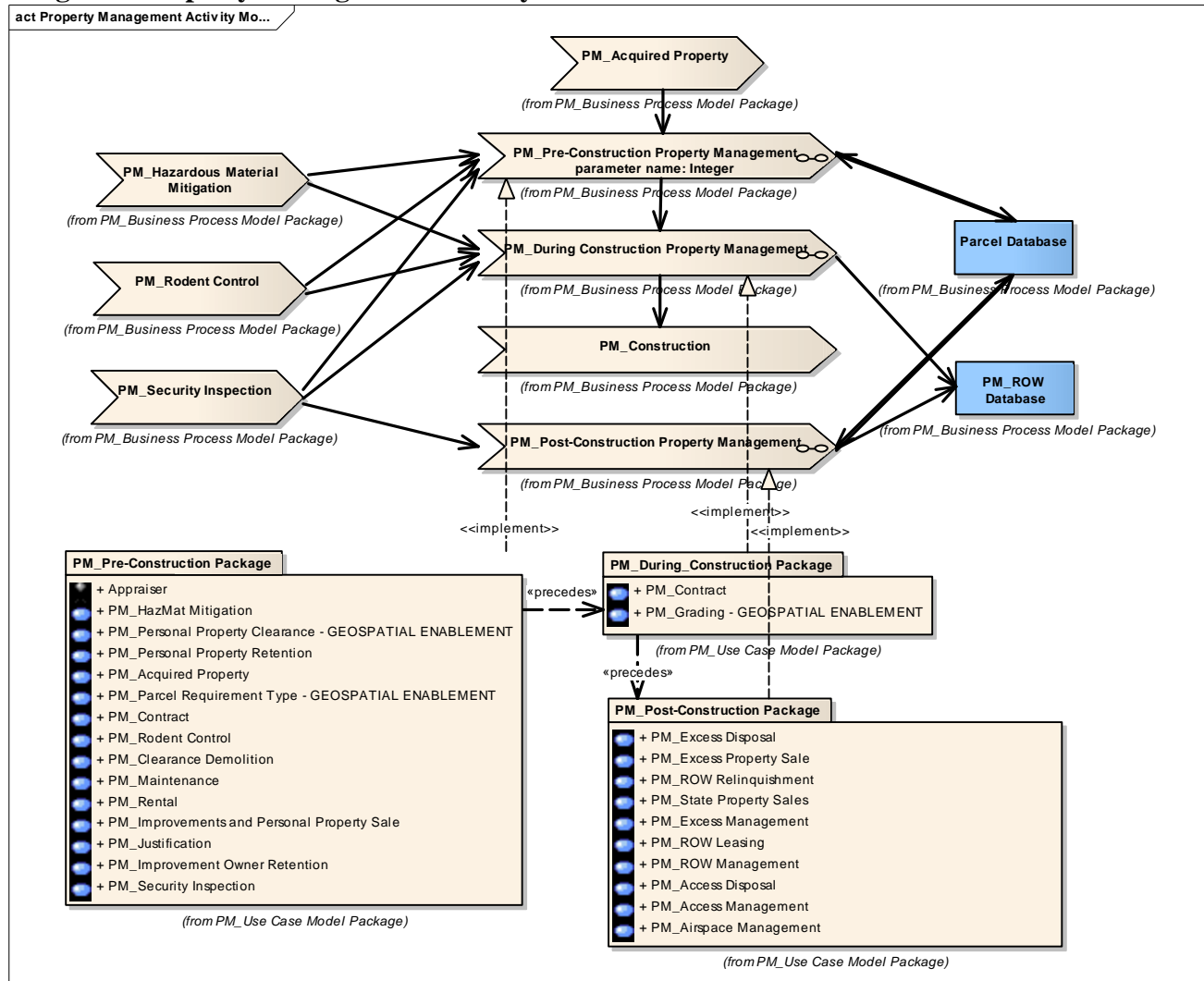


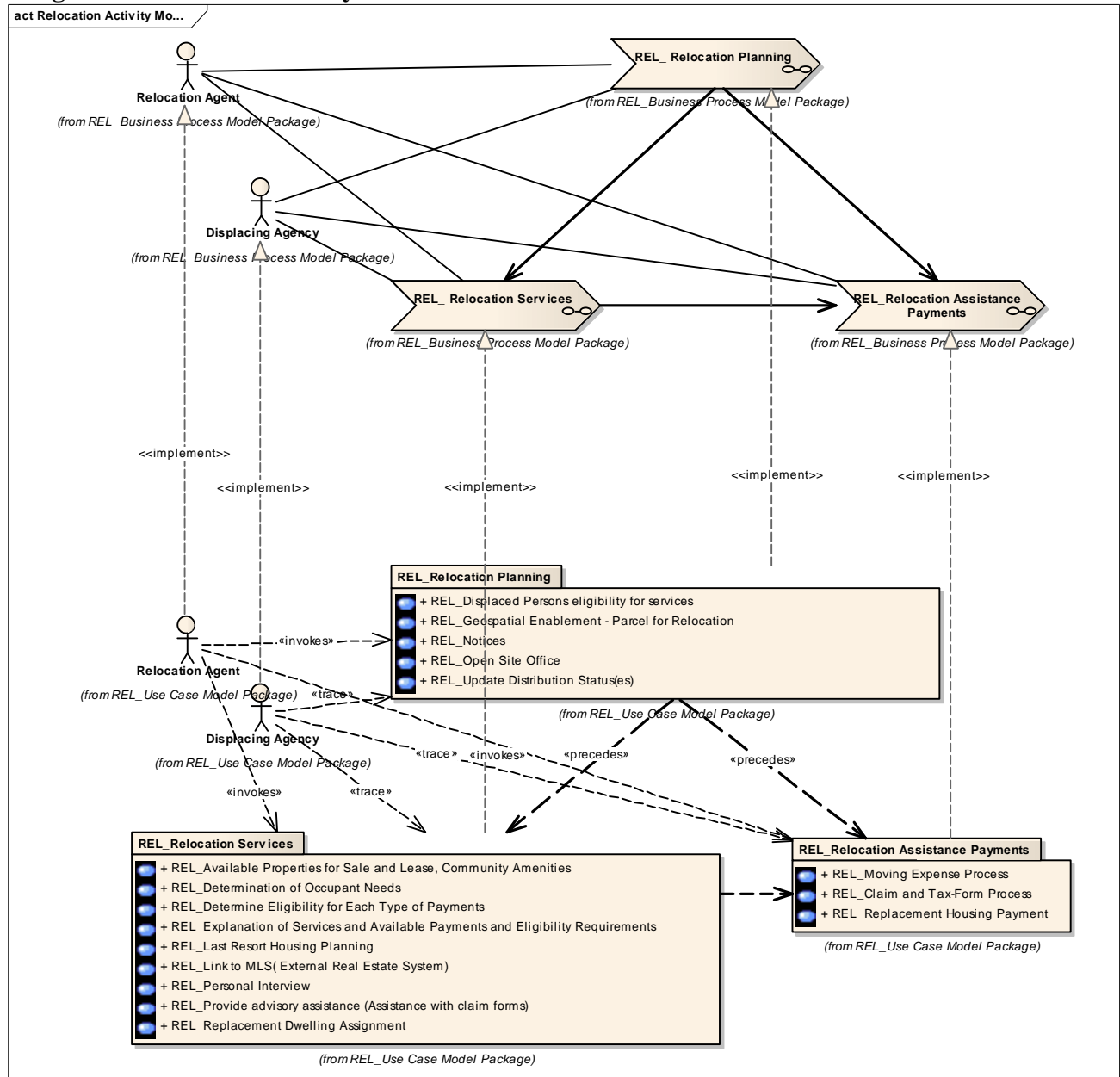
Diagram: Relocation Activity Model

Diagram: Staff Identification Activity Model

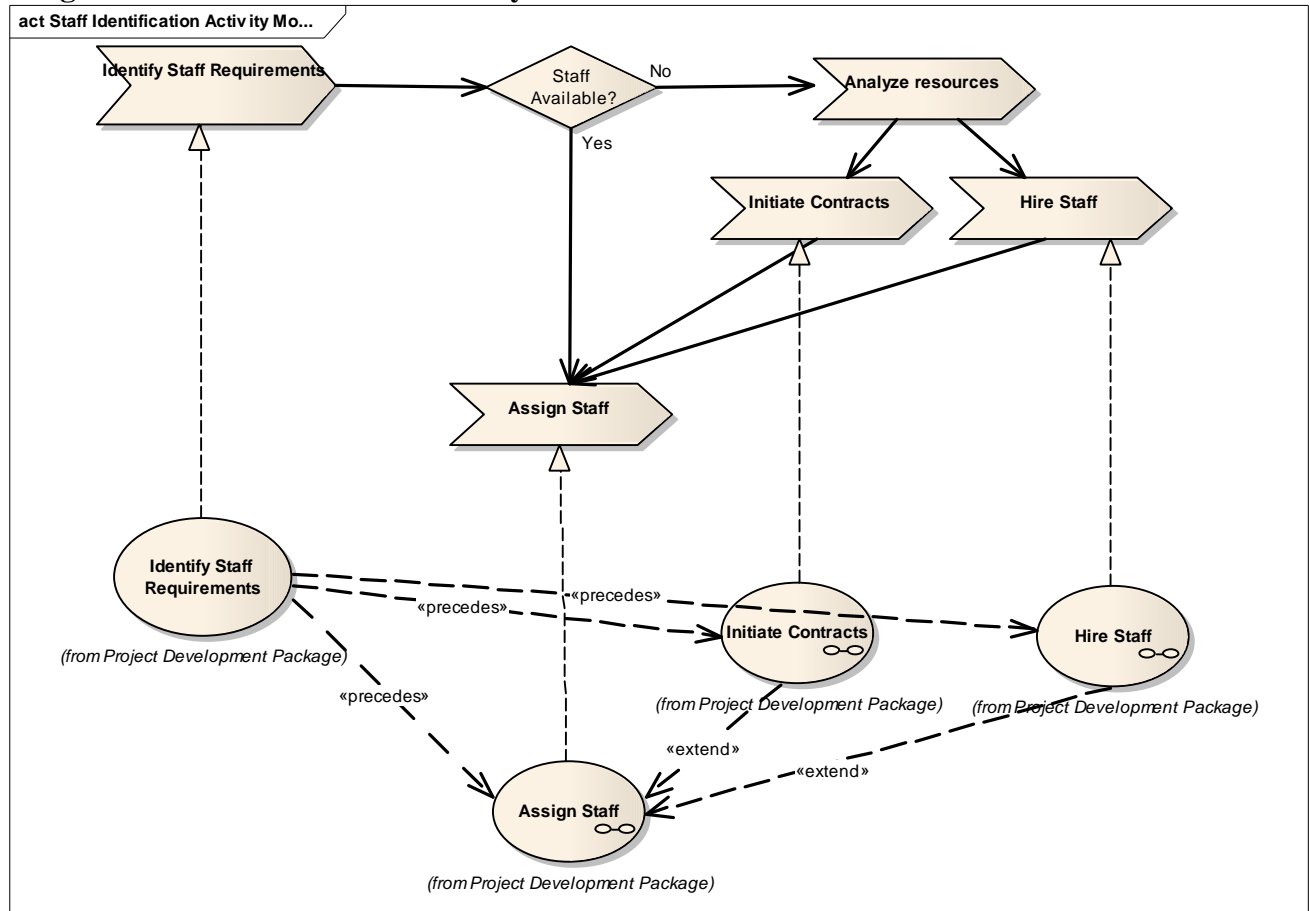


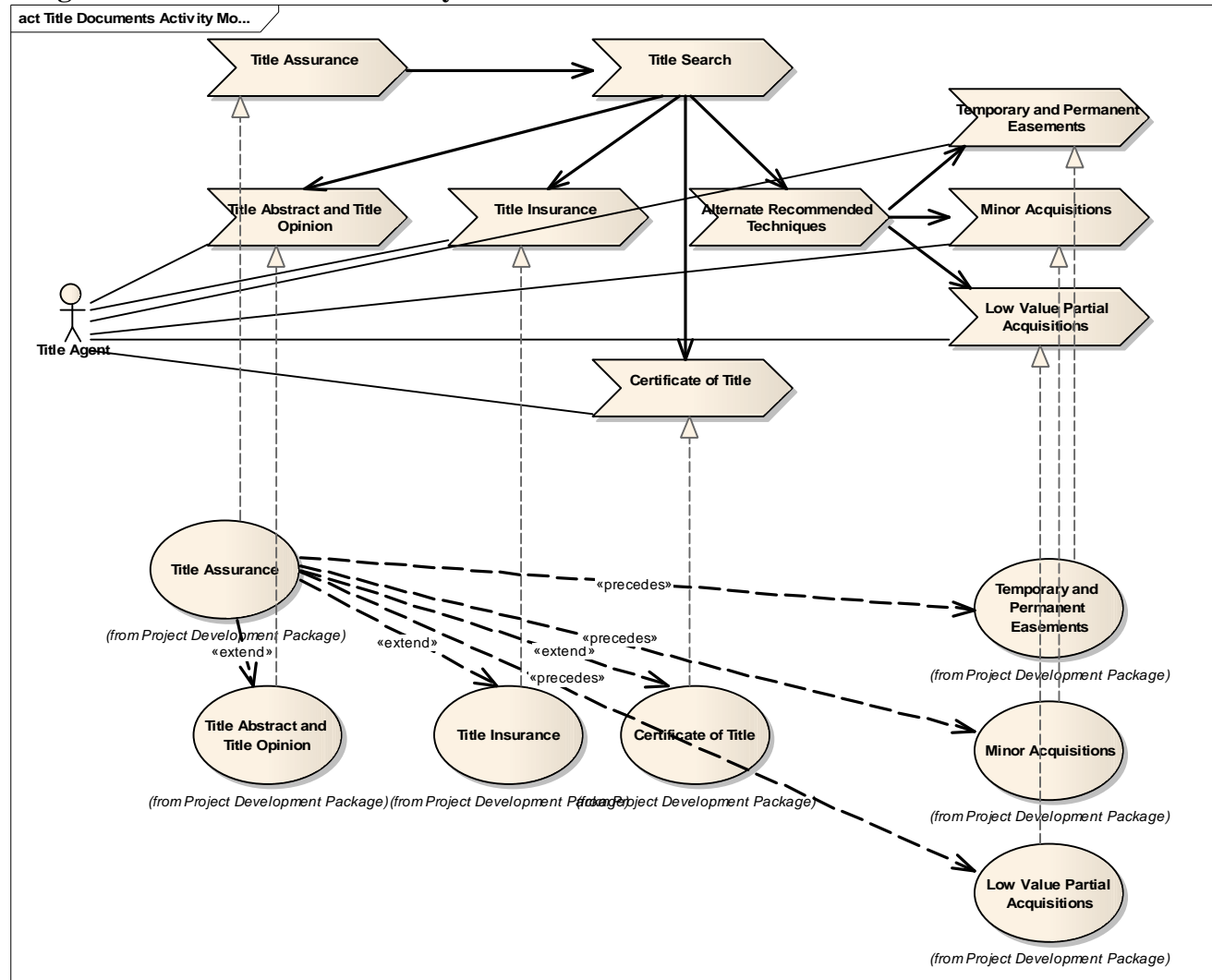
Diagram: Title Documents Activity Model

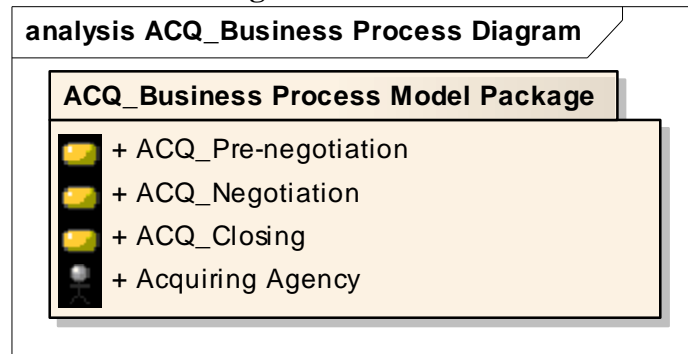
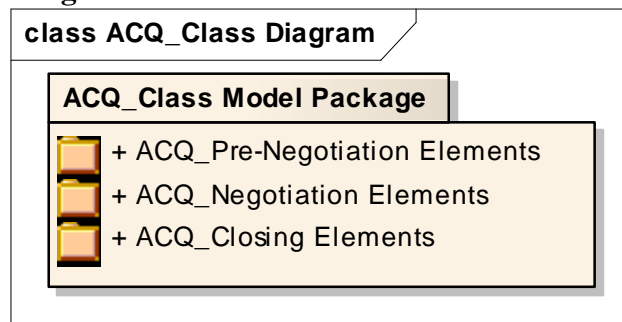
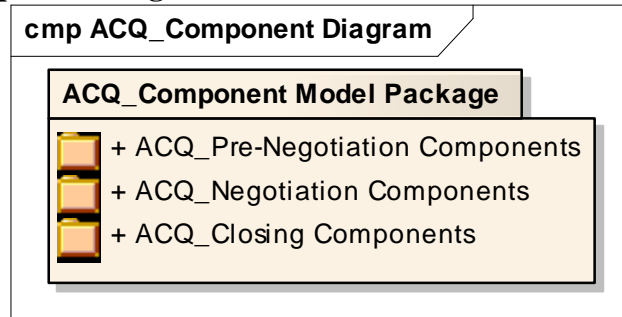
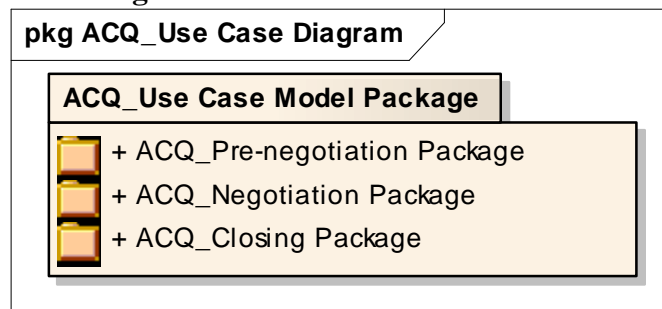
Diagram: ACQ_Business Process Diagram**Diagram: ACQ_Class Diagram****Diagram: ACQ_Component Diagram****Diagram: ACQ_Use Case Diagram**

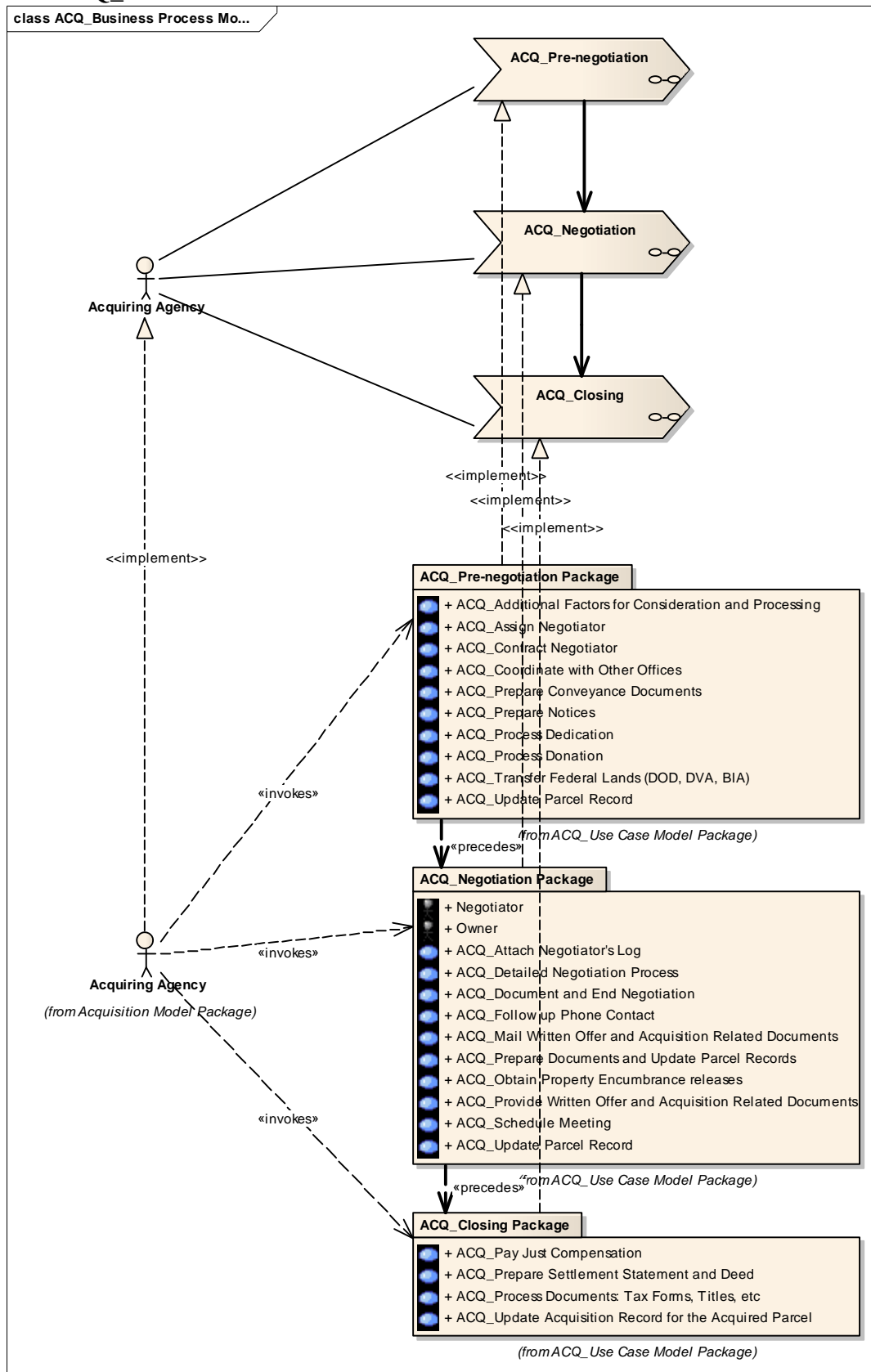
Diagram: ACQ_Business Process Model

Diagram: ACQ_Closing Activity

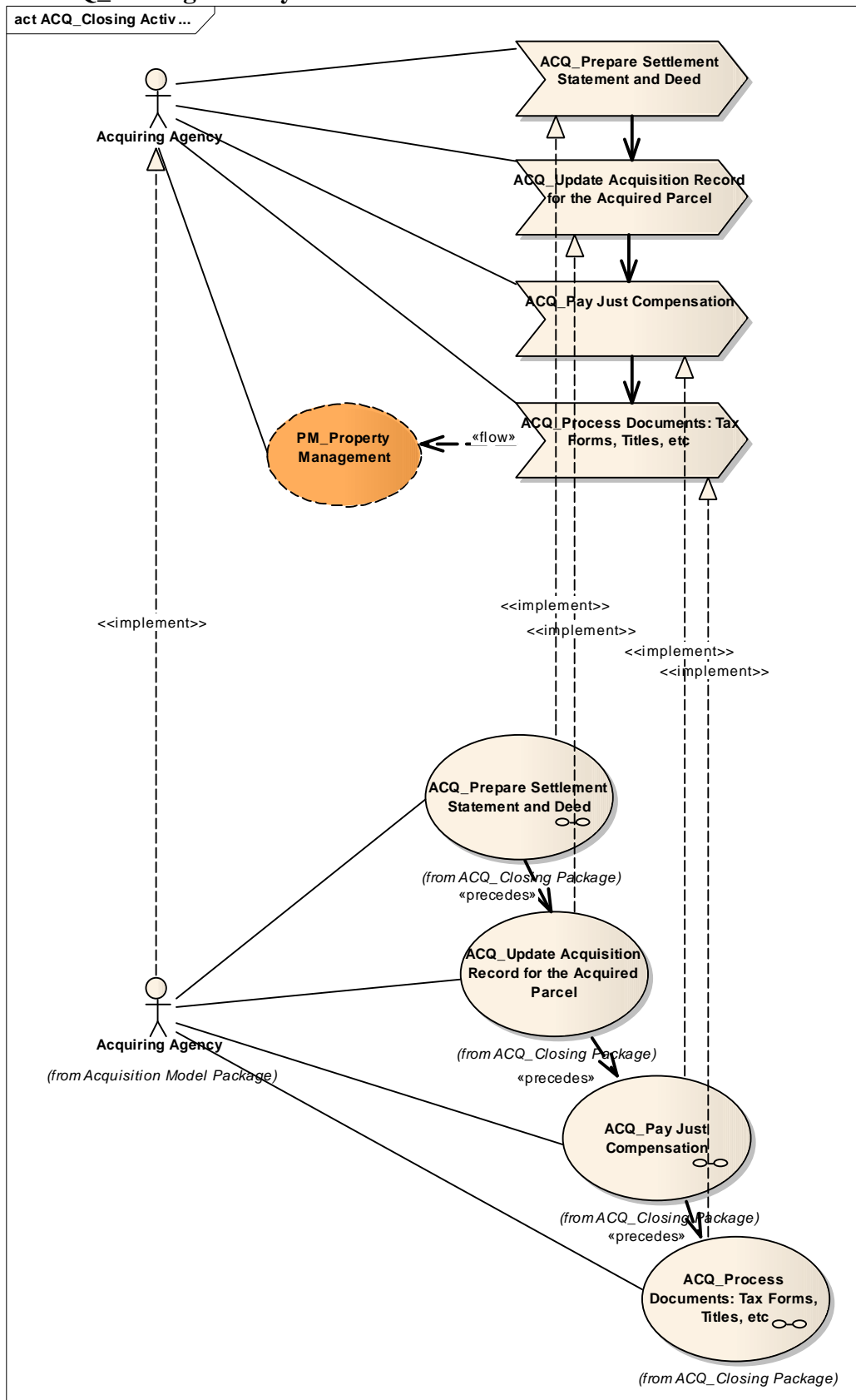


Diagram: ACQ_Negotiation Activity

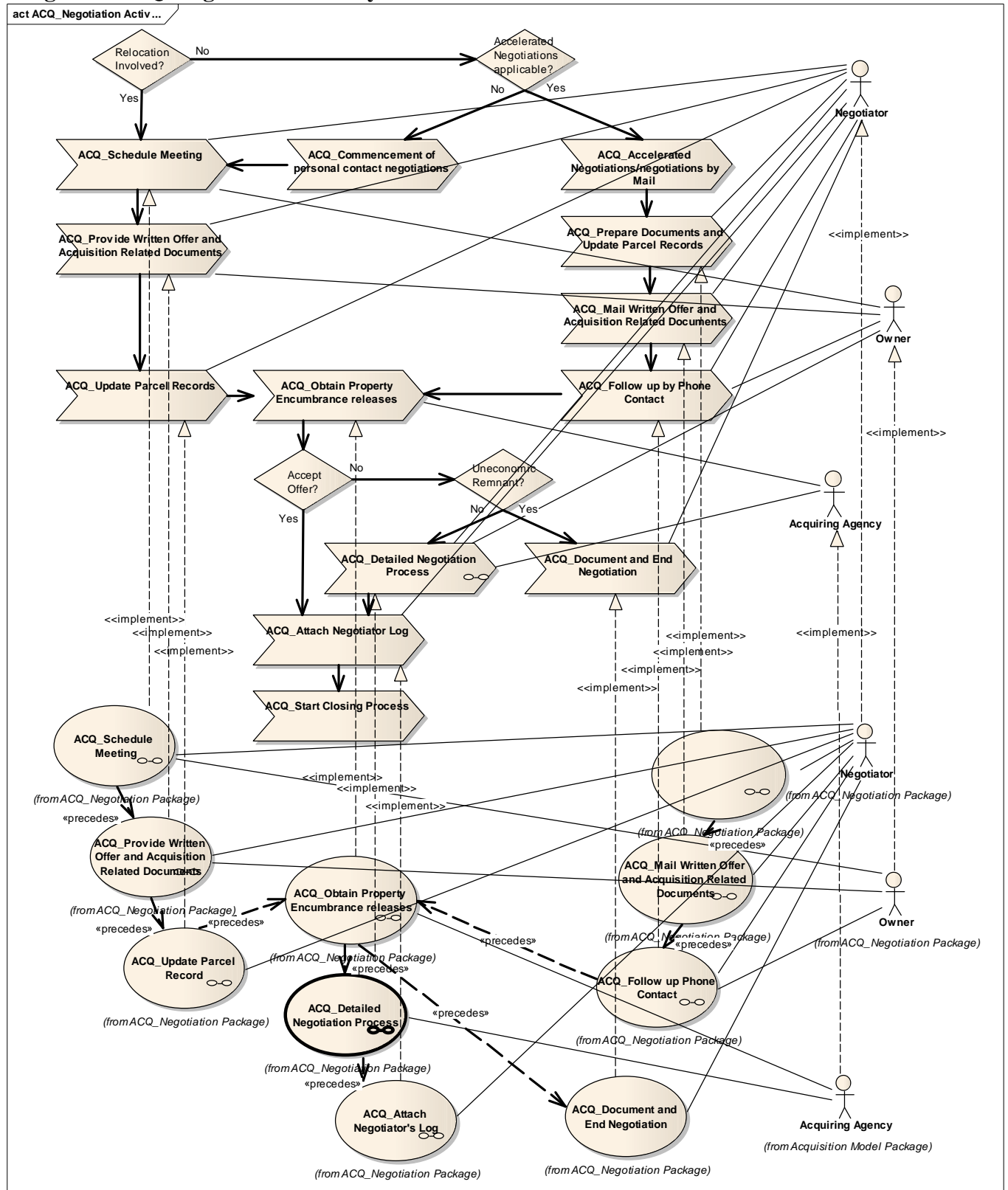


Diagram: ACQ_Pre-negotiation Activity

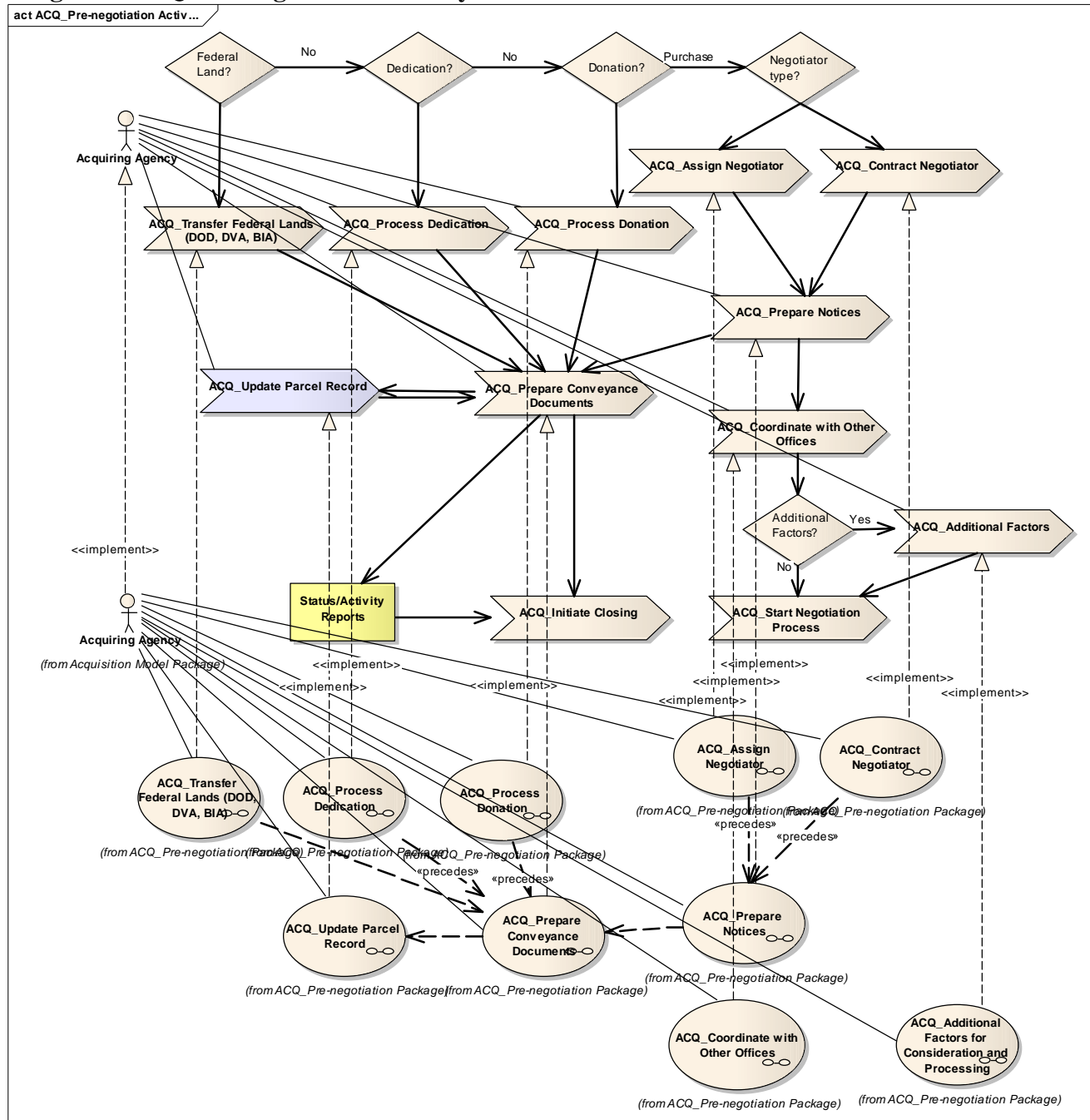


Diagram: Detailed Negotiation Activity

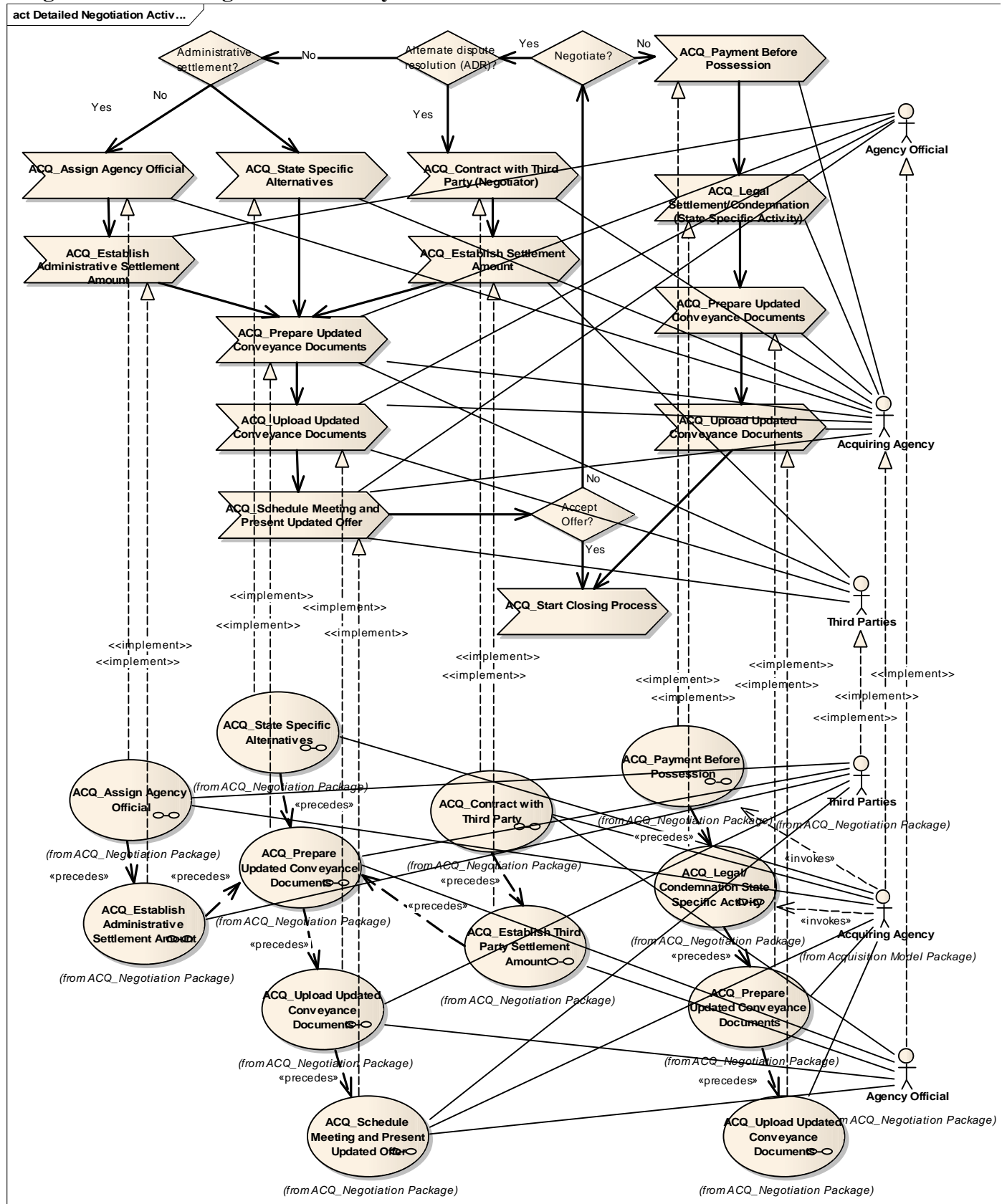


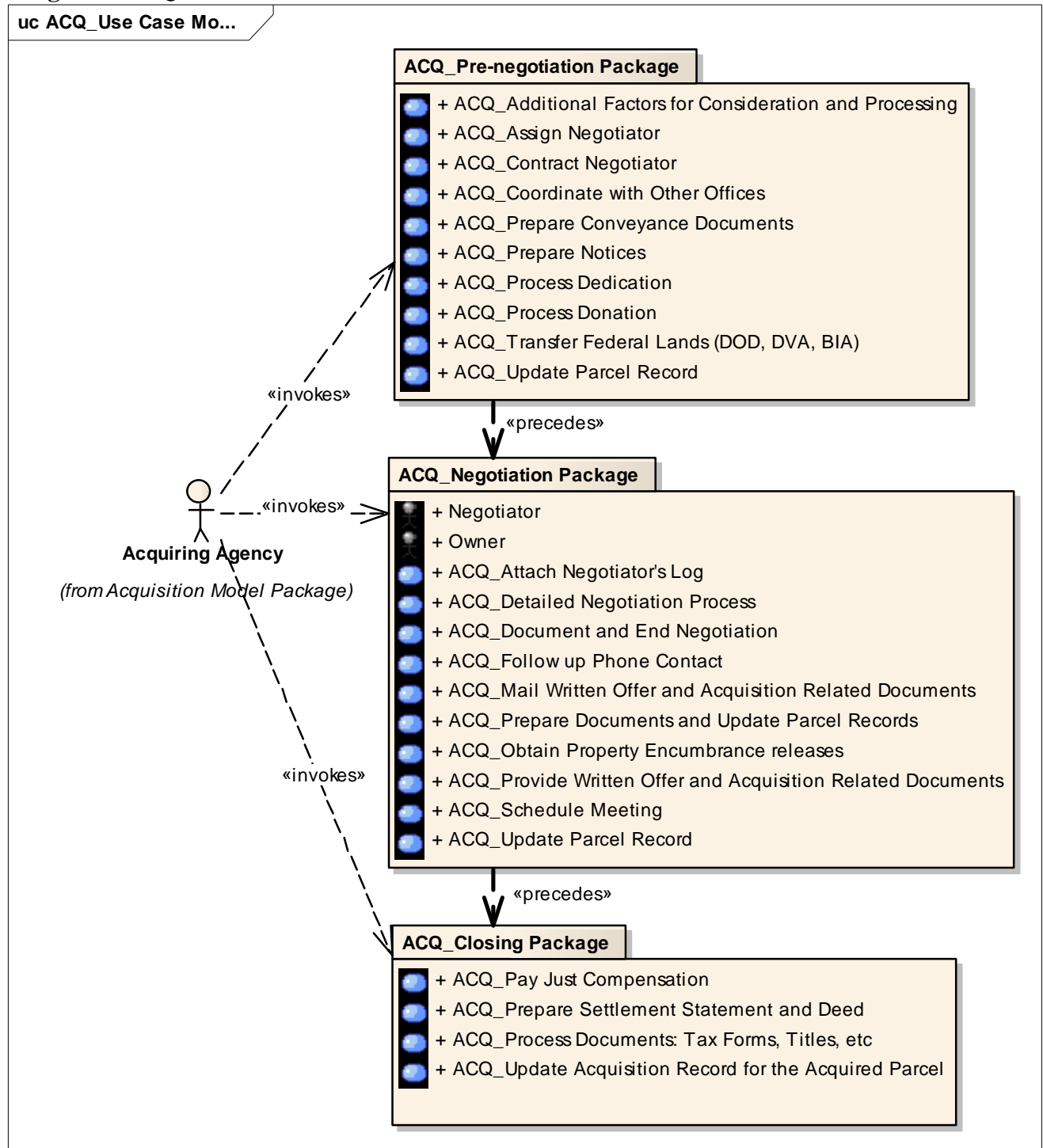
Diagram: ACQ_Use Case Model

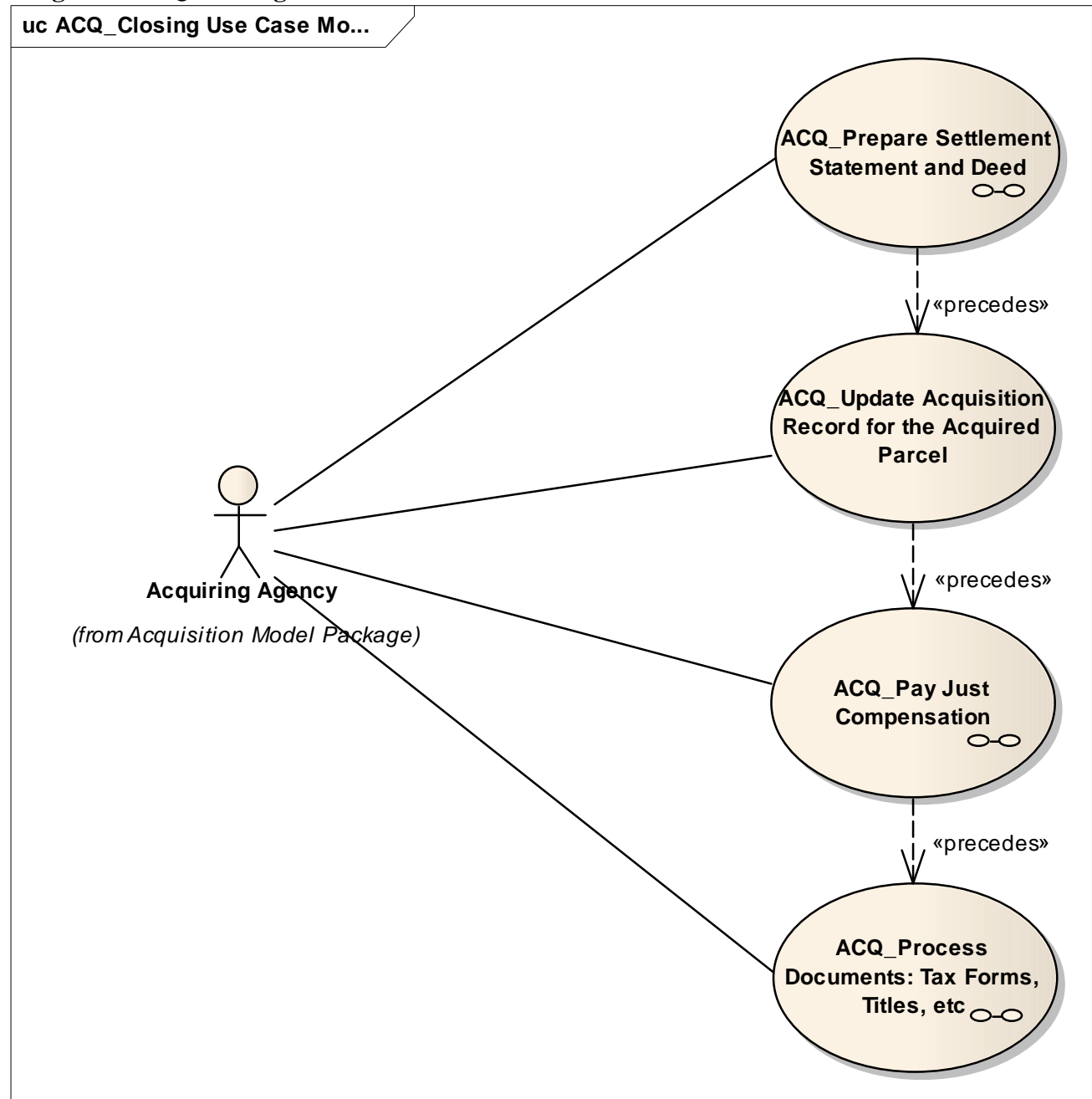
Diagram: ACQ_Closing Use Case Model

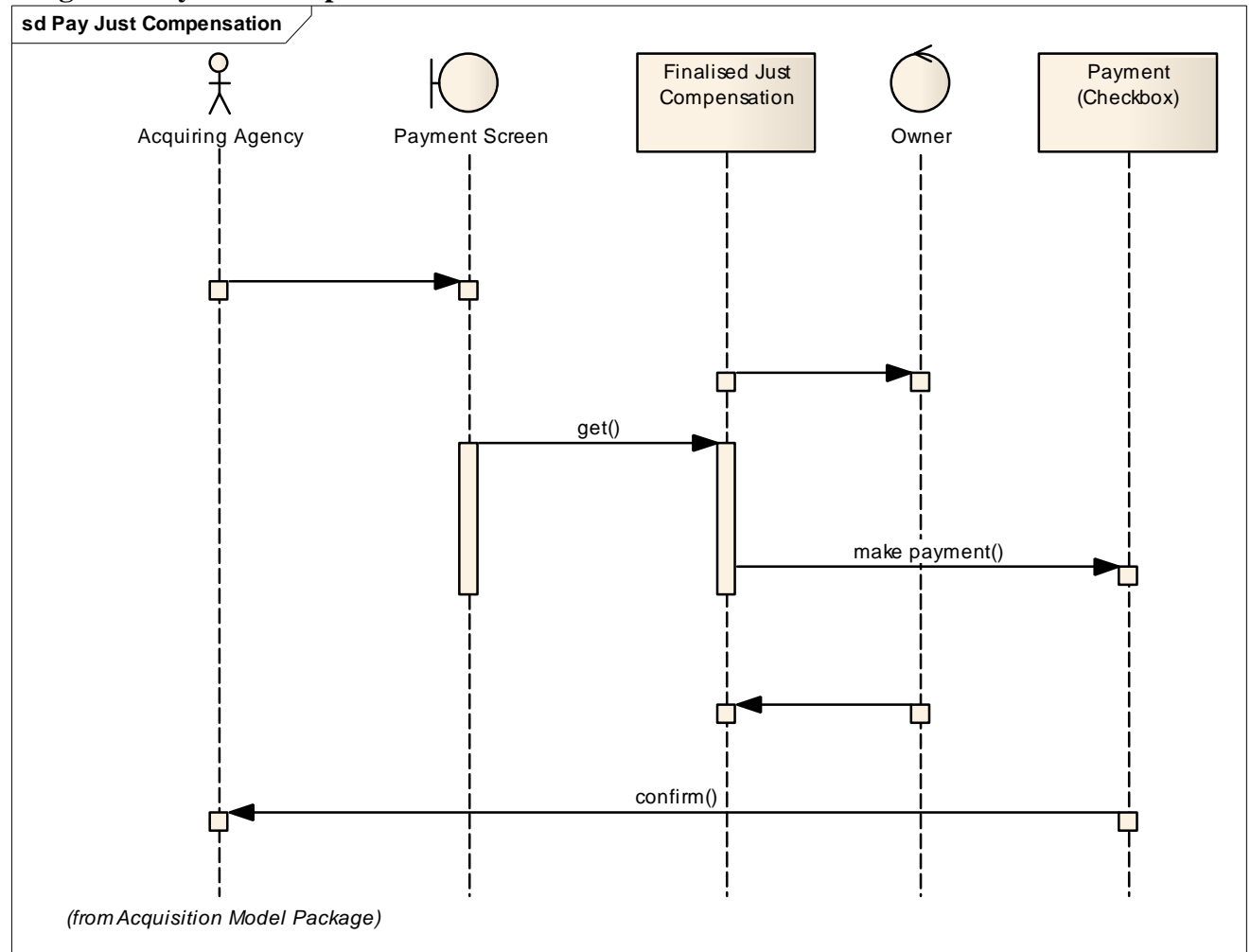
Diagram: Pay Just Compensation

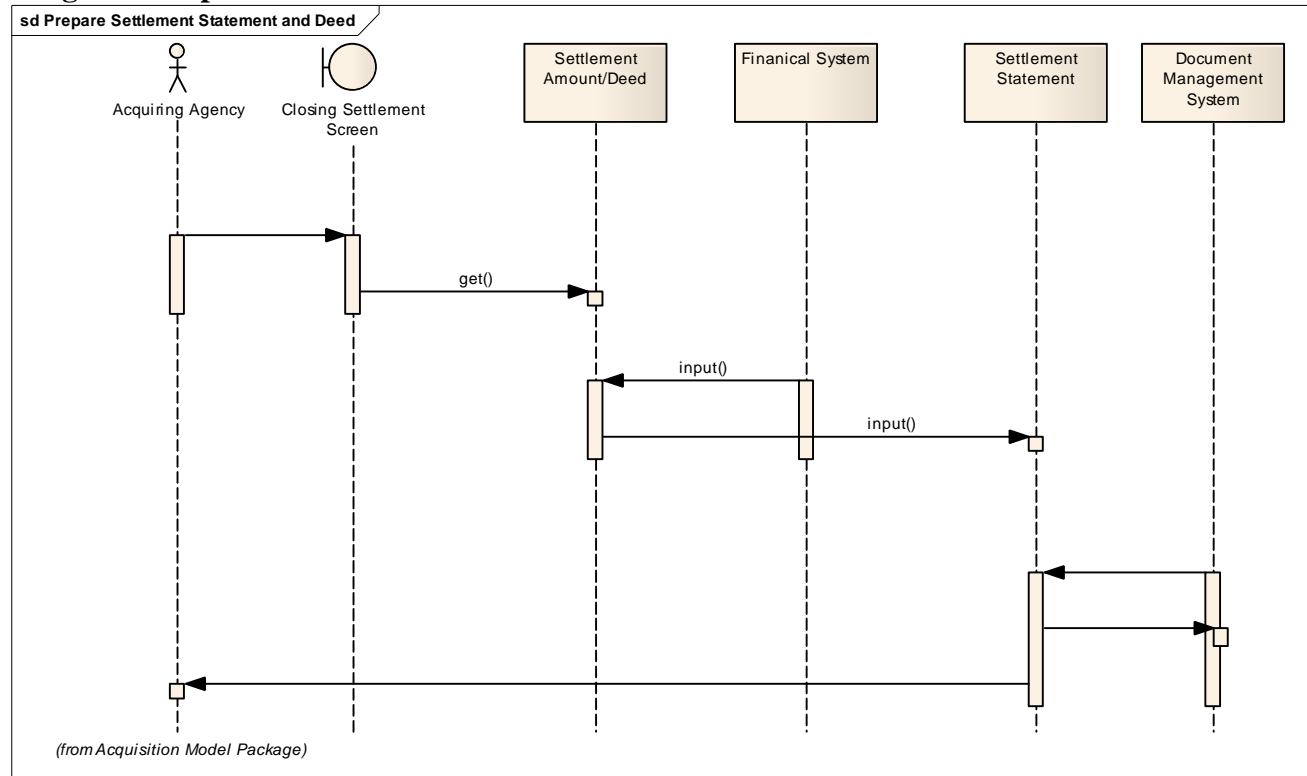
Diagram: Prepare Settlement Statement and Deed

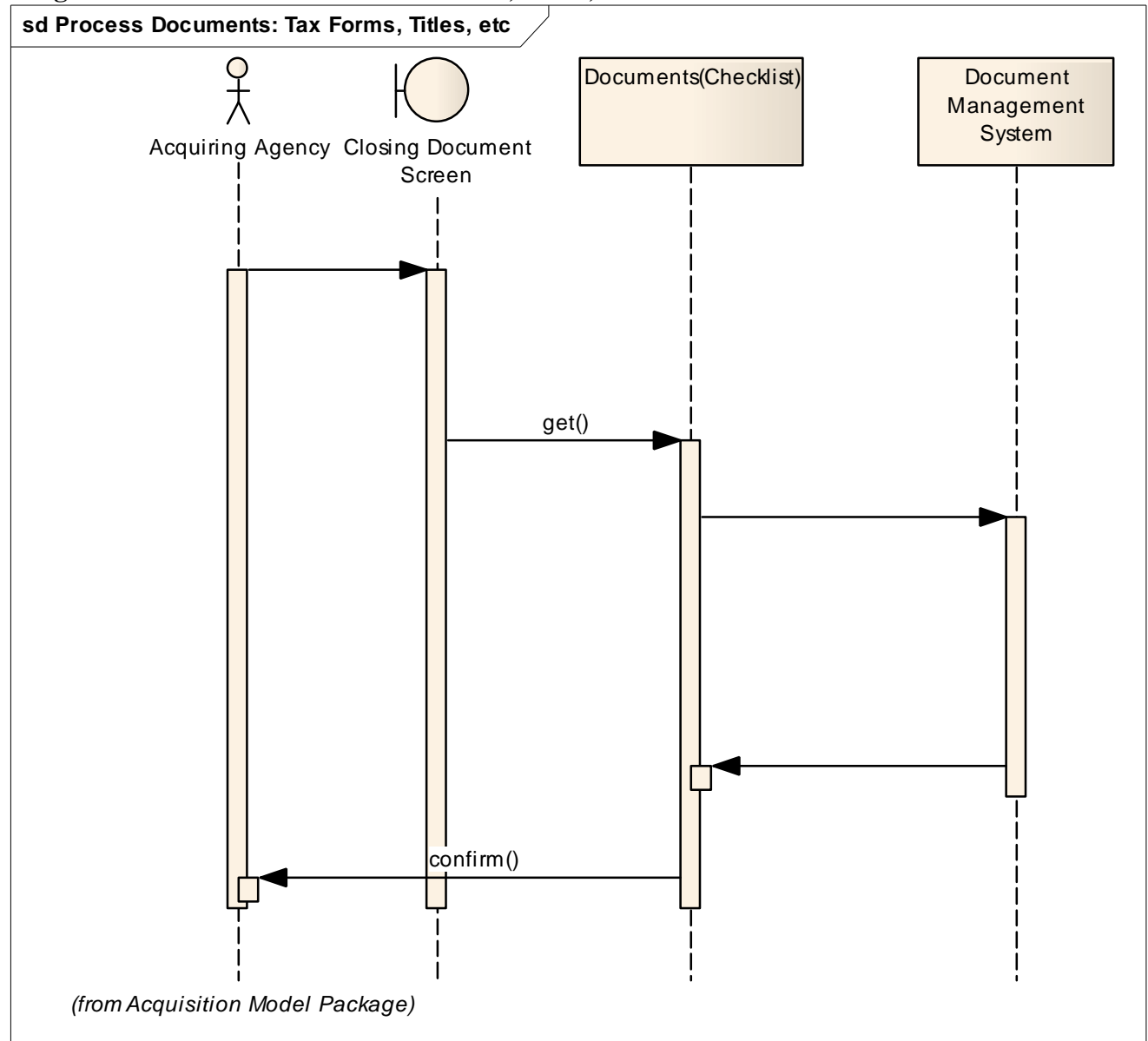
Diagram: Process Documents: Tax Forms, Titles, etc

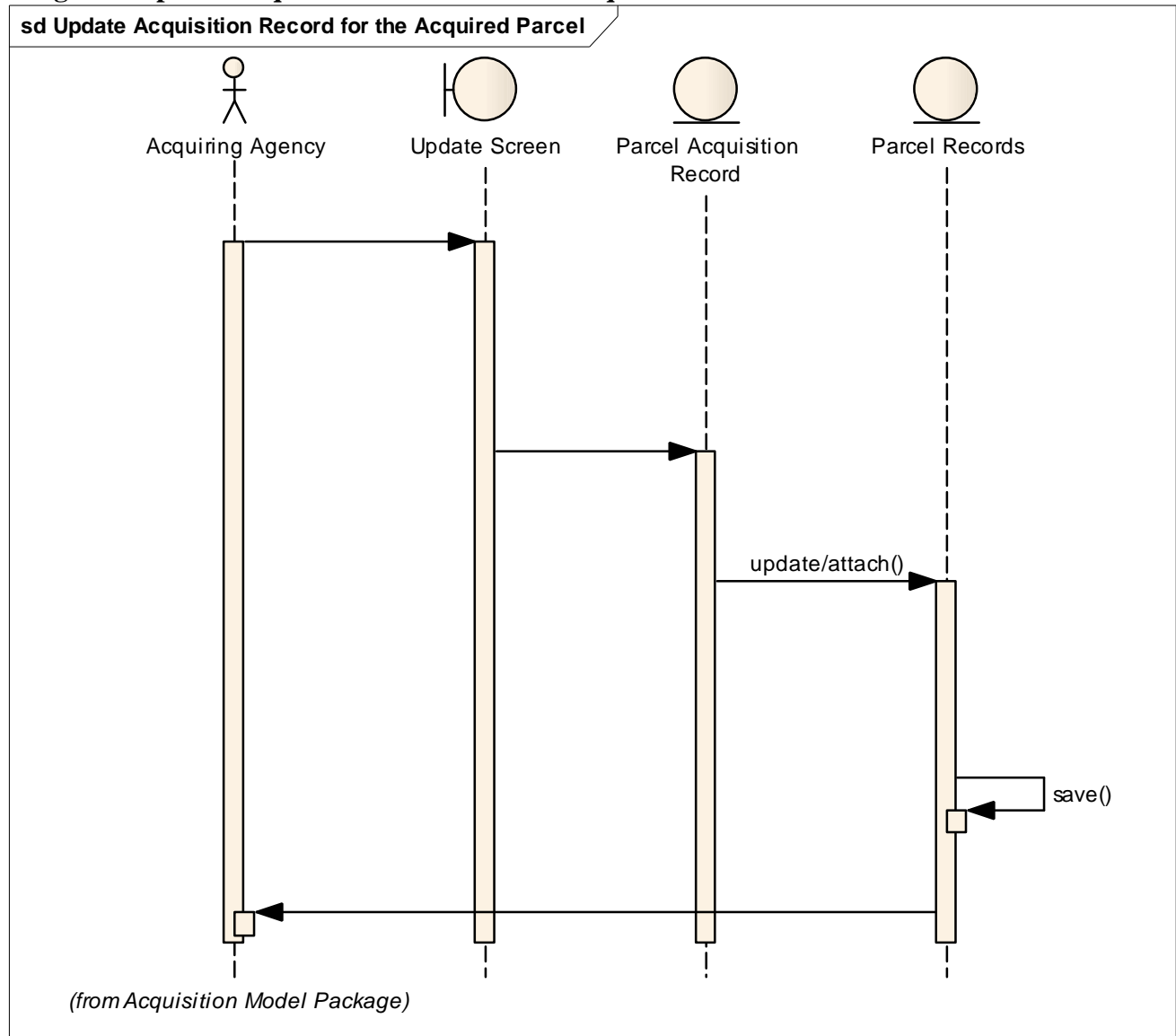
Diagram: Update Acquisition Record for the Acquired Parcel

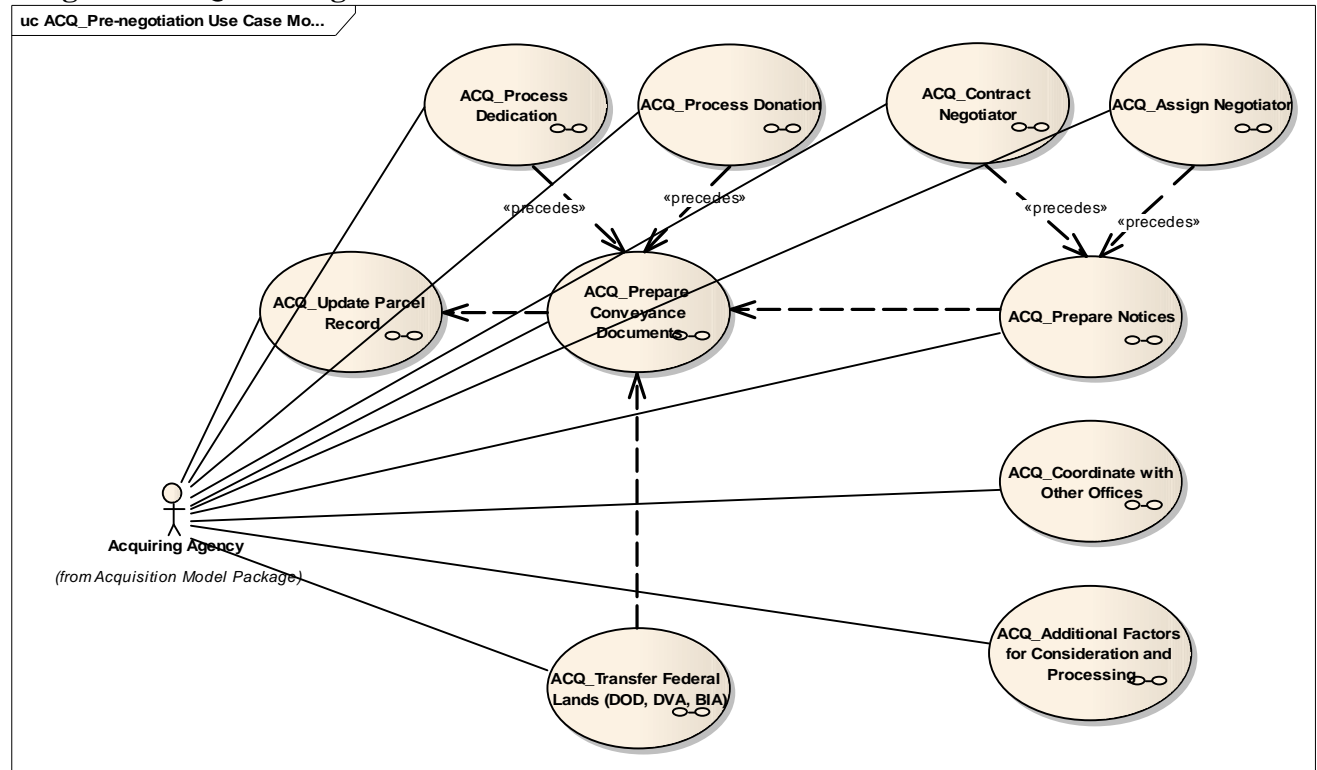
Diagram: ACQ_Pre-negotiation Use Case Model

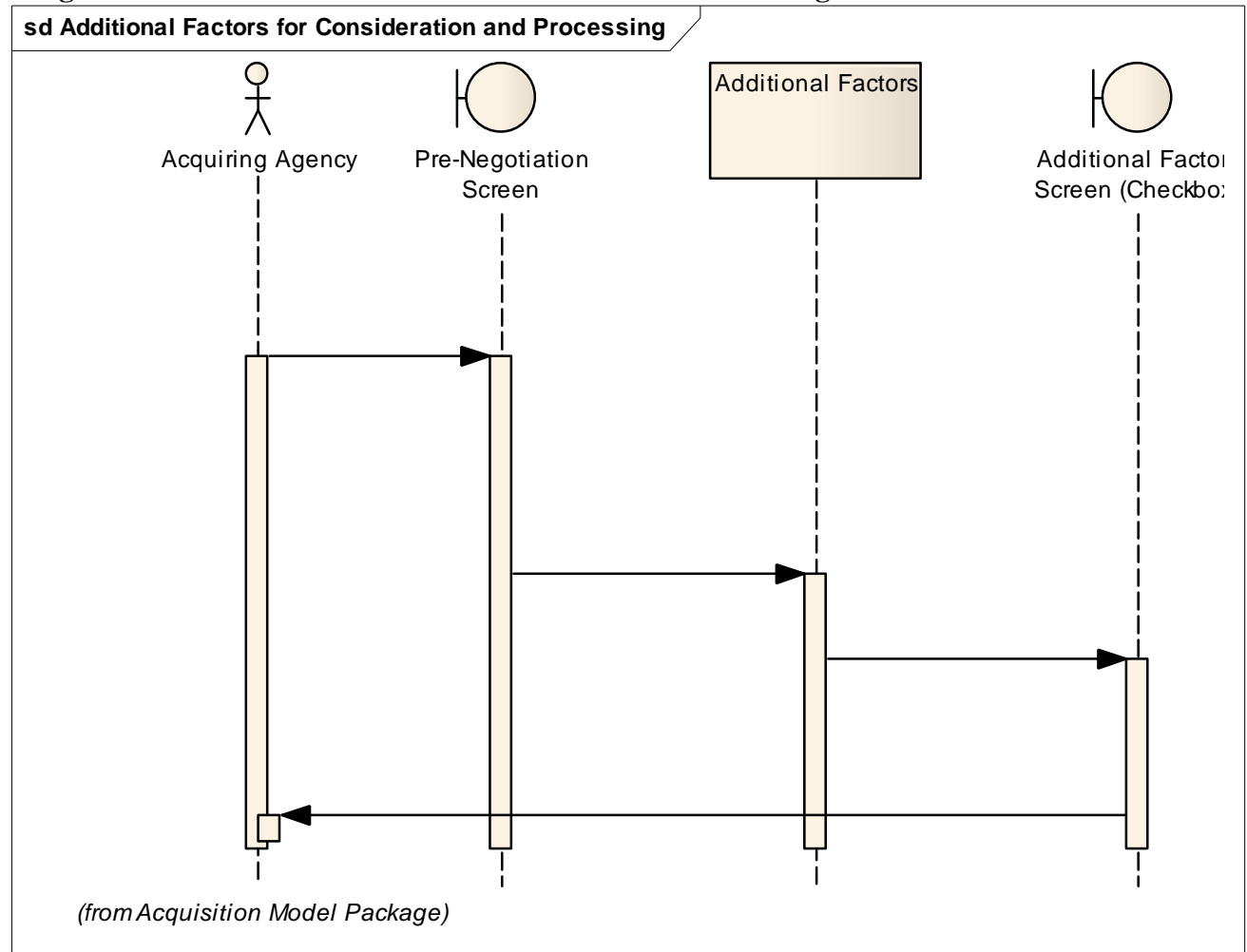
Diagram: Additional Factors for Consideration and Processing

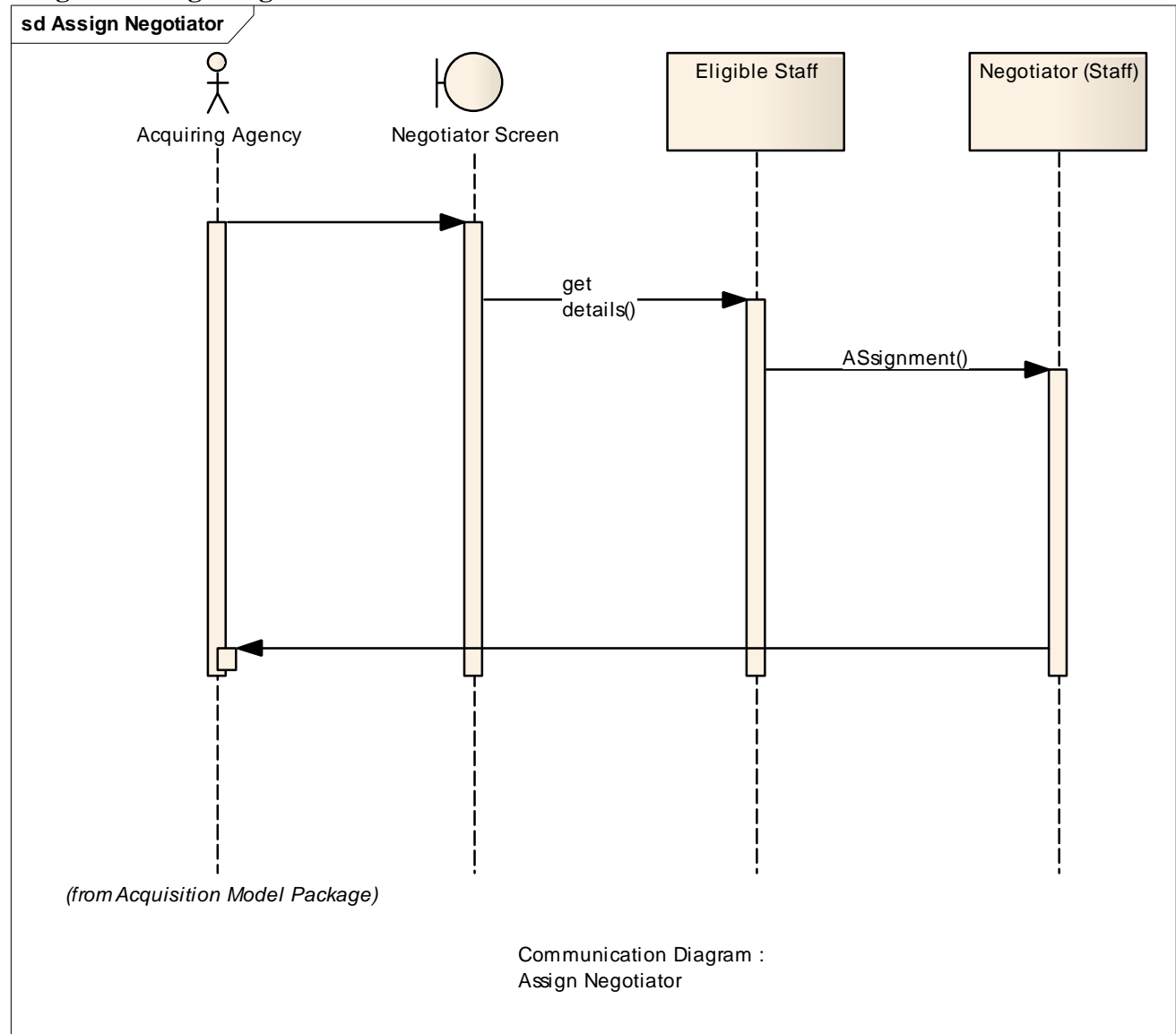
Diagram: Assign Negotiator

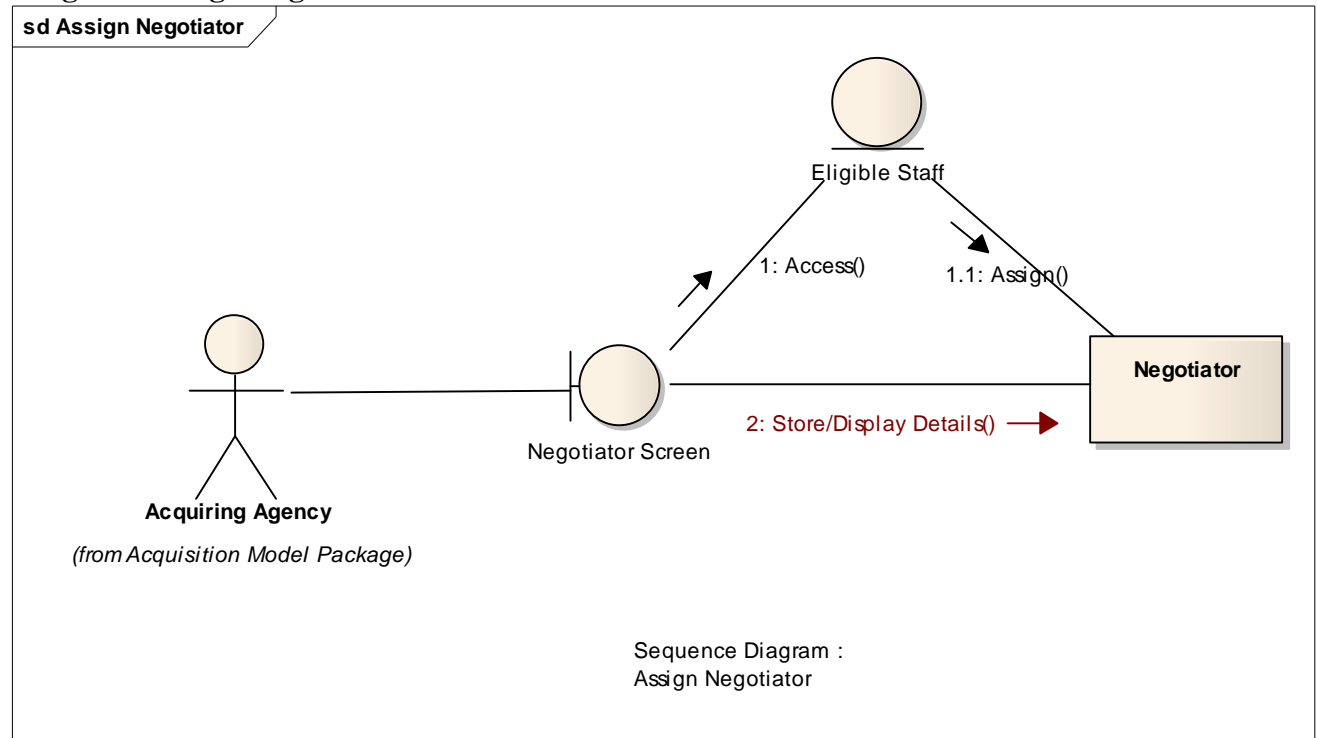
Diagram: Assign Negotiator

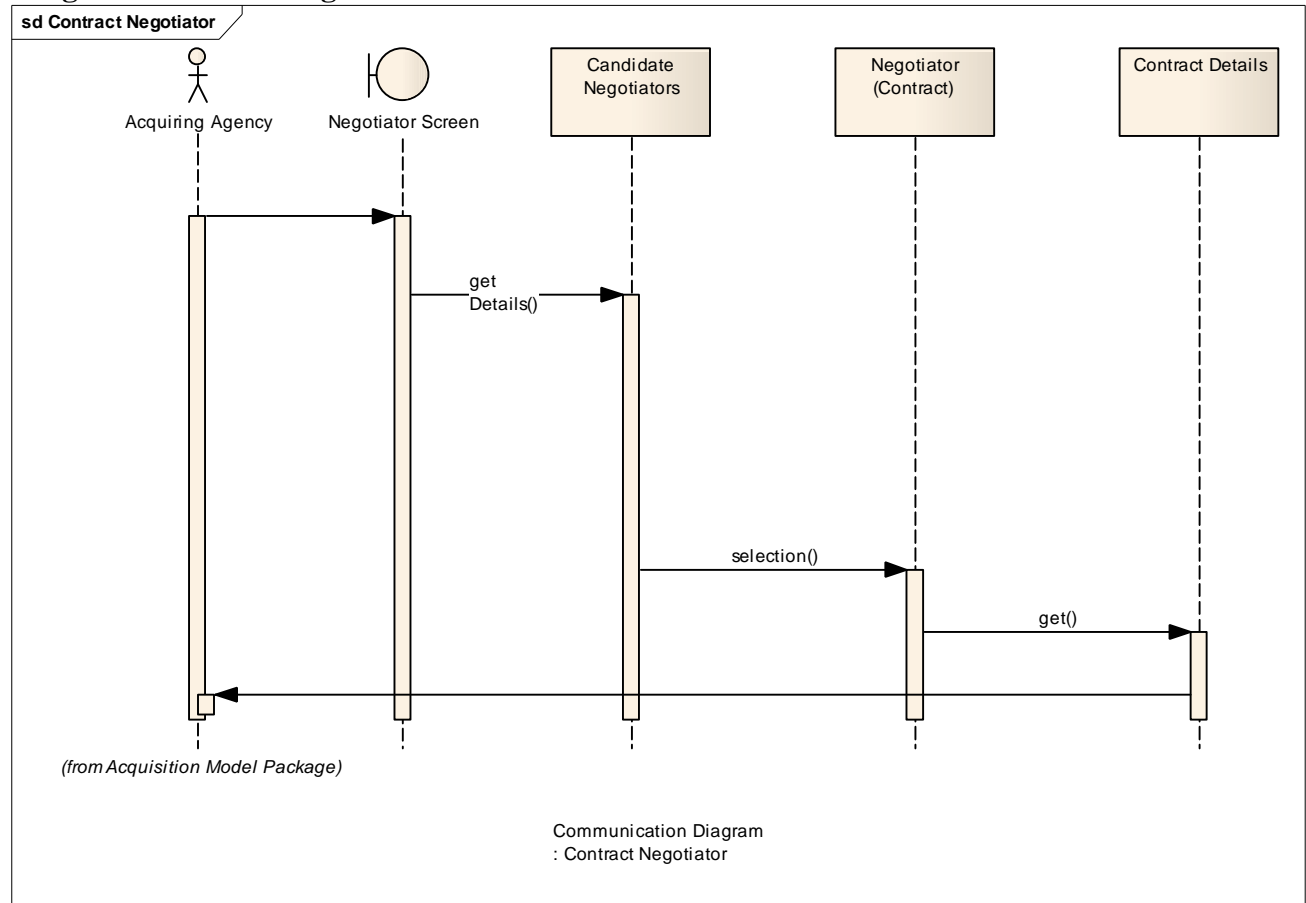
Diagram: Contract Negotiator

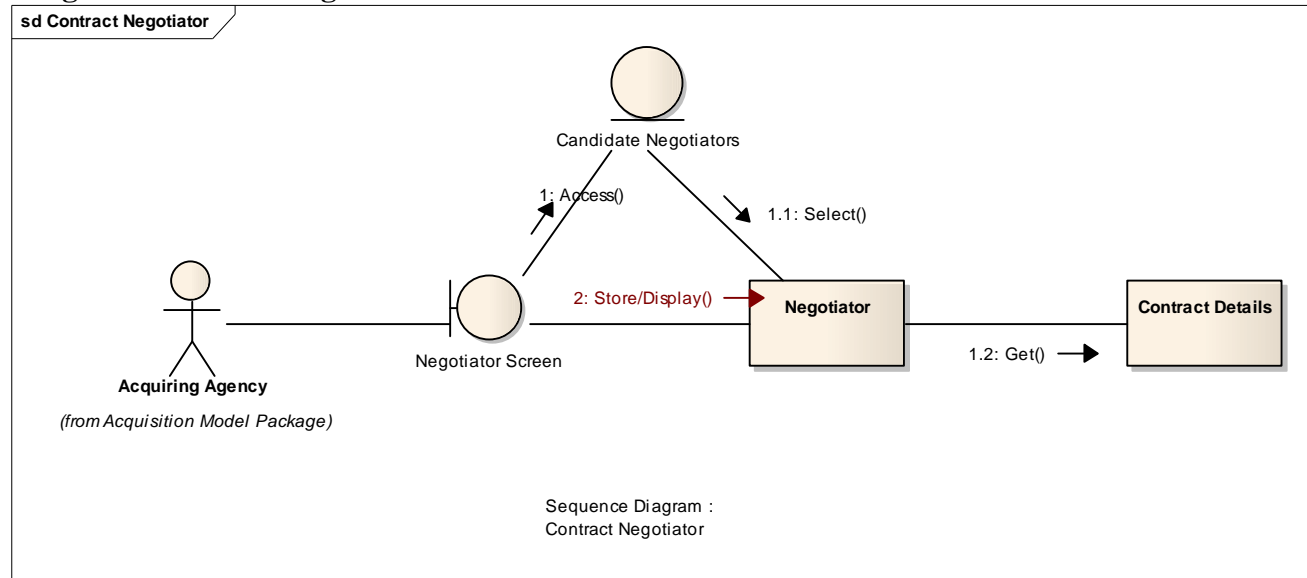
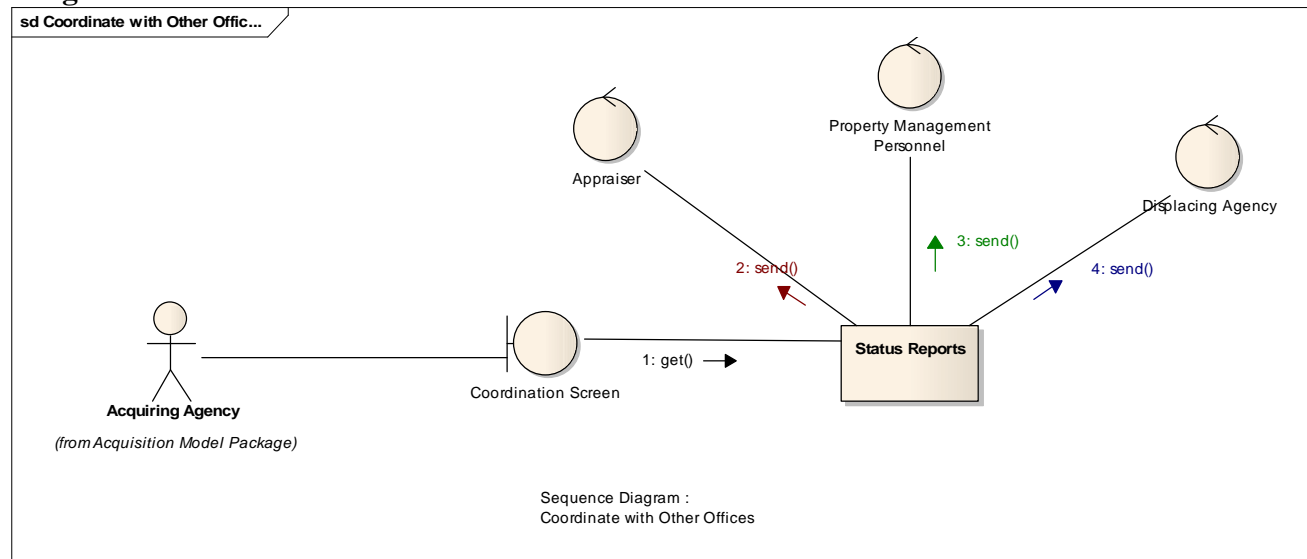
Diagram: Contract Negotiator**Diagram: Coordinate with Other Offices**

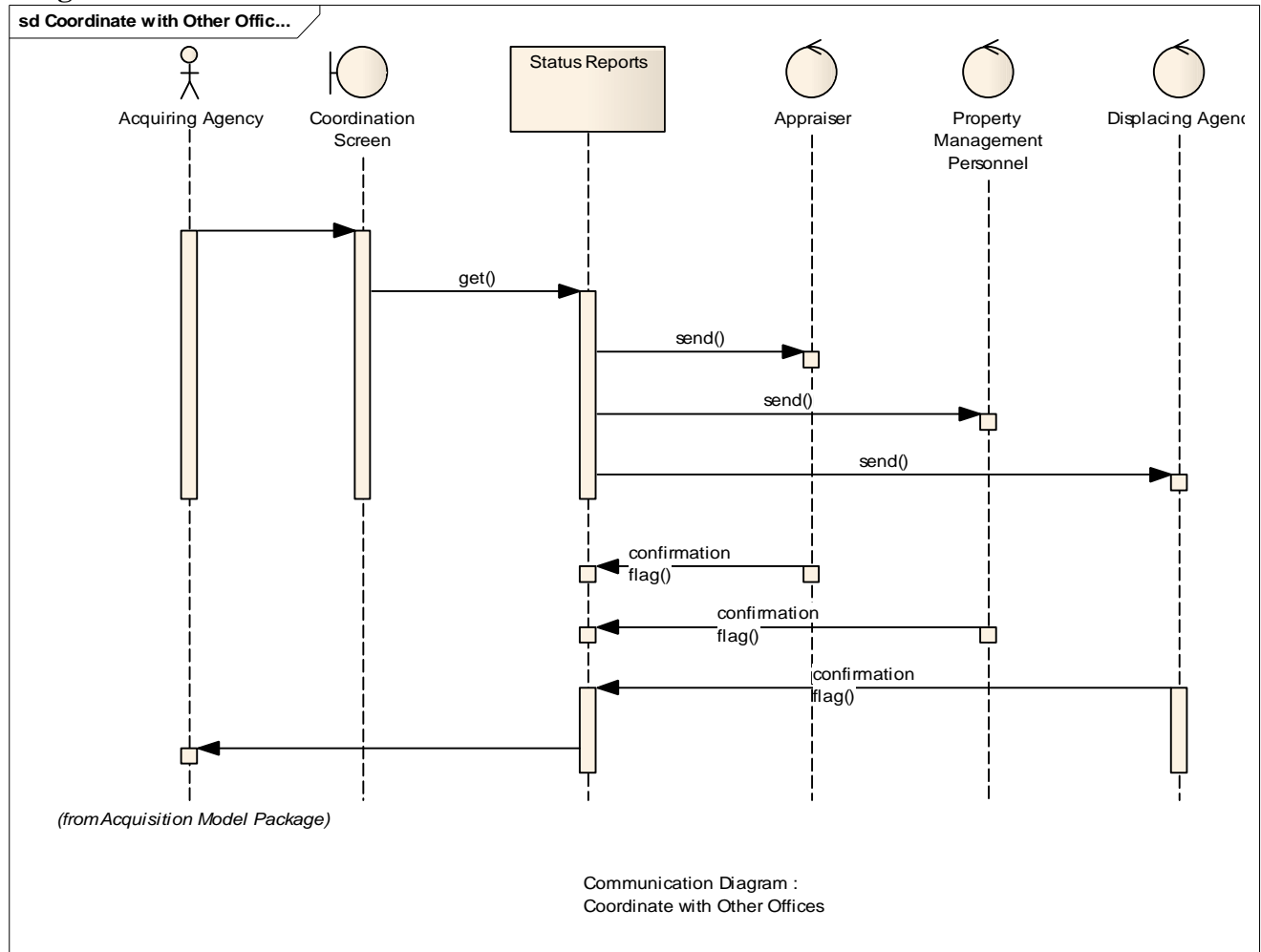
Diagram: Coordinate with Other Offices

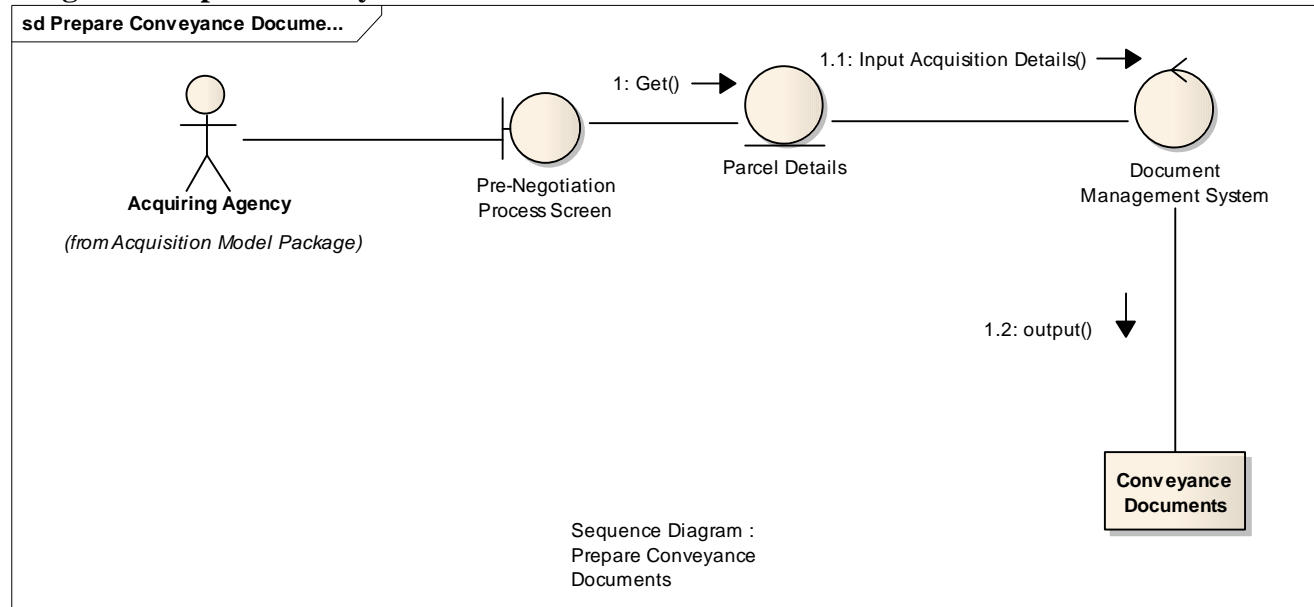
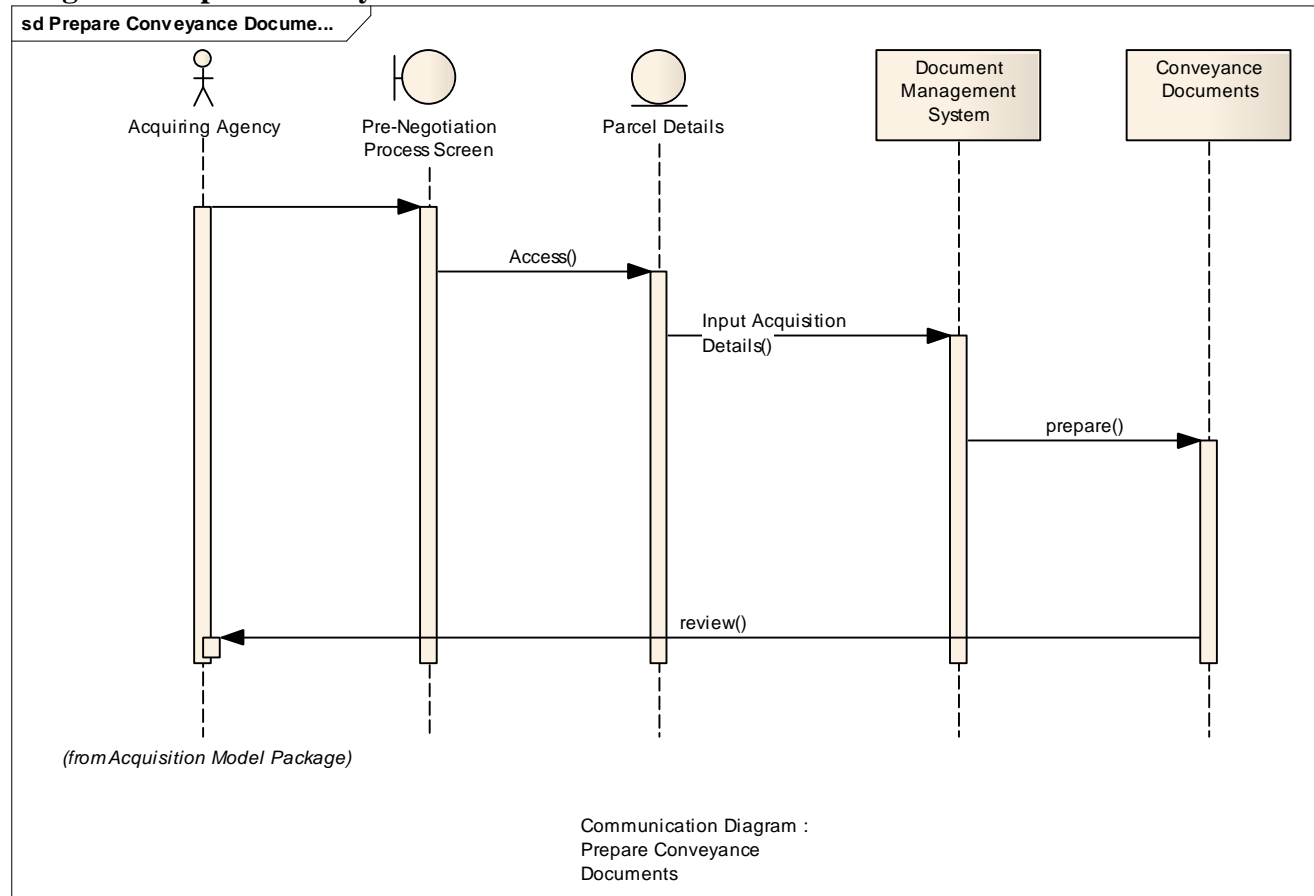
Diagram: Prepare Conveyance Documents**Diagram: Prepare Conveyance Documents**

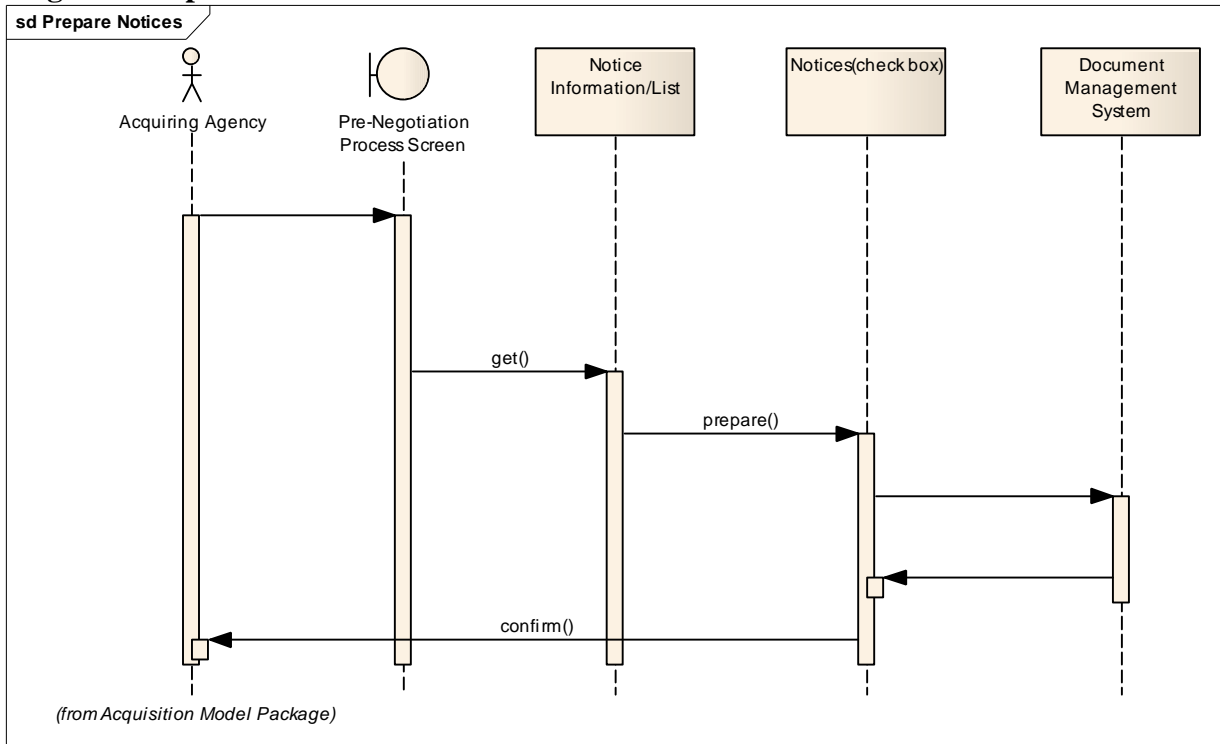
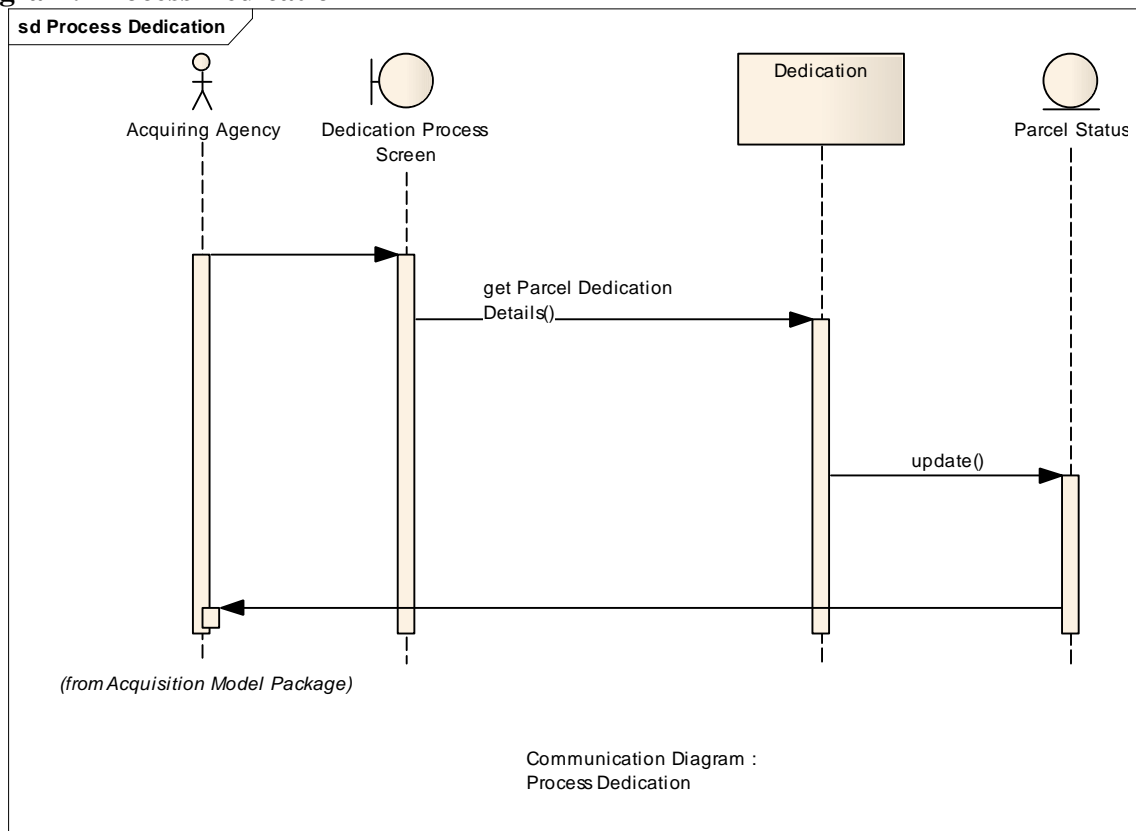
Diagram: Prepare Notices**Diagram: Process Dedication**

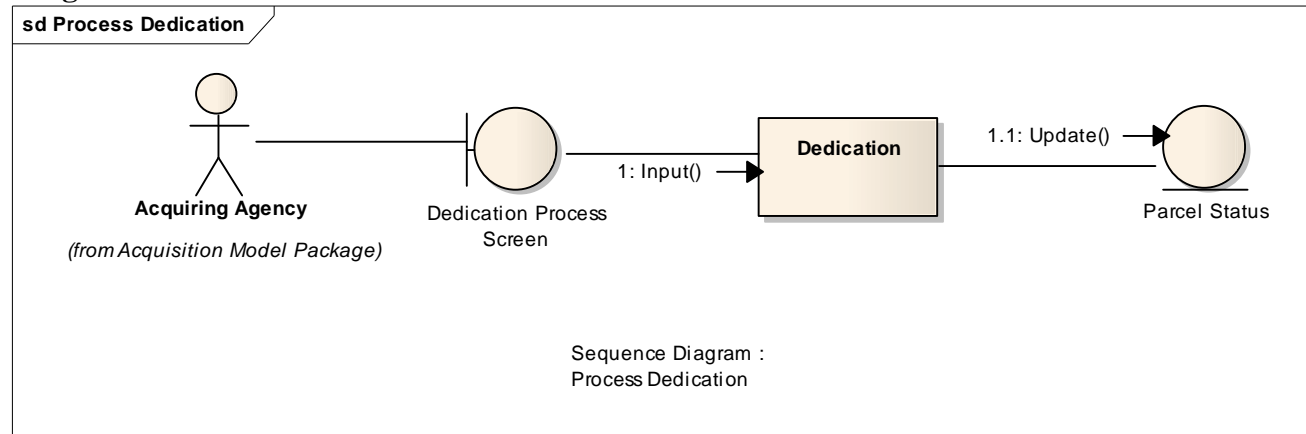
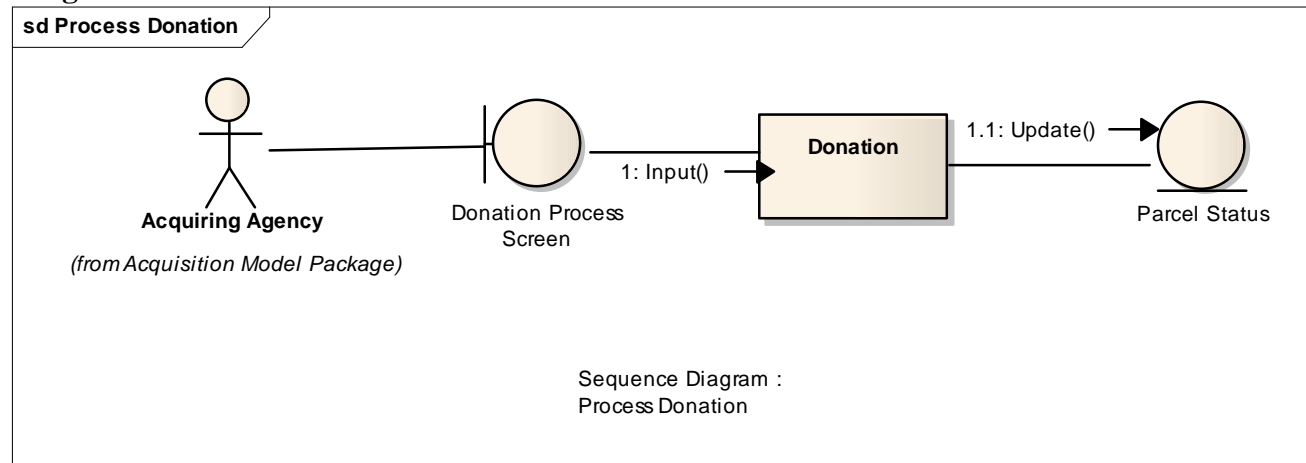
Diagram: Process Dedication**Diagram: Process Donation**

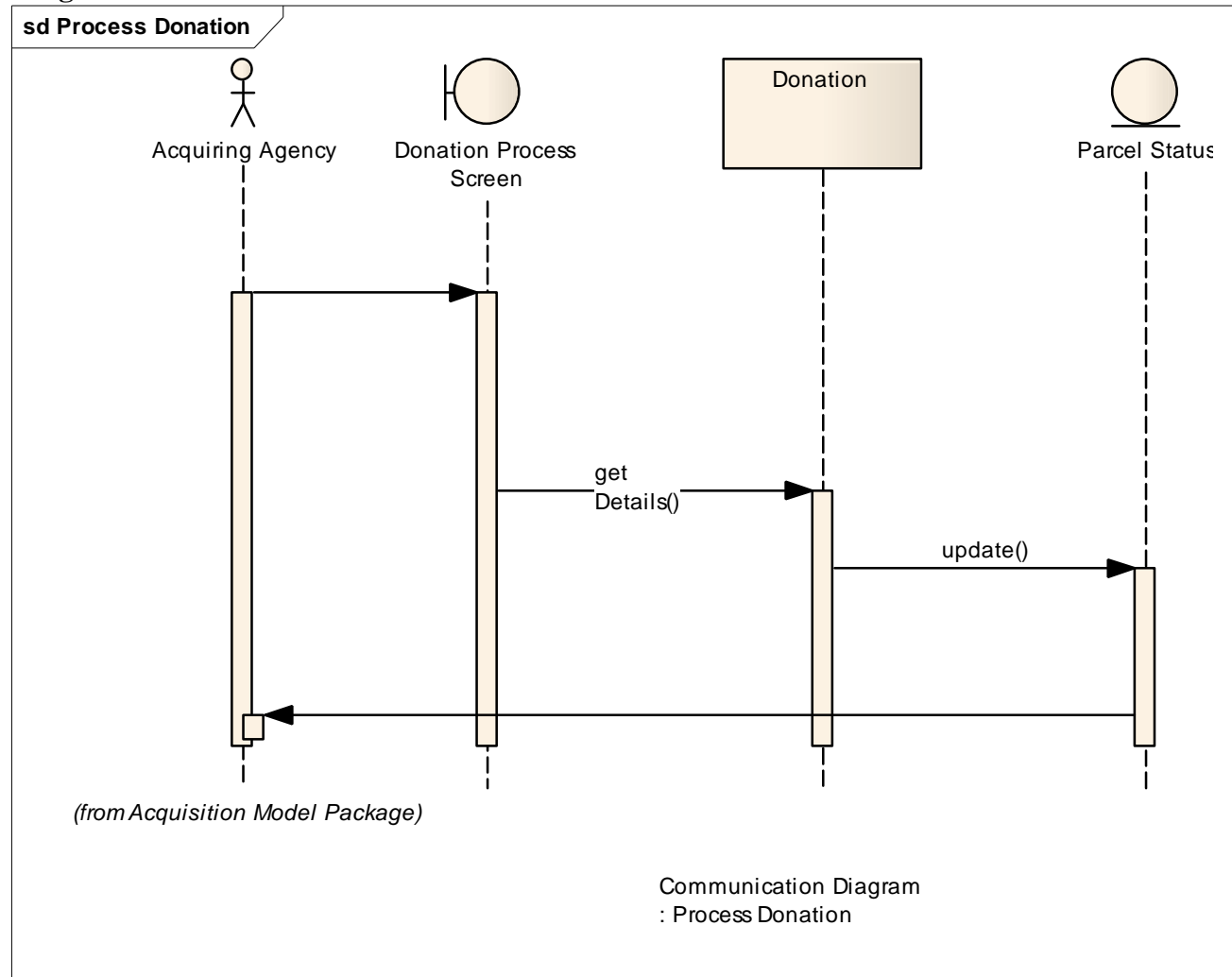
Diagram: Process Donation

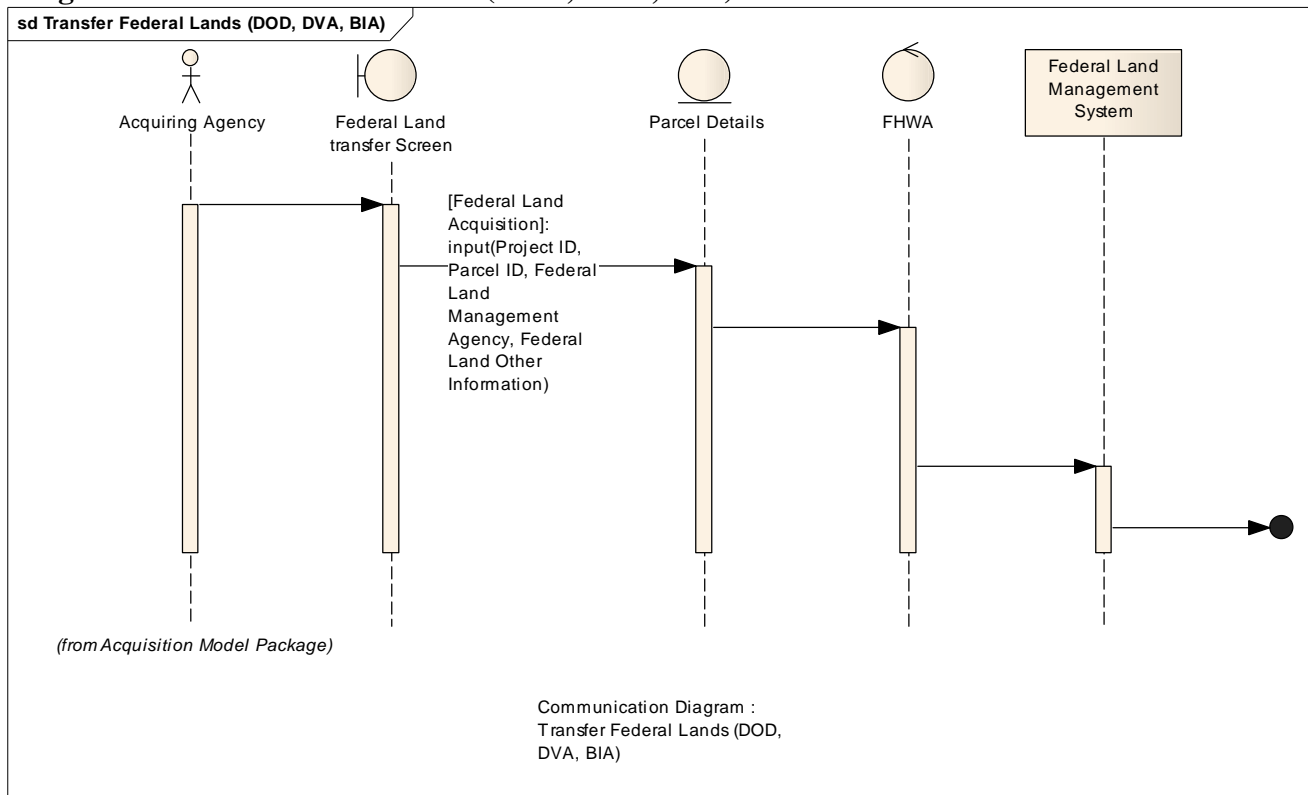
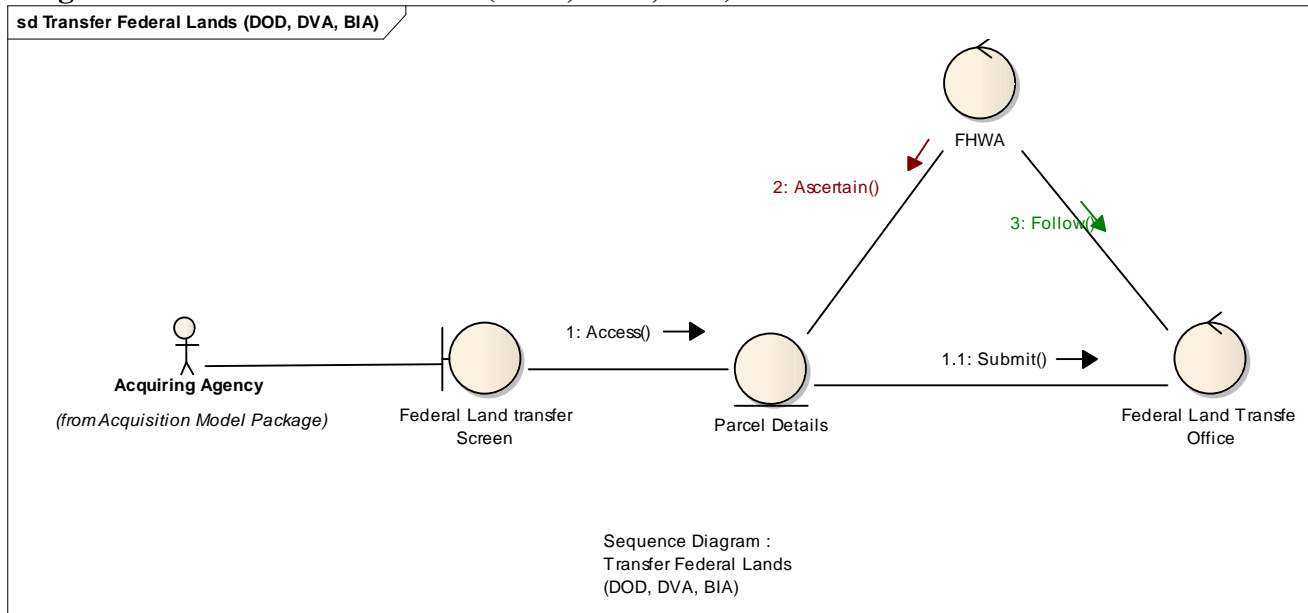
Diagram: Transfer Federal Lands (DOD, DVA, BIA)**Diagram: Transfer Federal Lands (DOD, DVA, BIA)**

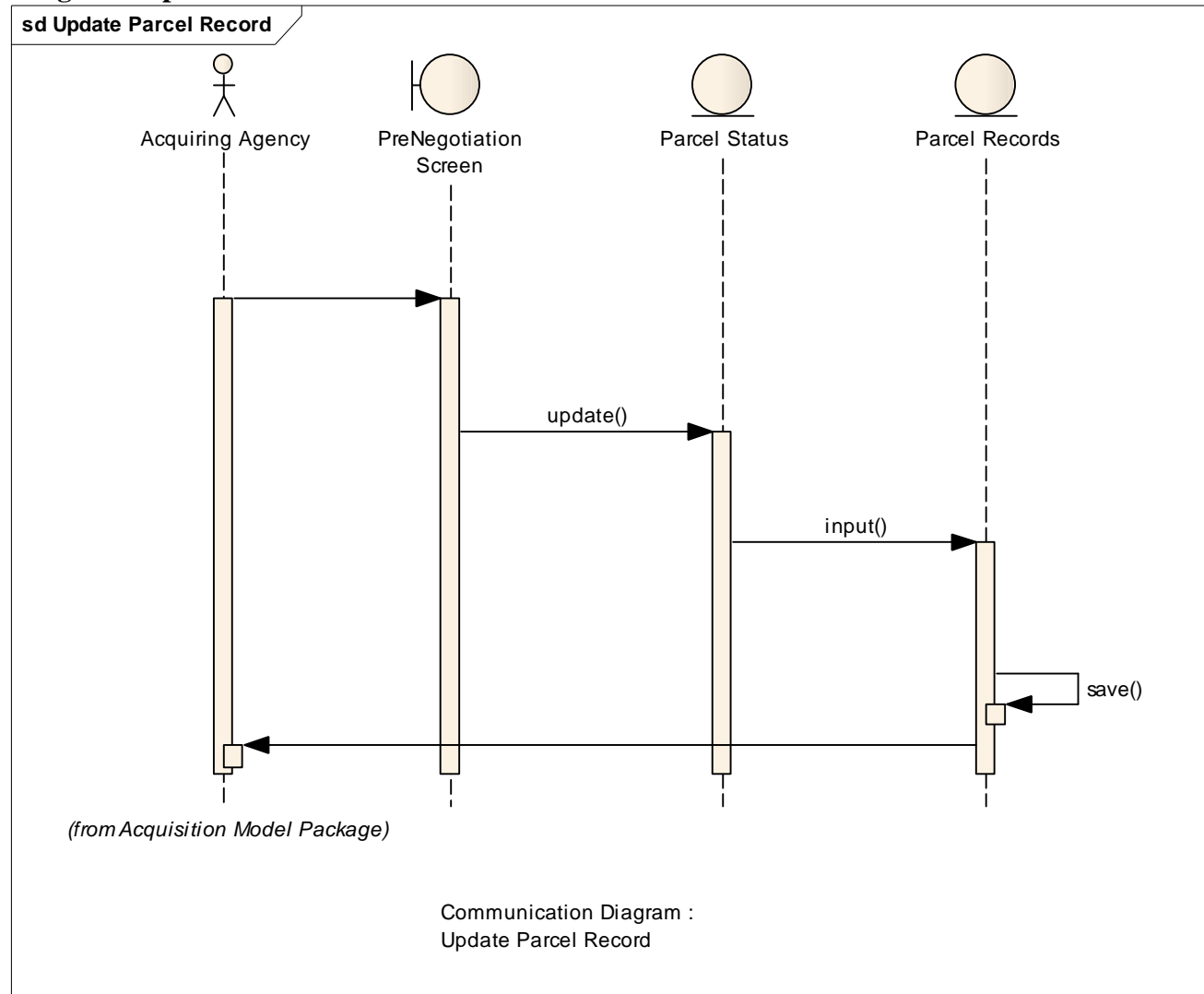
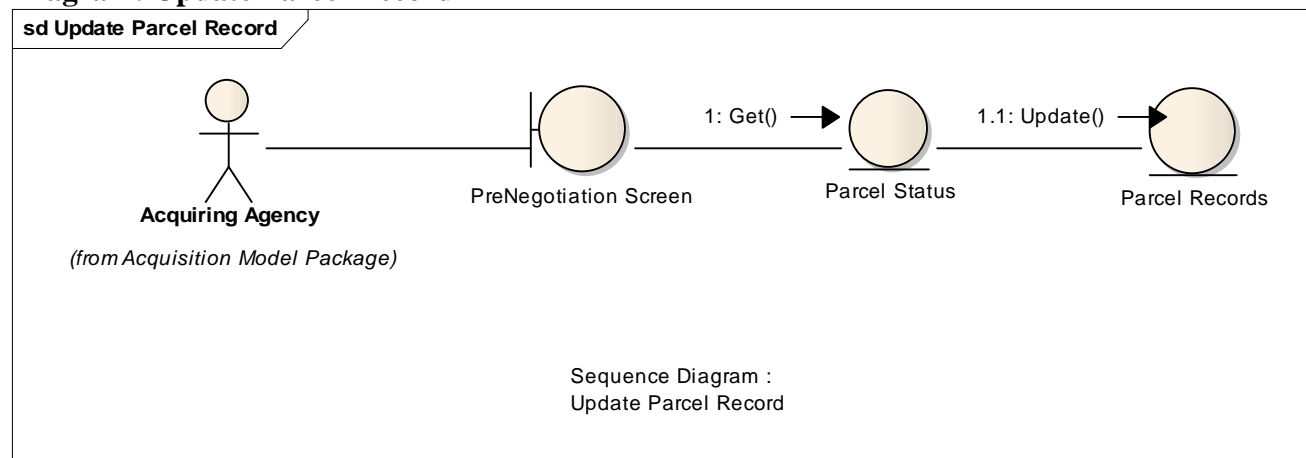
Diagram: Update Parcel Record**Diagram: Update Parcel Record**

Diagram: ACQ_Detailed Negotiation Use Case Model

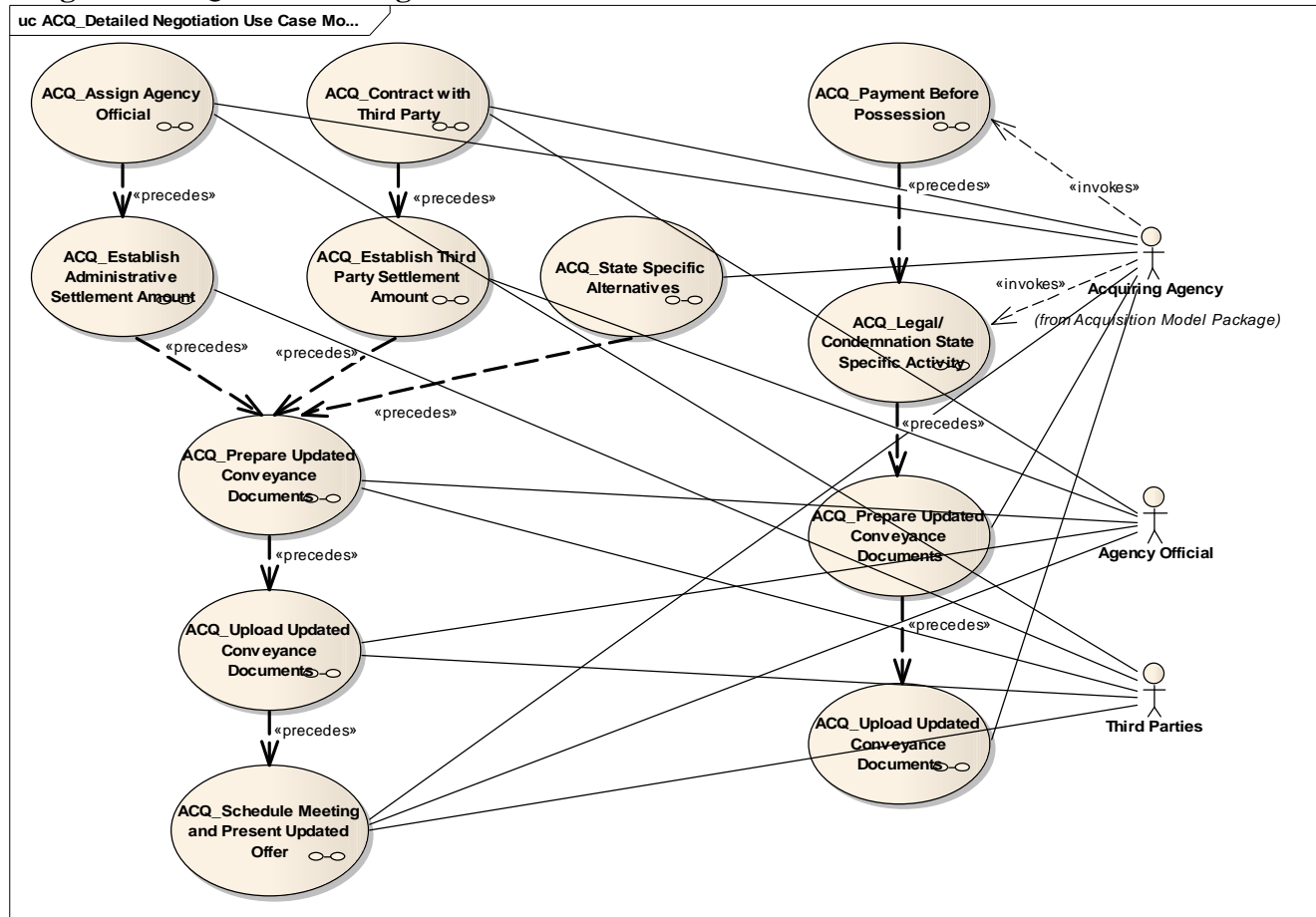


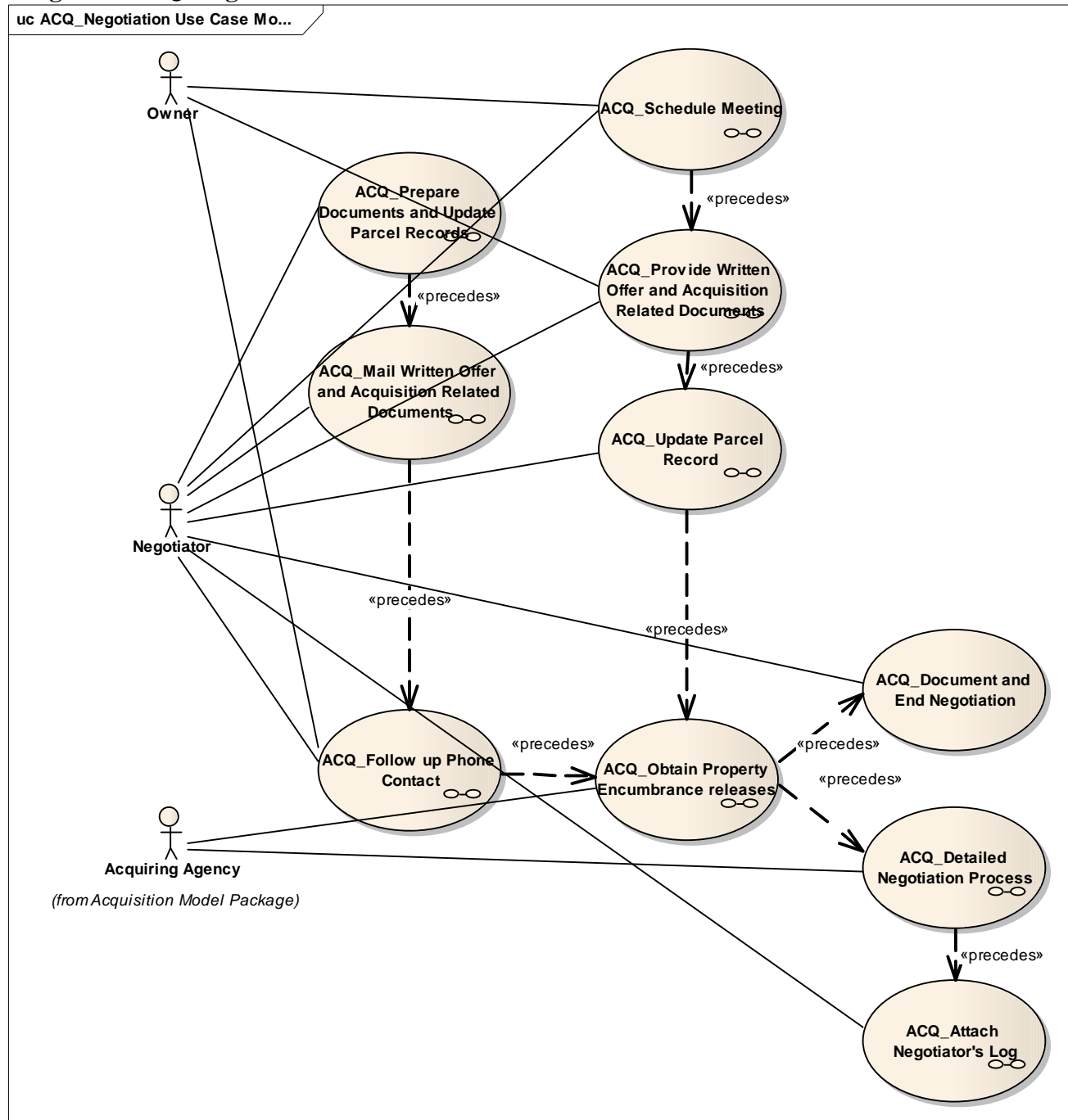
Diagram: ACQ_Negotiation Use Case Model

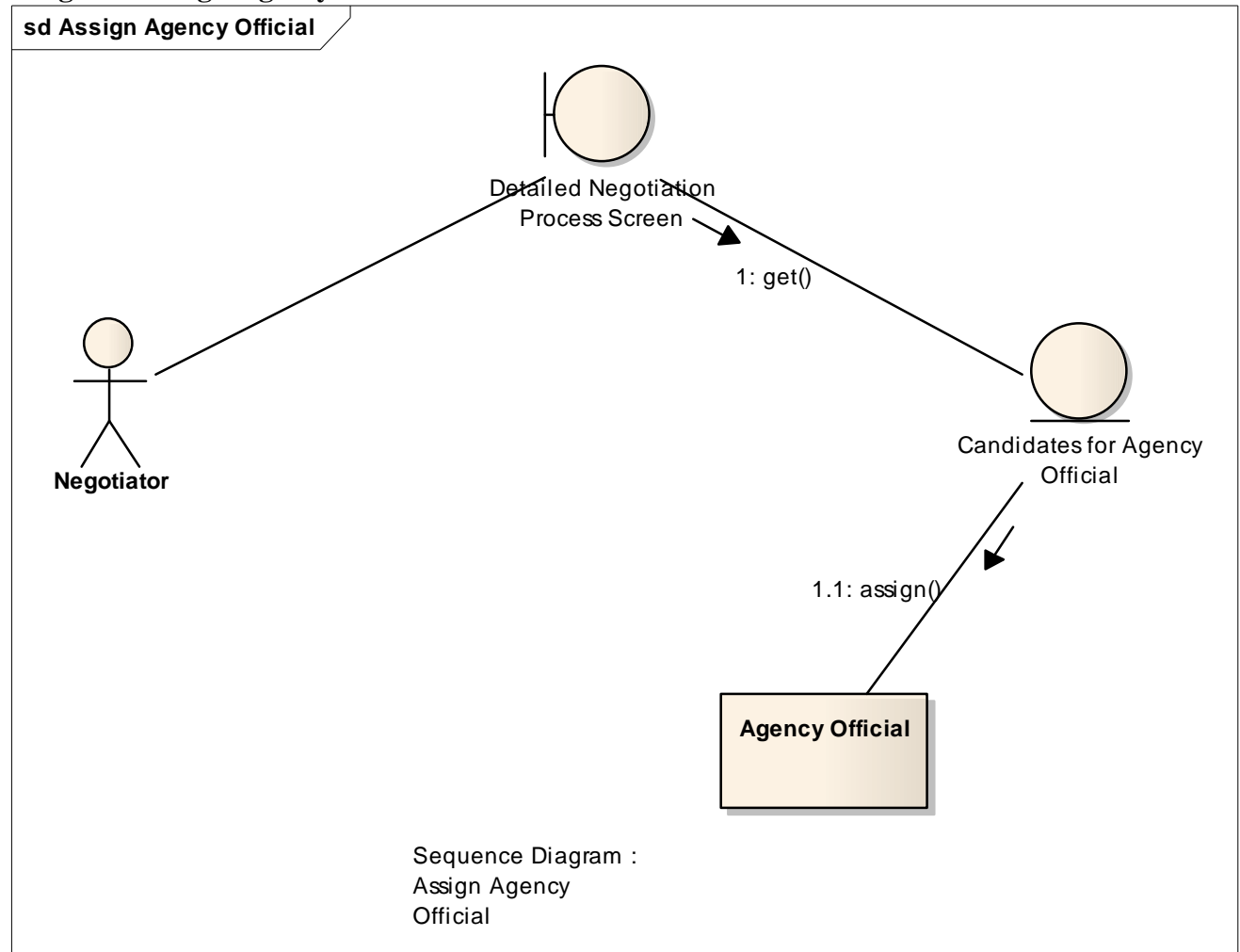
Diagram: Assign Agency Official

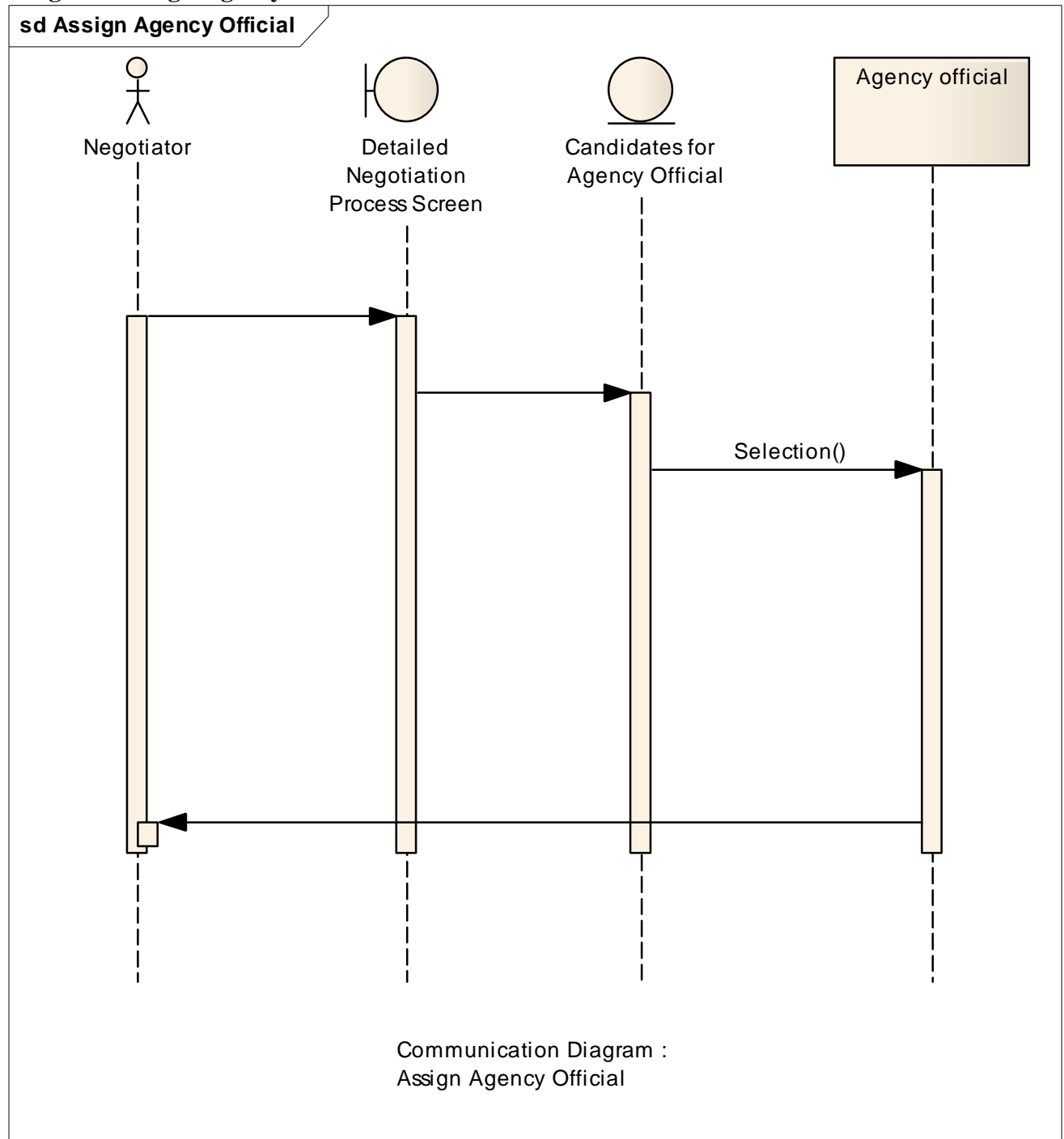
Diagram: Assign Agency Official

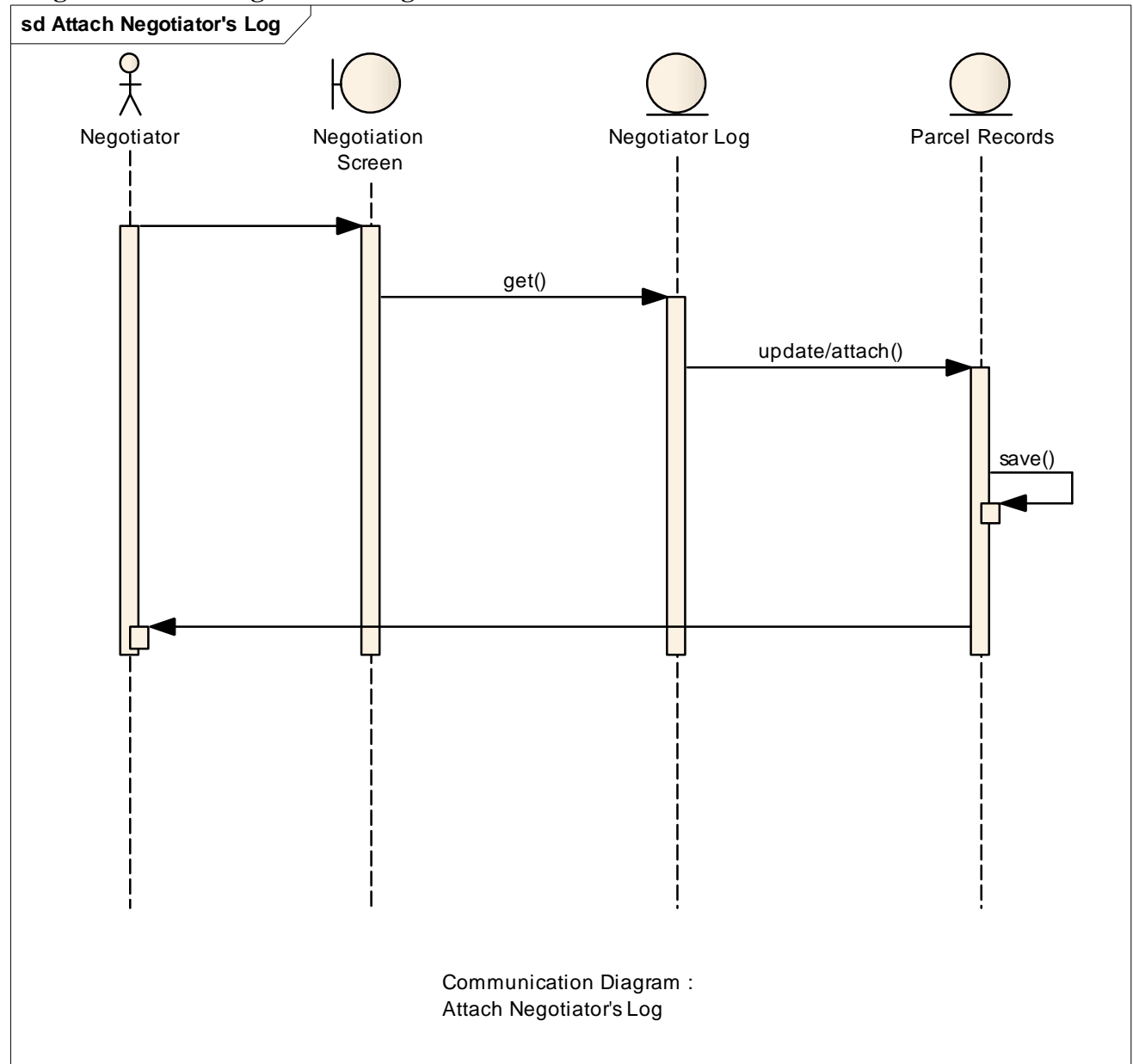
Diagram: Attach Negotiator's Log

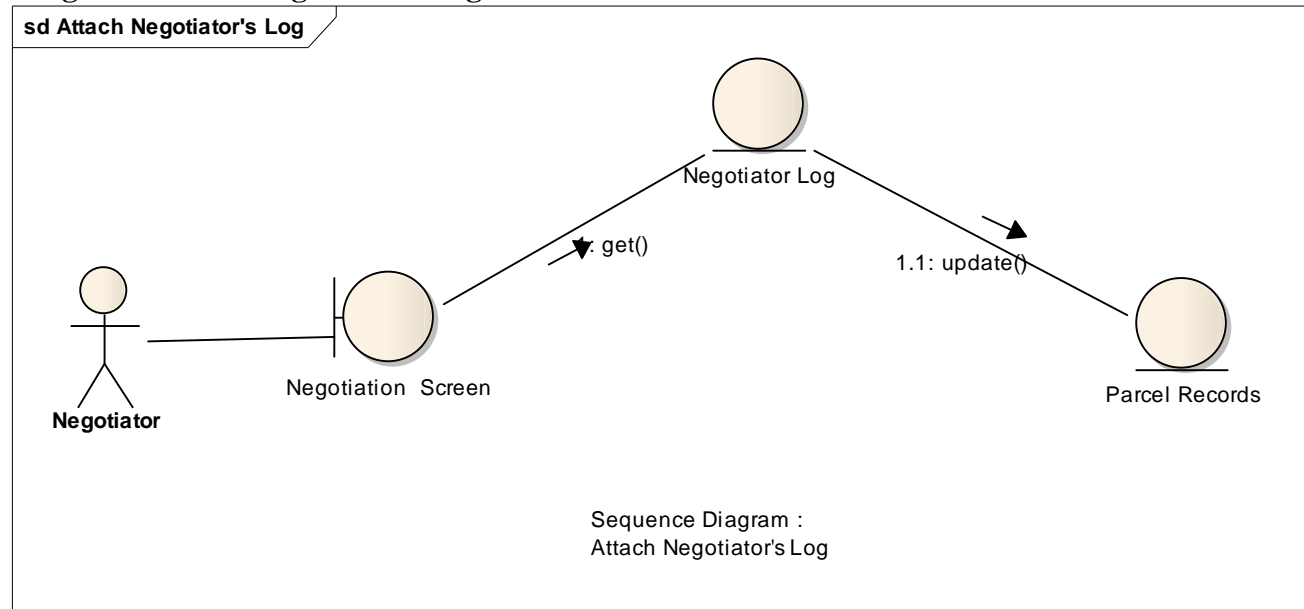
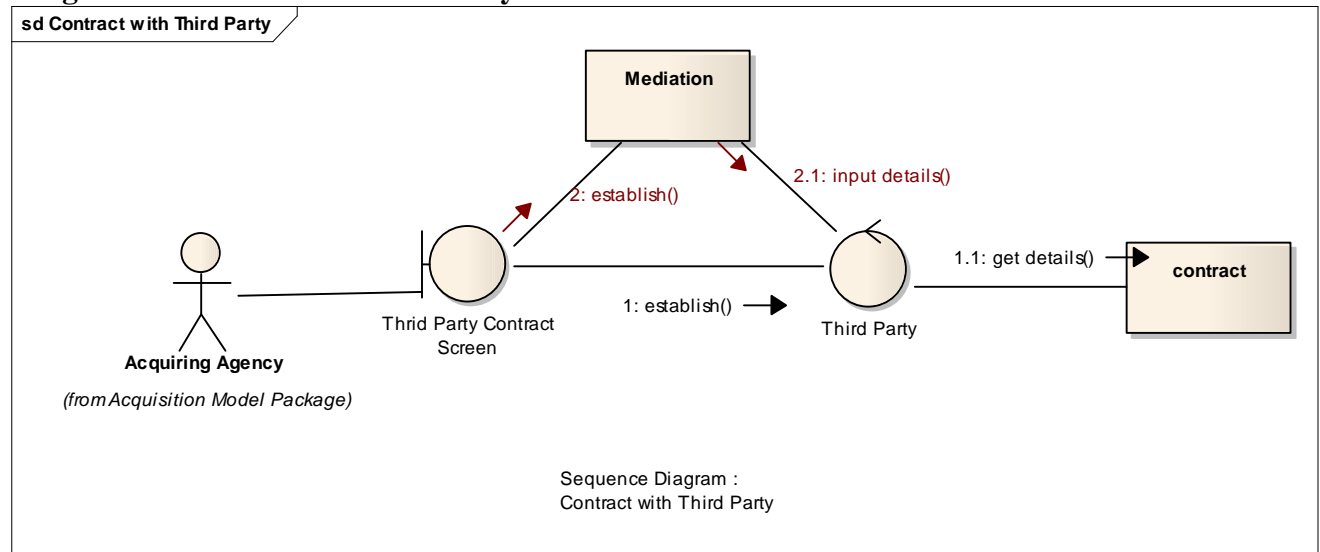
Diagram: Attach Negotiator's Log**Diagram: Contract with Third Party**

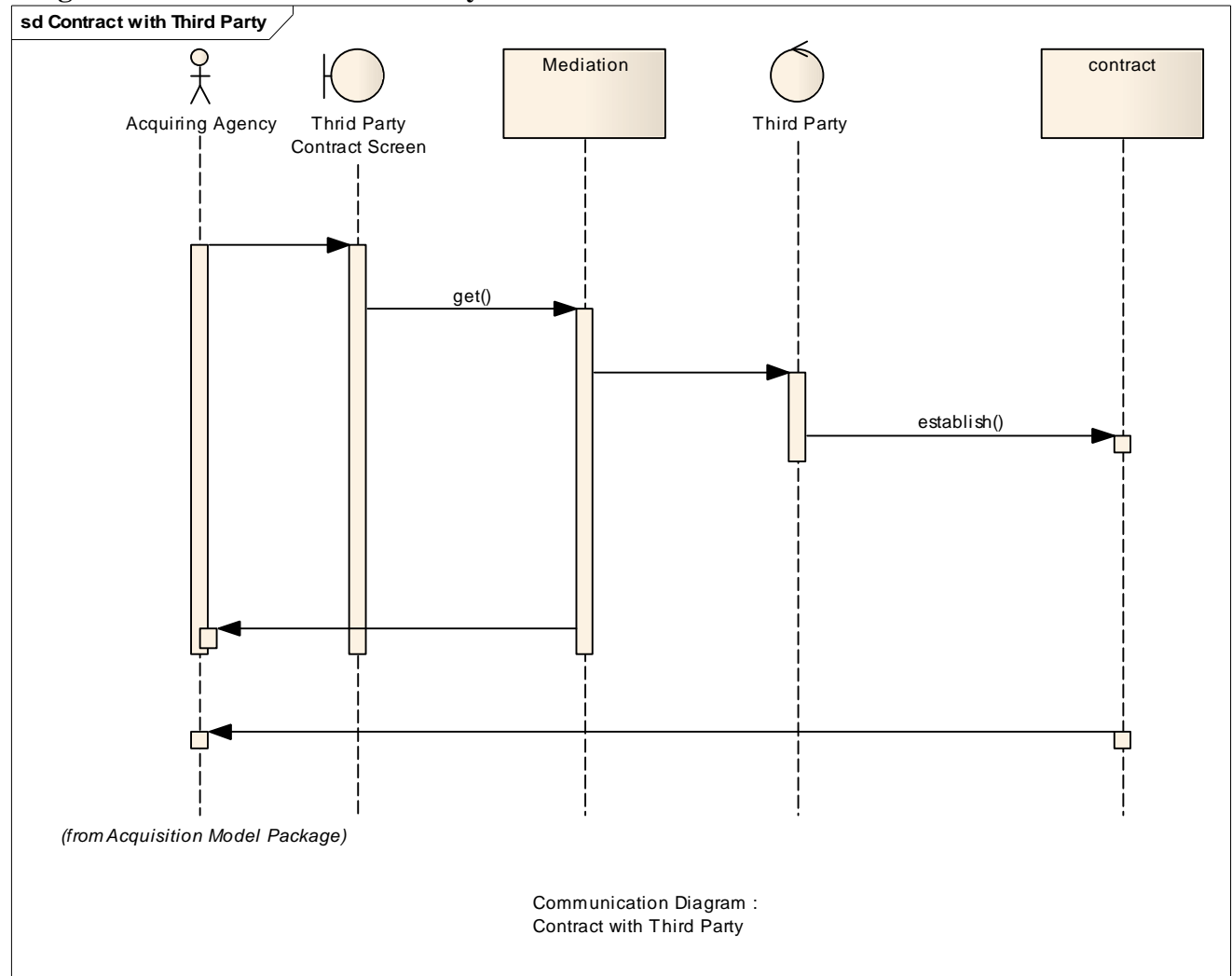
Diagram: Contract with Third Party

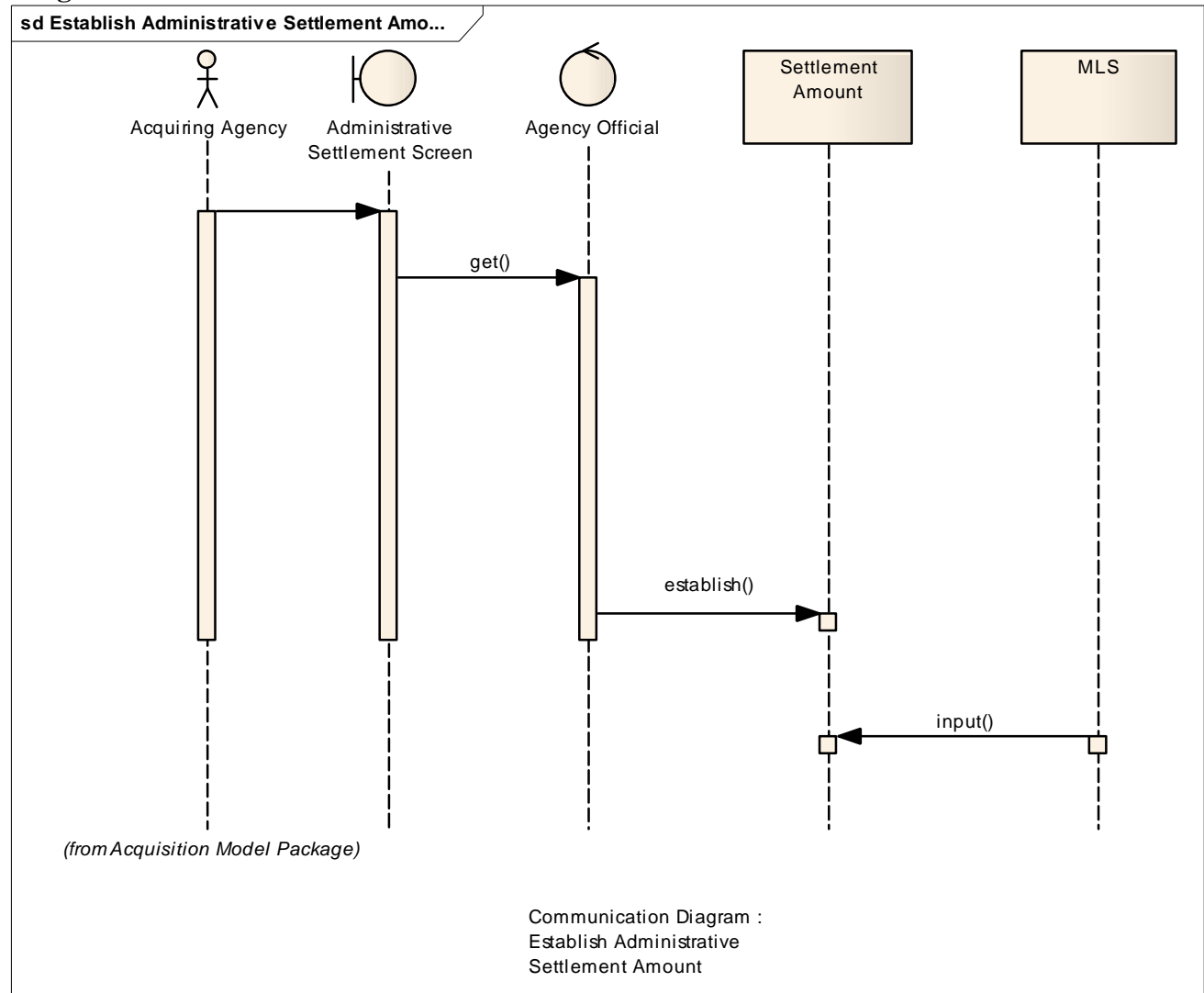
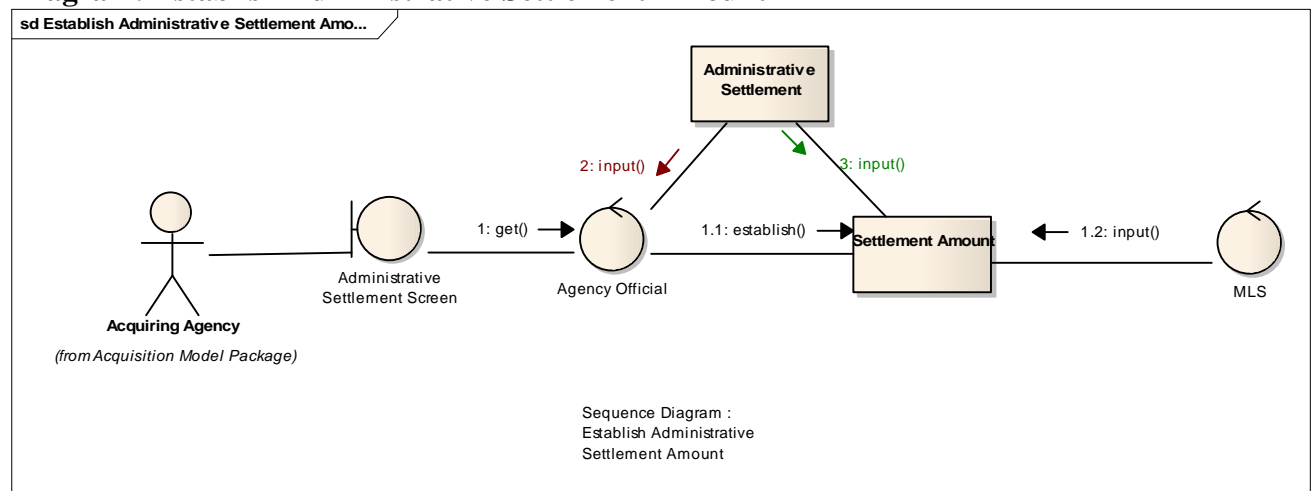
Diagram: Establish Administrative Settlement Amount**Diagram: Establish Administrative Settlement Amount**

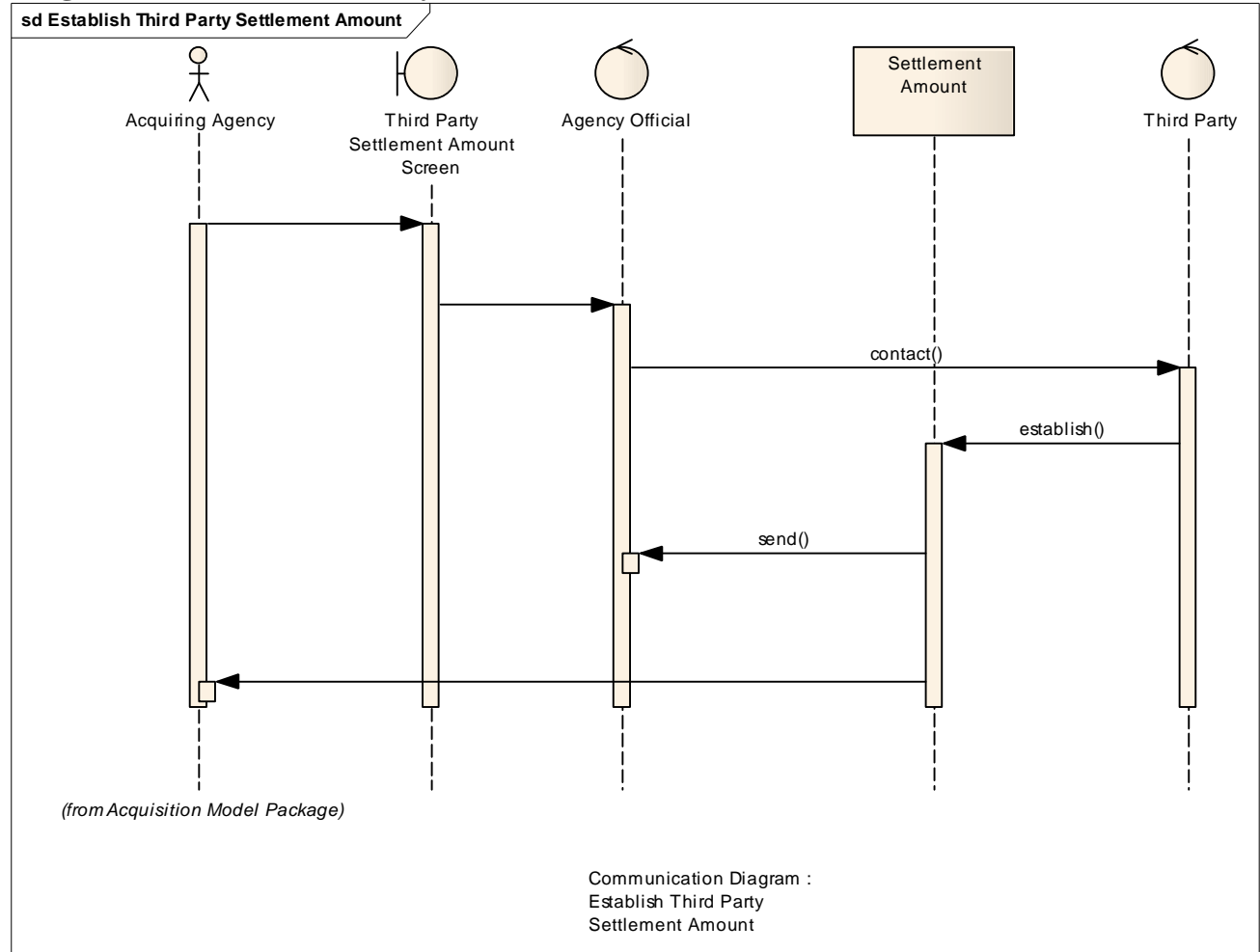
Diagram: Establish Third Party Settlement Amount

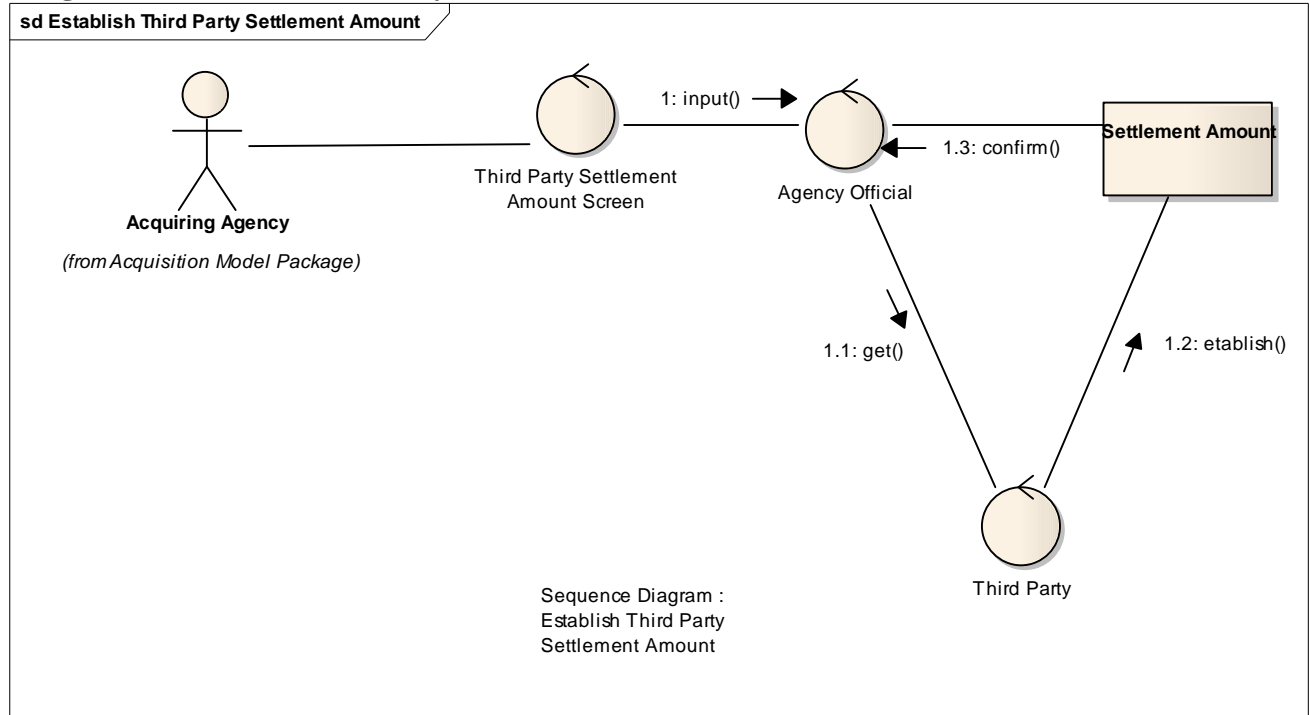
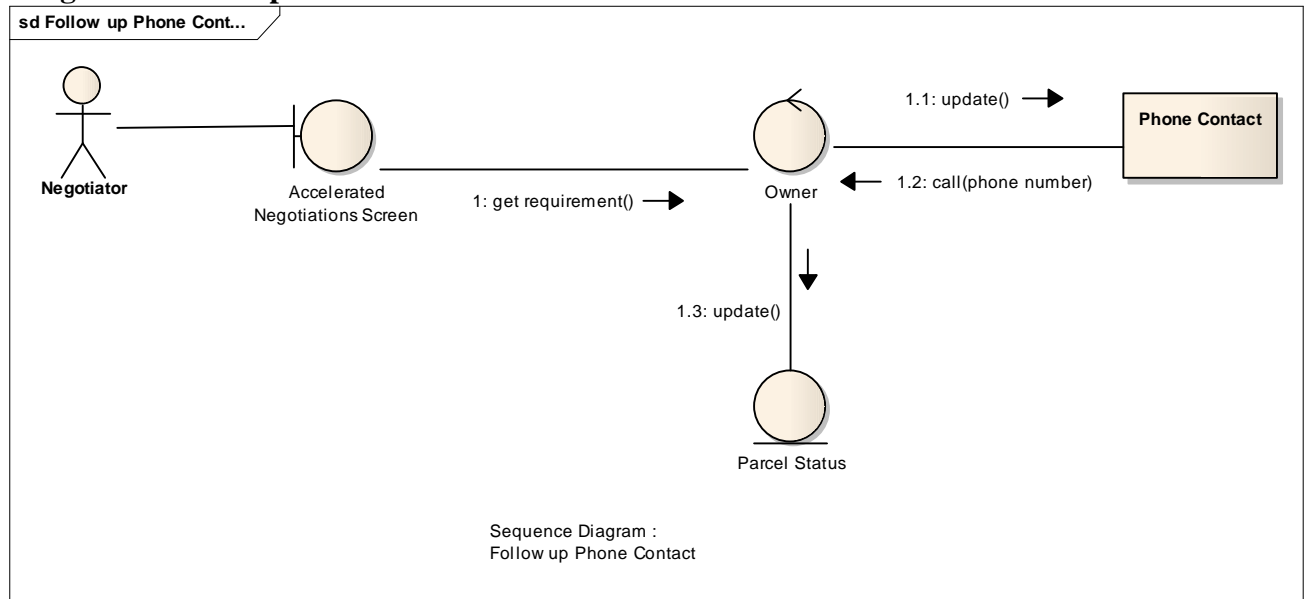
Diagram: Establish Third Party Settlement Amount**Diagram: Follow up Phone Contact**

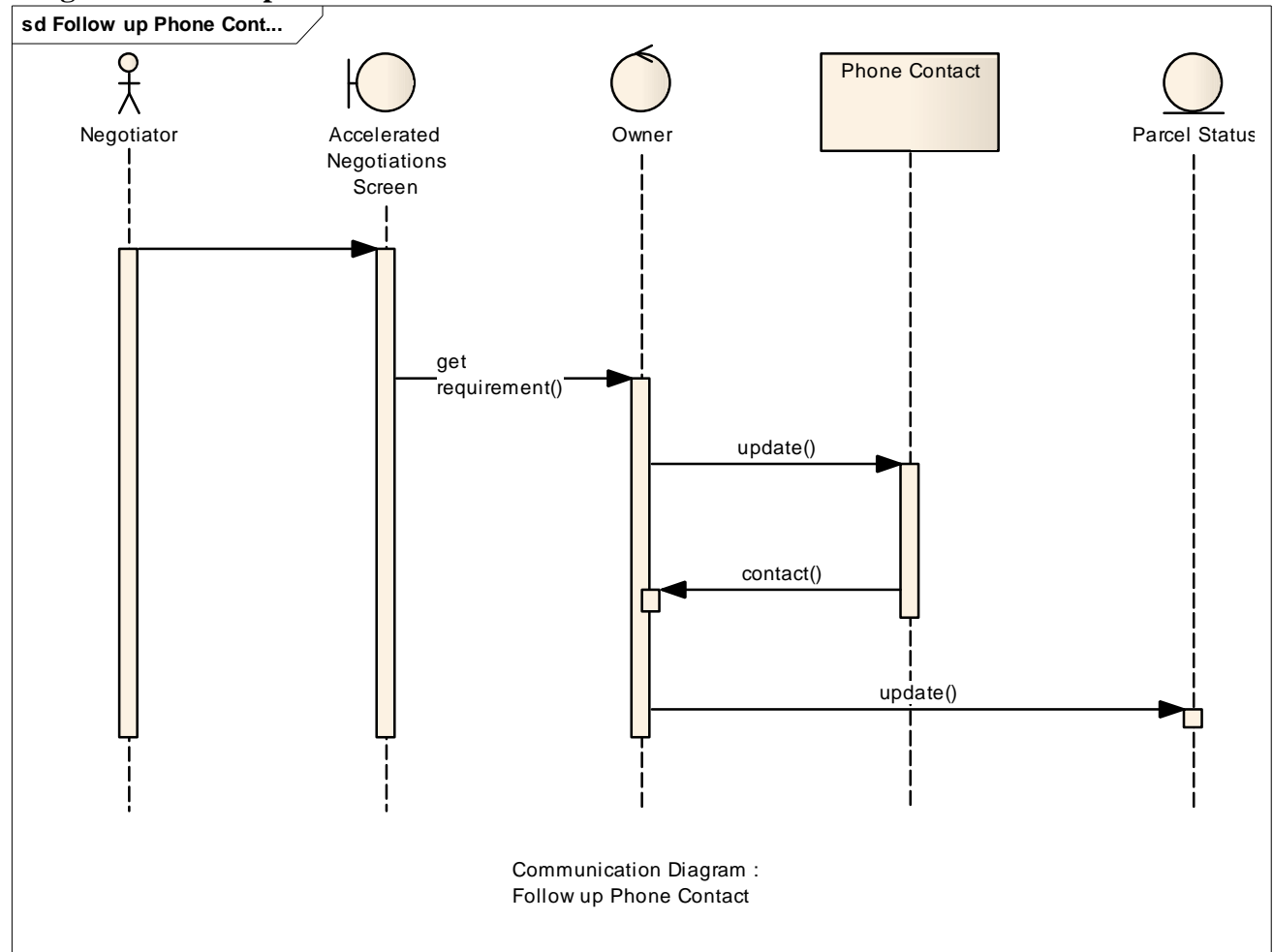
Diagram: Follow up Phone Contact

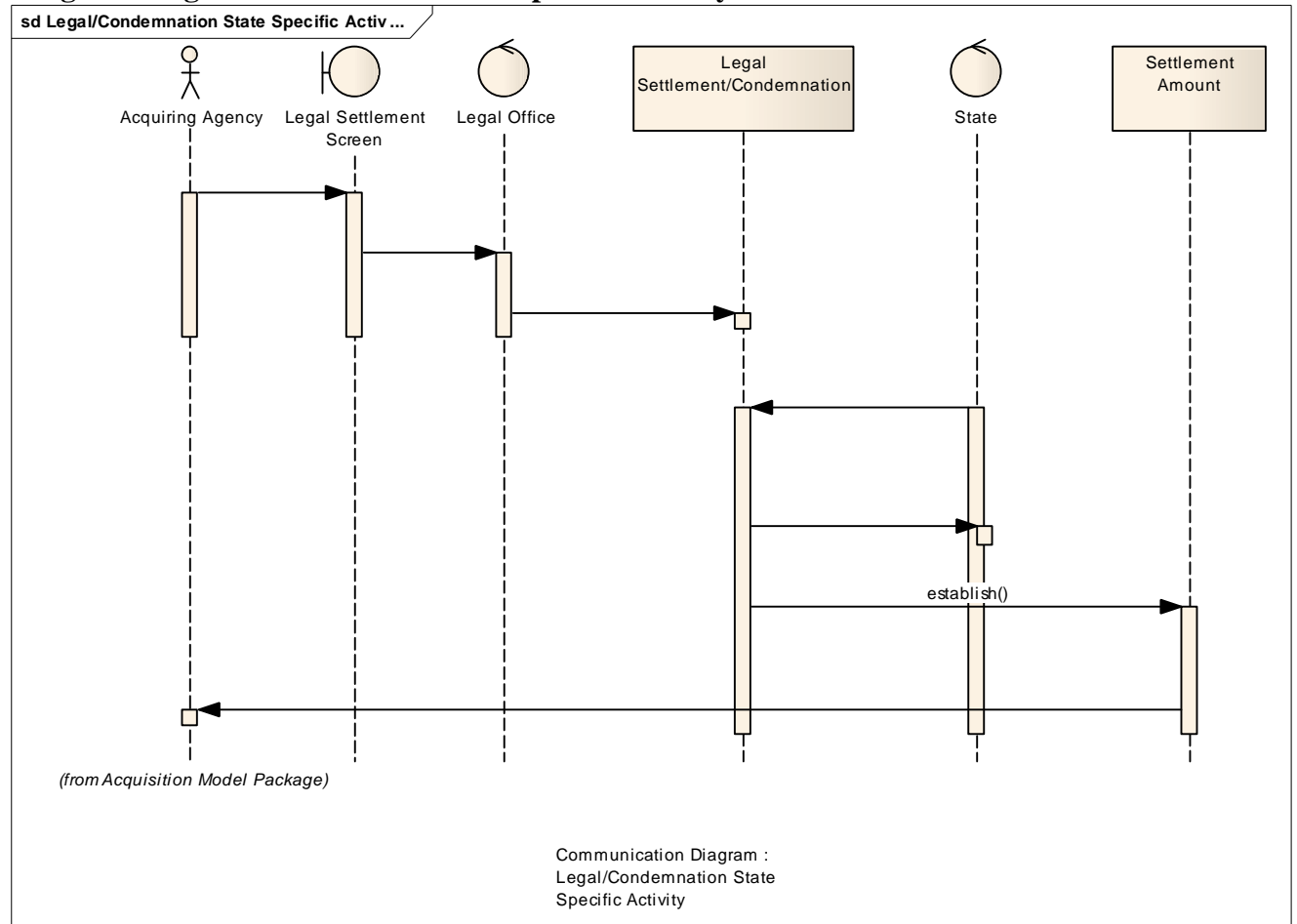
Diagram: Legal/Condemnation State Specific Activity

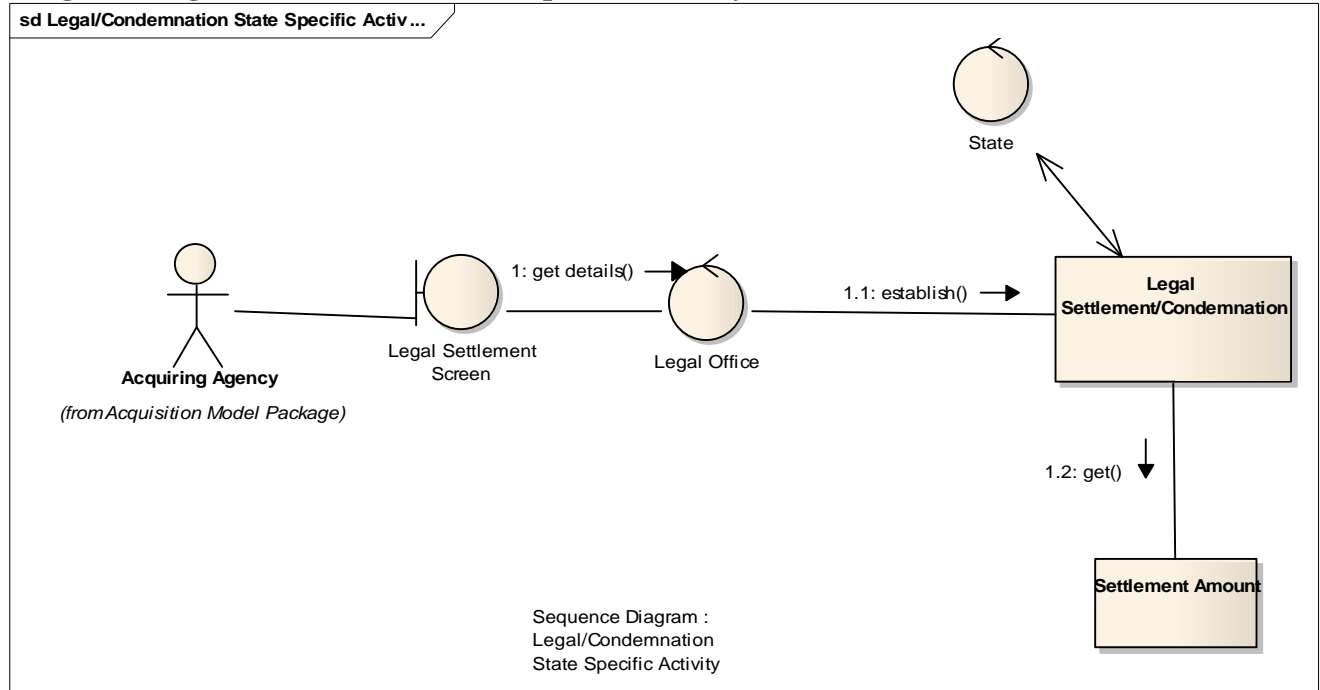
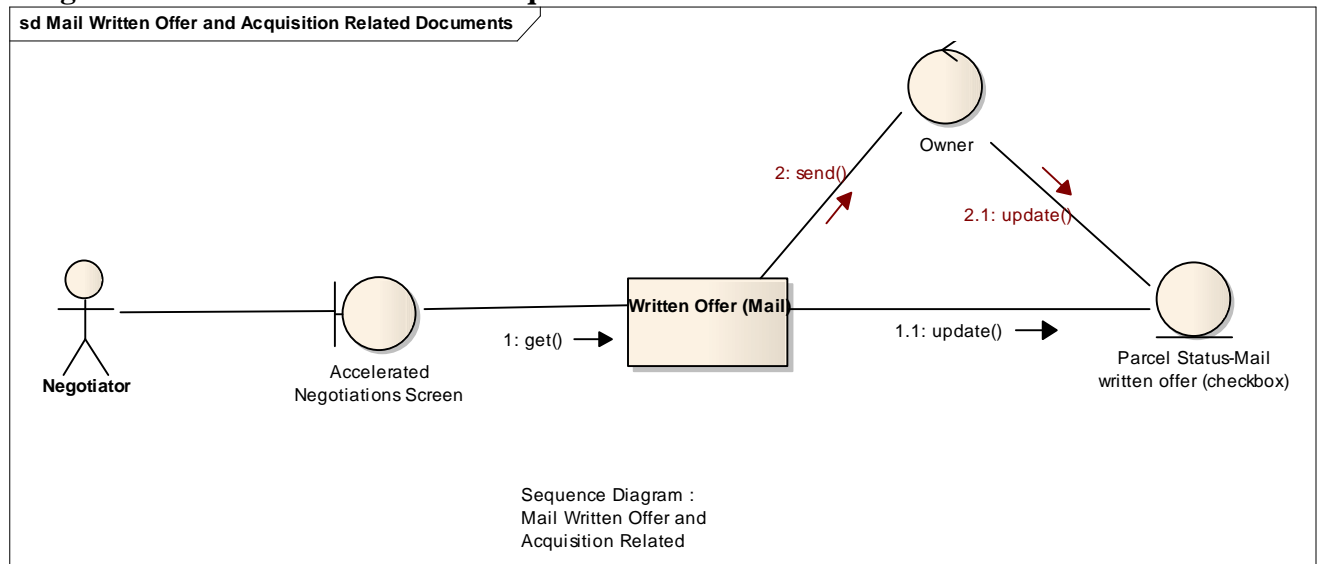
Diagram: Legal/Condemnation State Specific Activity**Diagram: Mail Written Offer and Acquisition Related Documents**

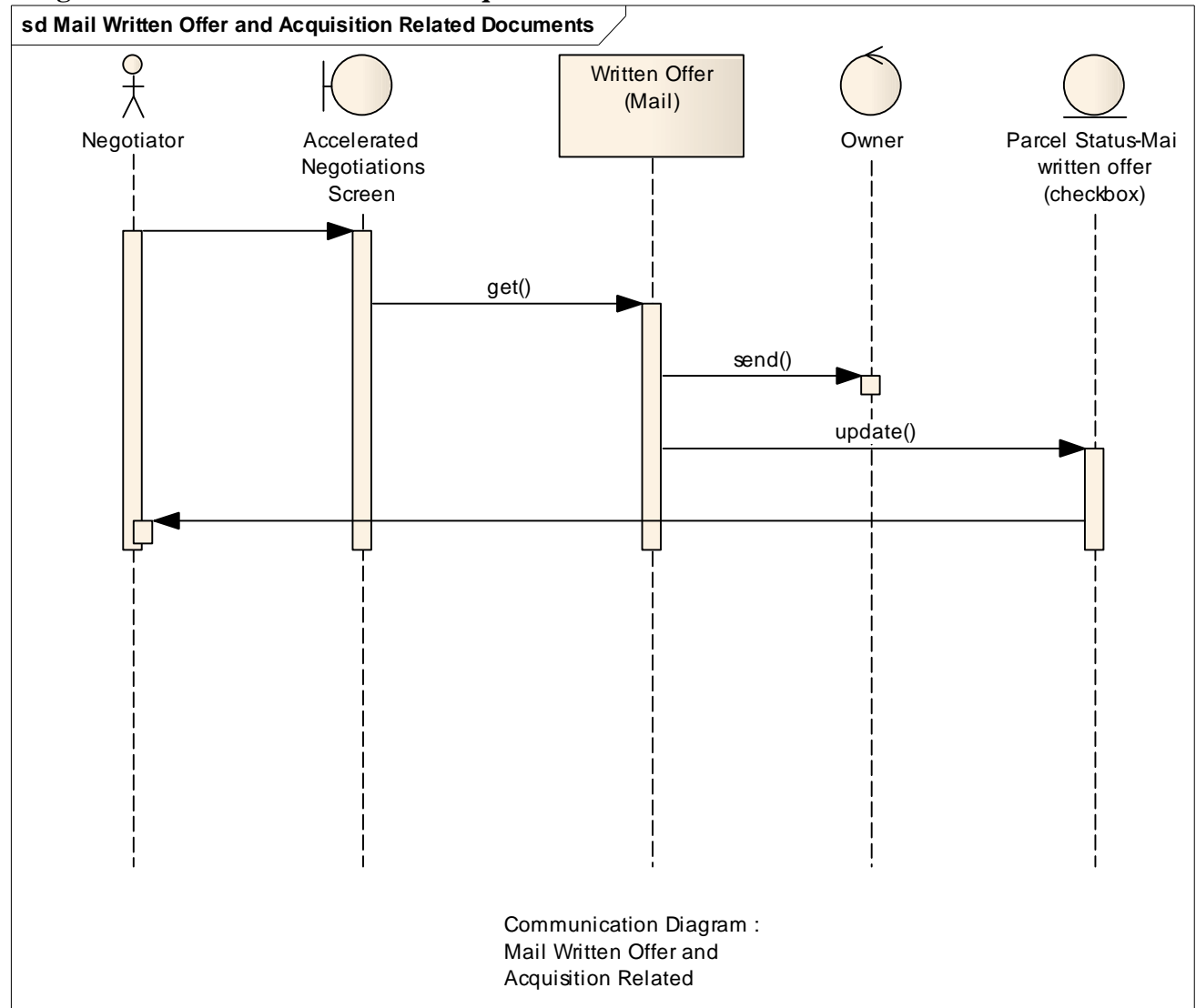
Diagram: Mail Written Offer and Acquisition Related Documents

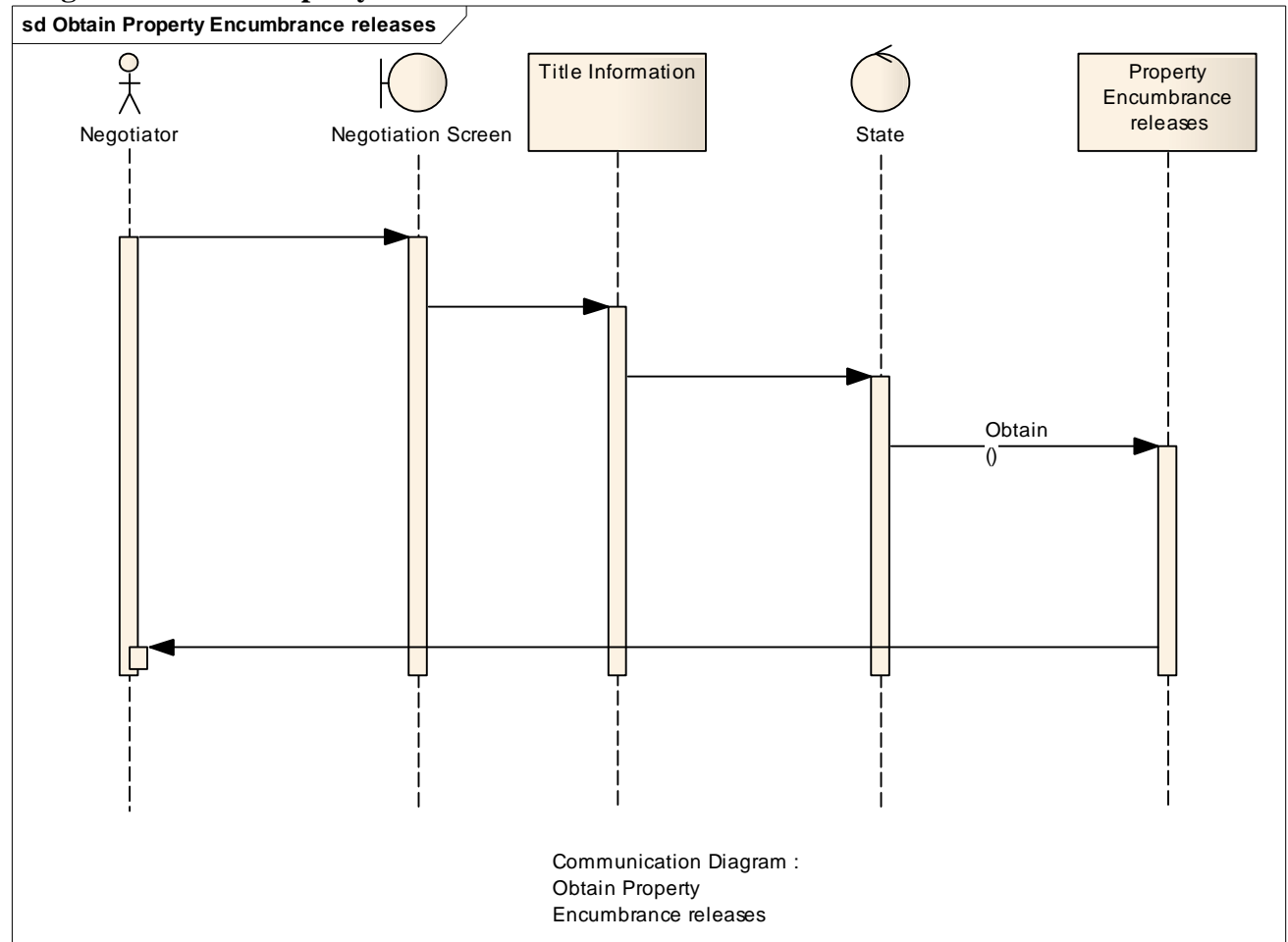
Diagram: Obtain Property Encumbrance releases

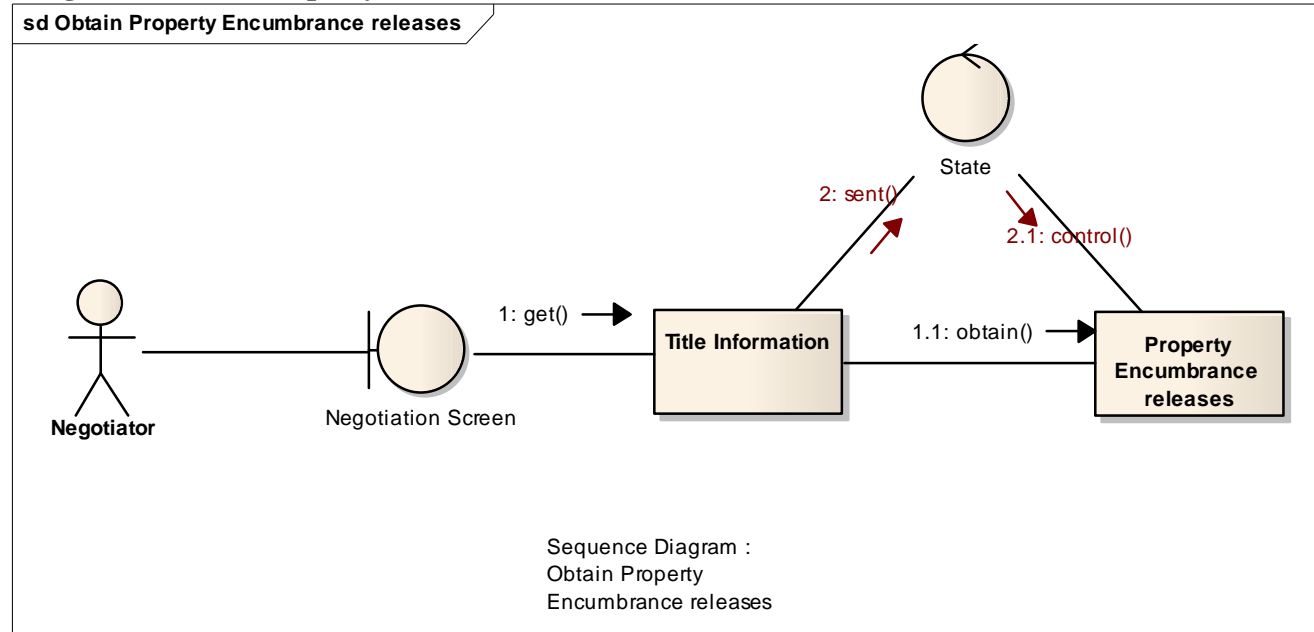
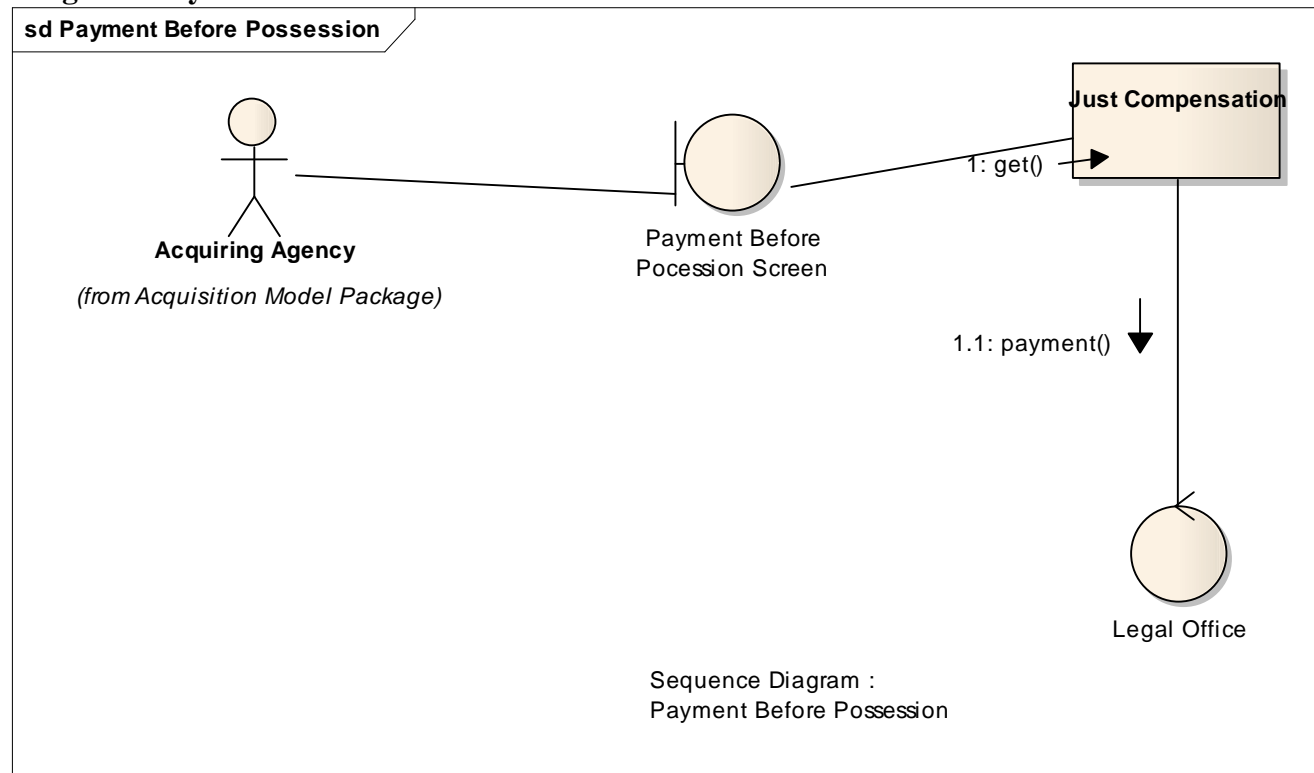
Diagram: Obtain Property Encumbrance releases**Diagram: Payment Before Possession**

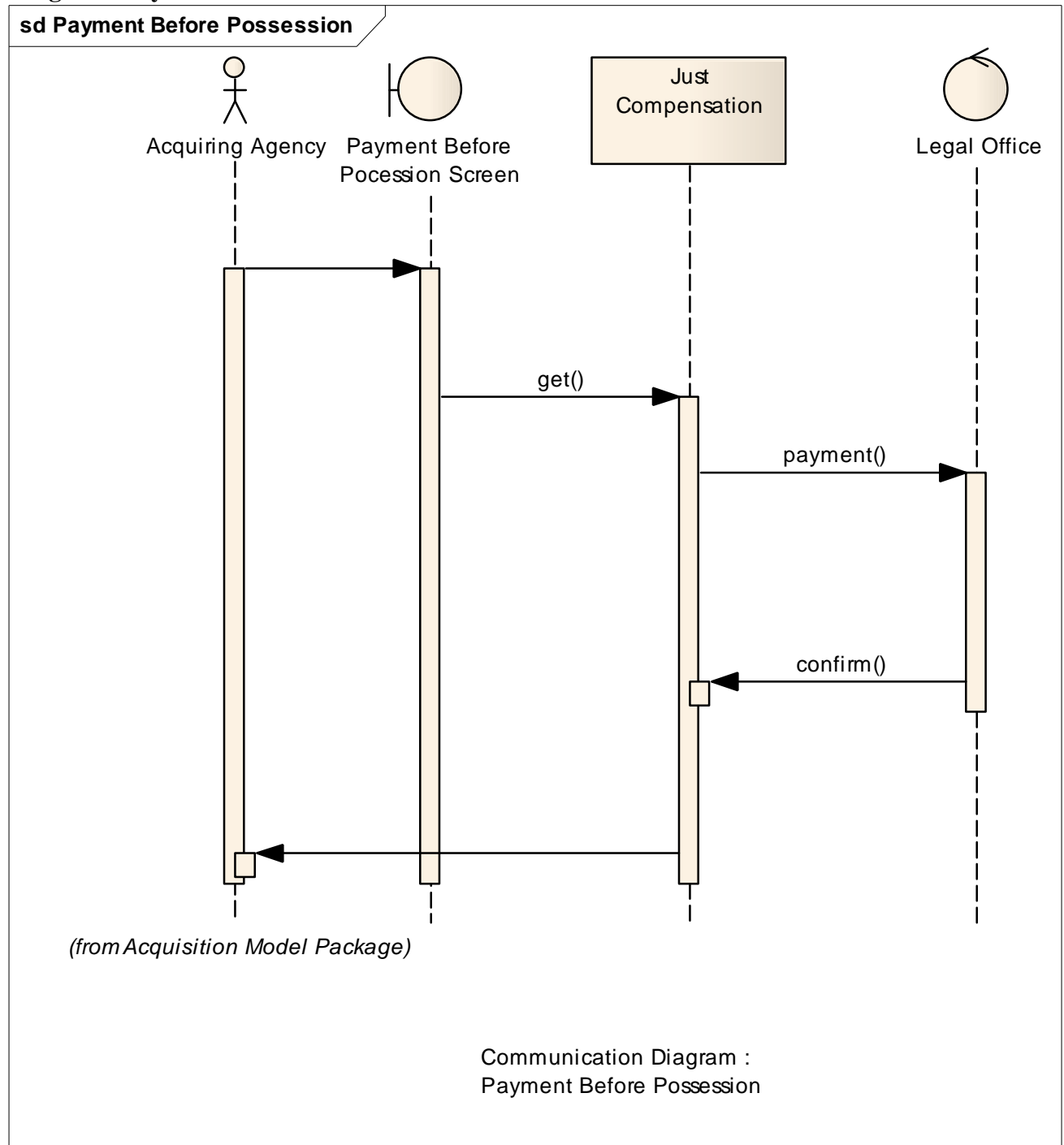
Diagram: Payment Before Possession

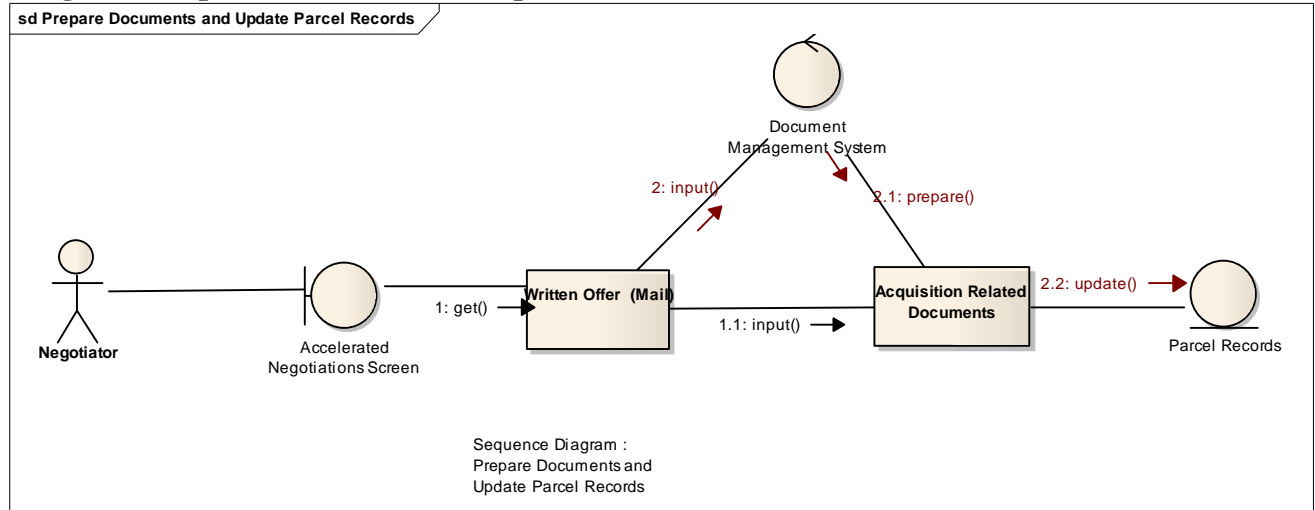
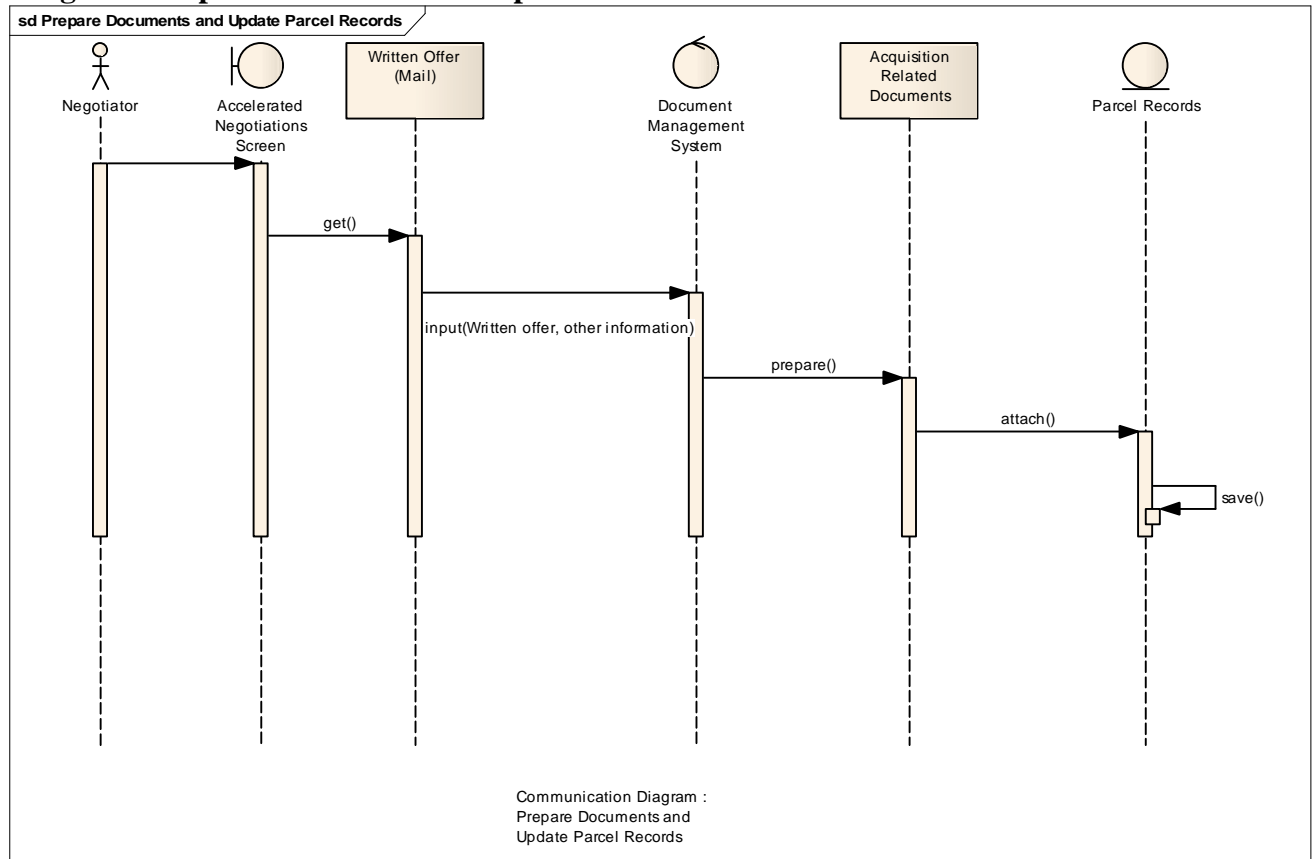
Diagram: Prepare Documents and Update Parcel Records**Diagram: Prepare Documents and Update Parcel Records**

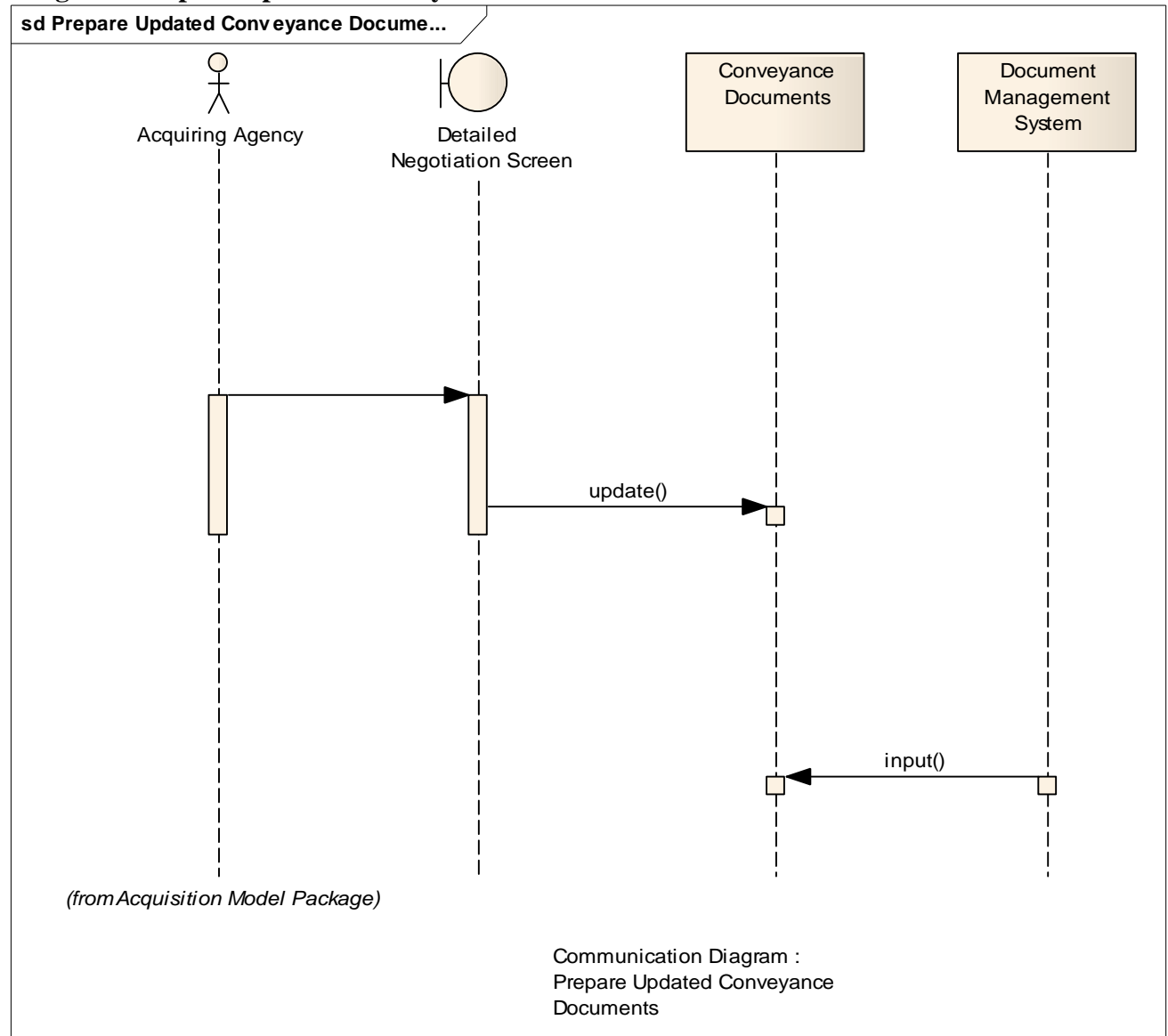
Diagram: Prepare Updated Conveyance Documents

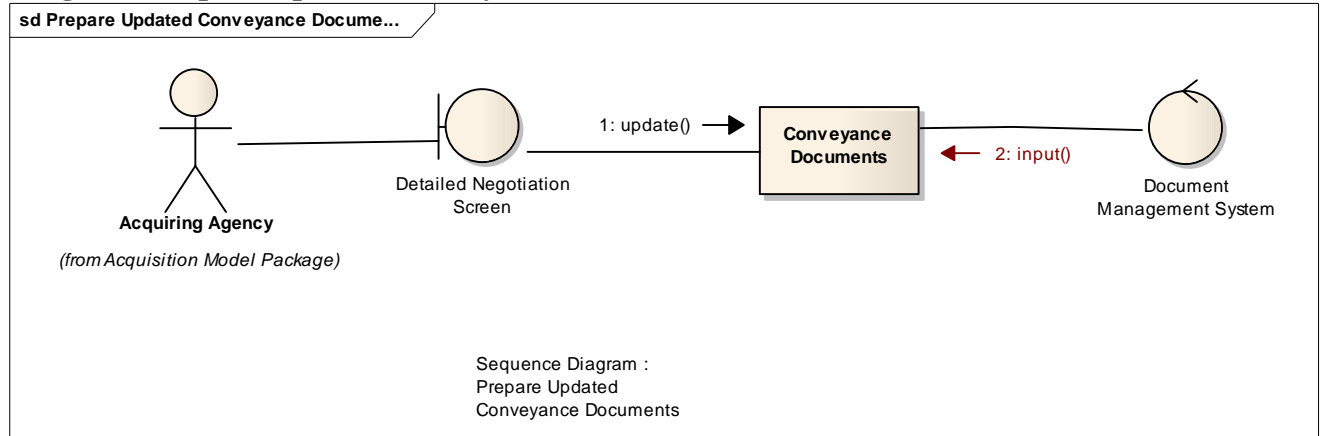
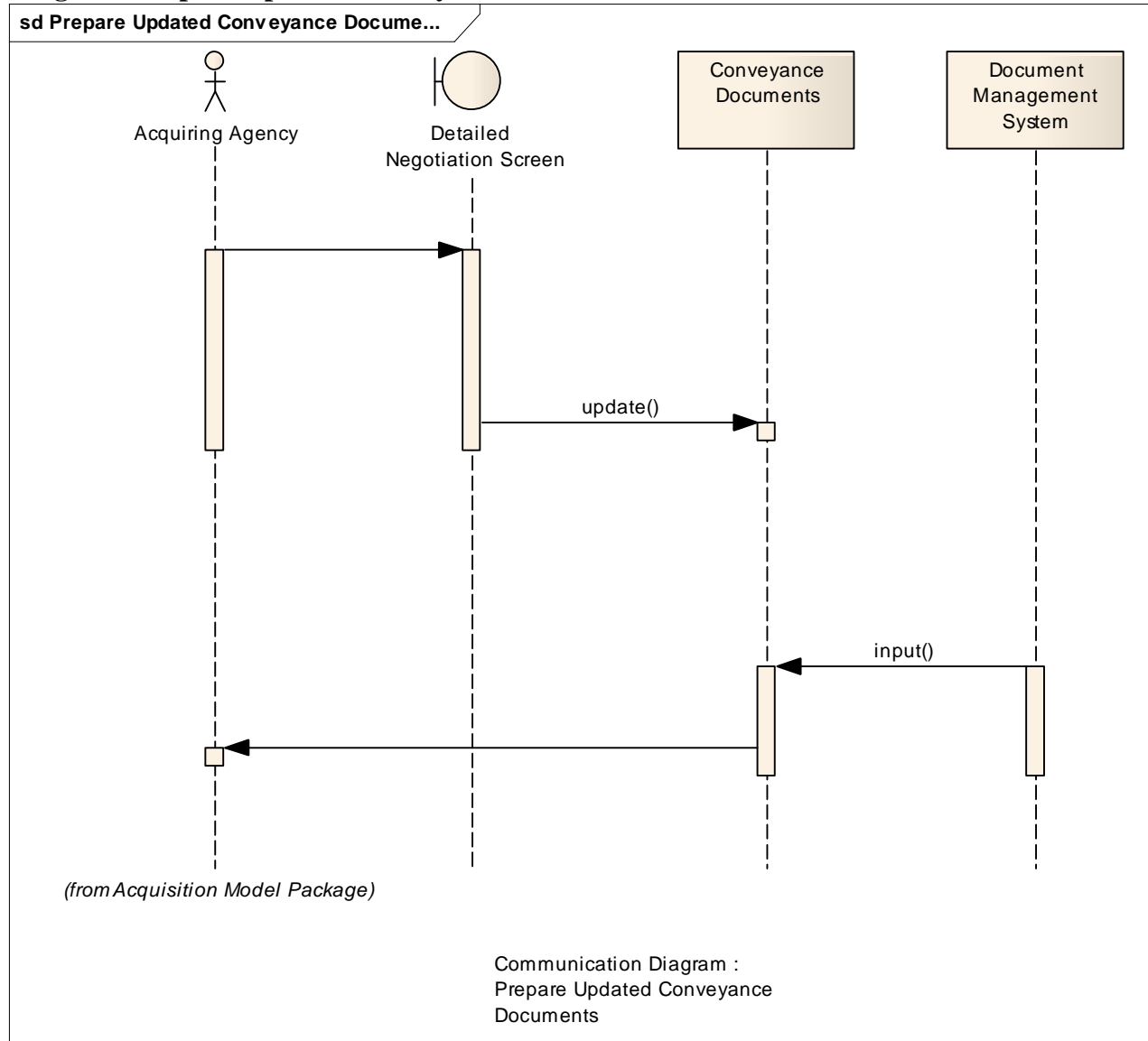
Diagram: Prepare Updated Conveyance Documents**Diagram: Prepare Updated Conveyance Documents**

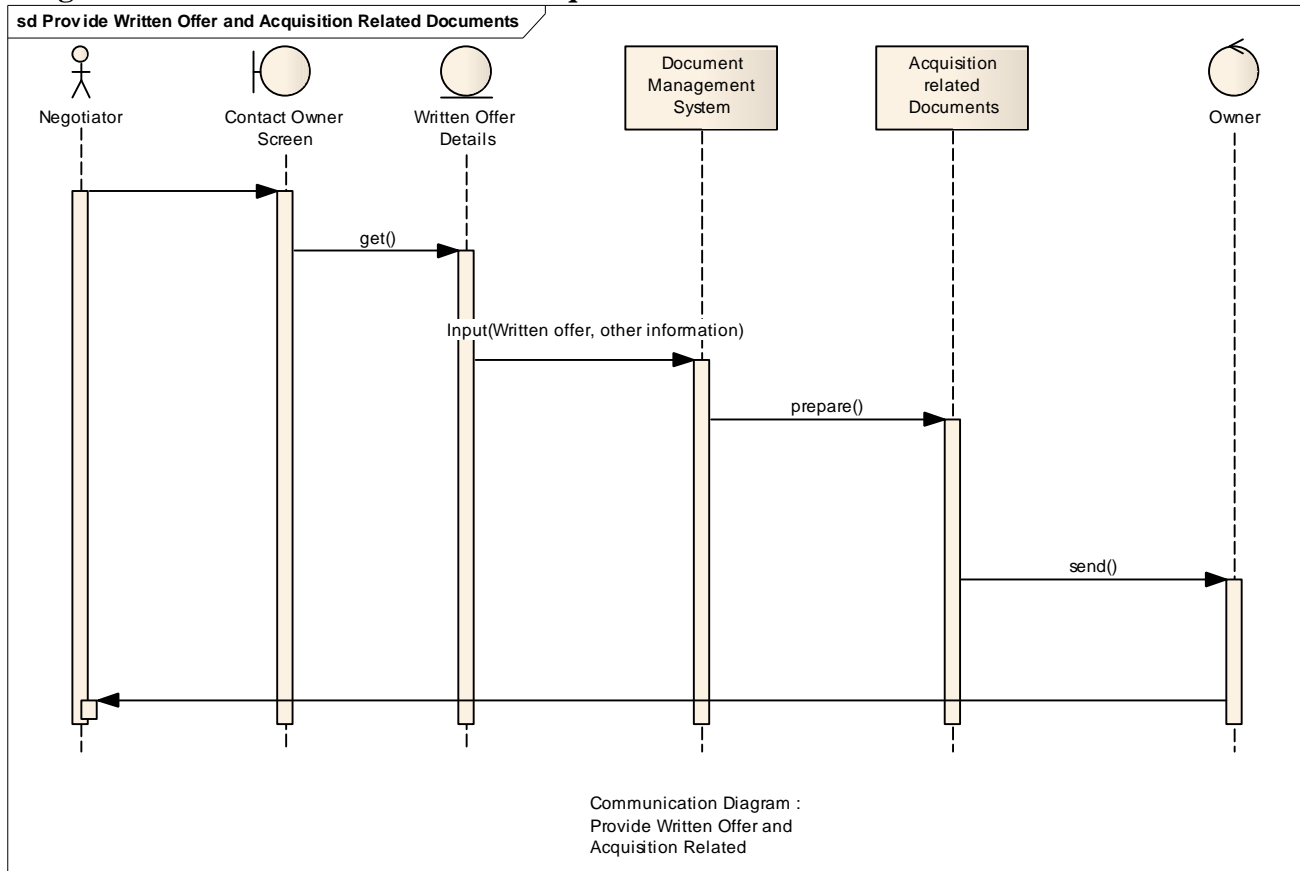
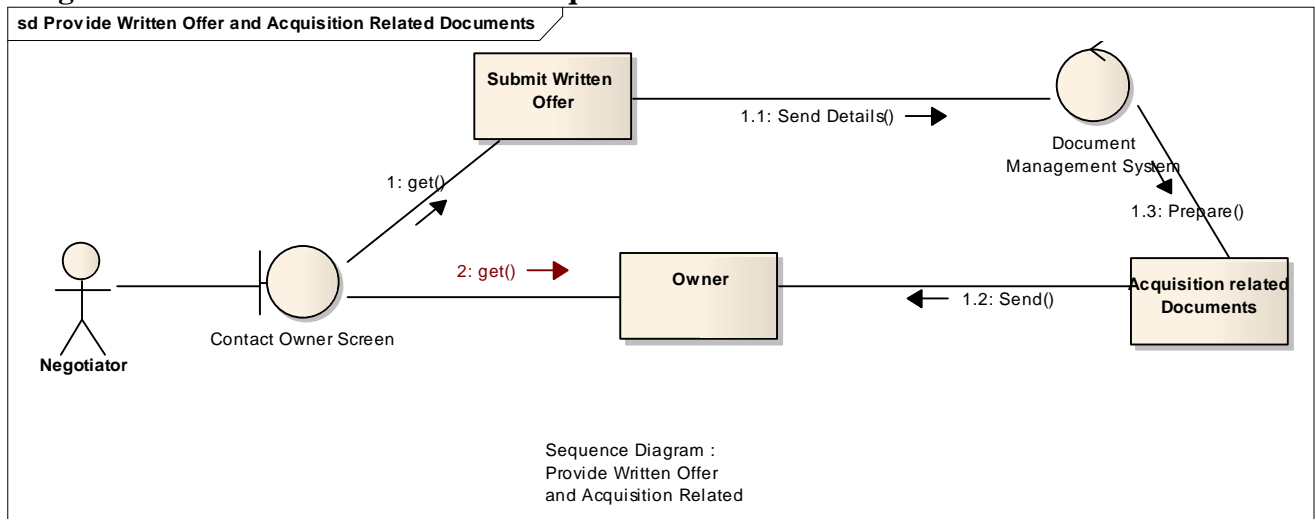
Diagram: Provide Written Offer and Acquisition Related Documents**Diagram: Provide Written Offer and Acquisition Related Documents**

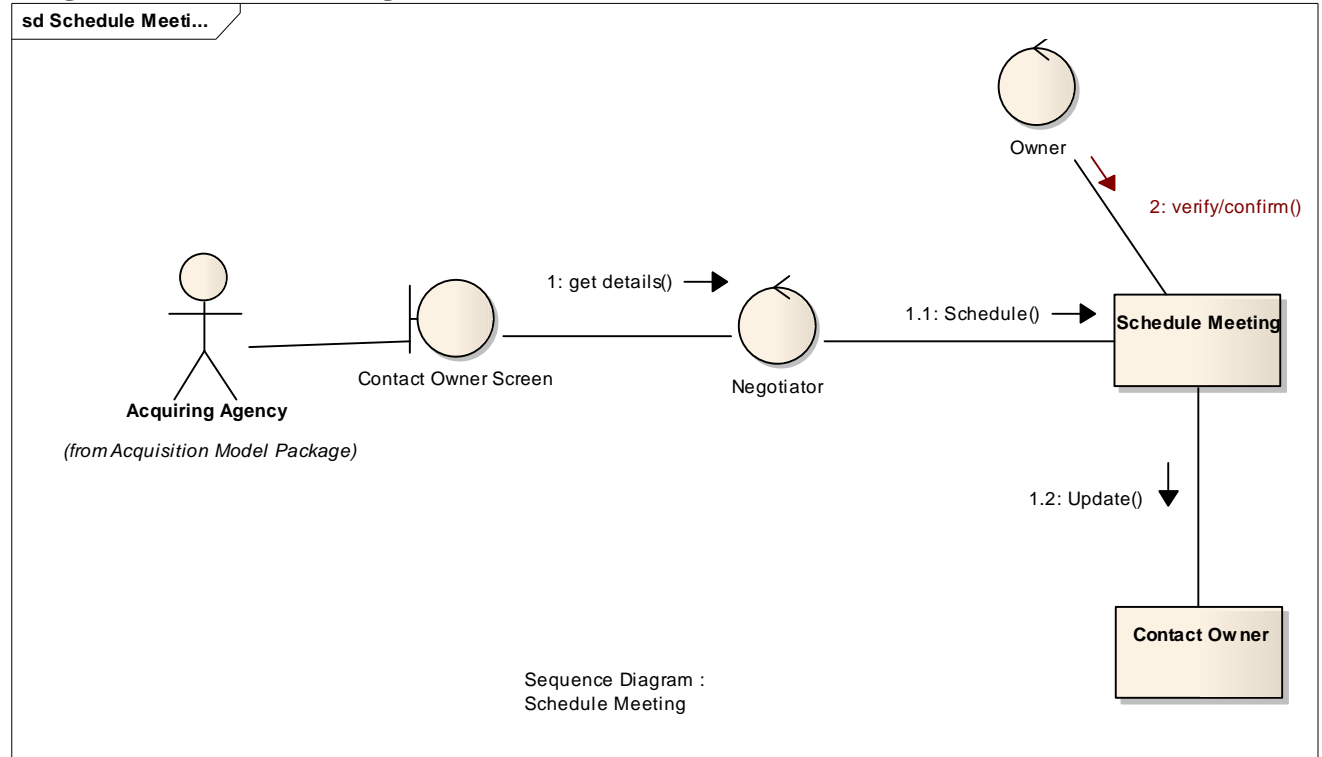
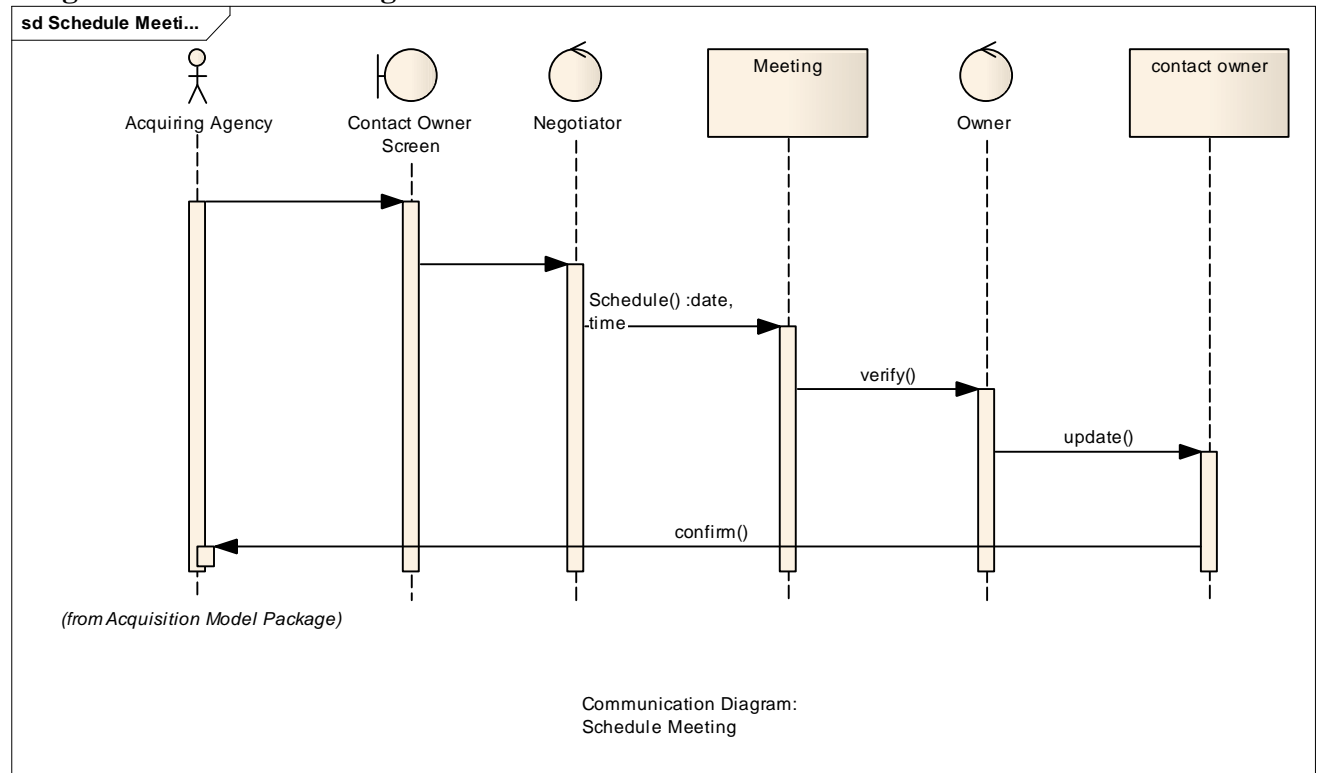
Diagram: Schedule Meeting**Diagram: Schedule Meeting**

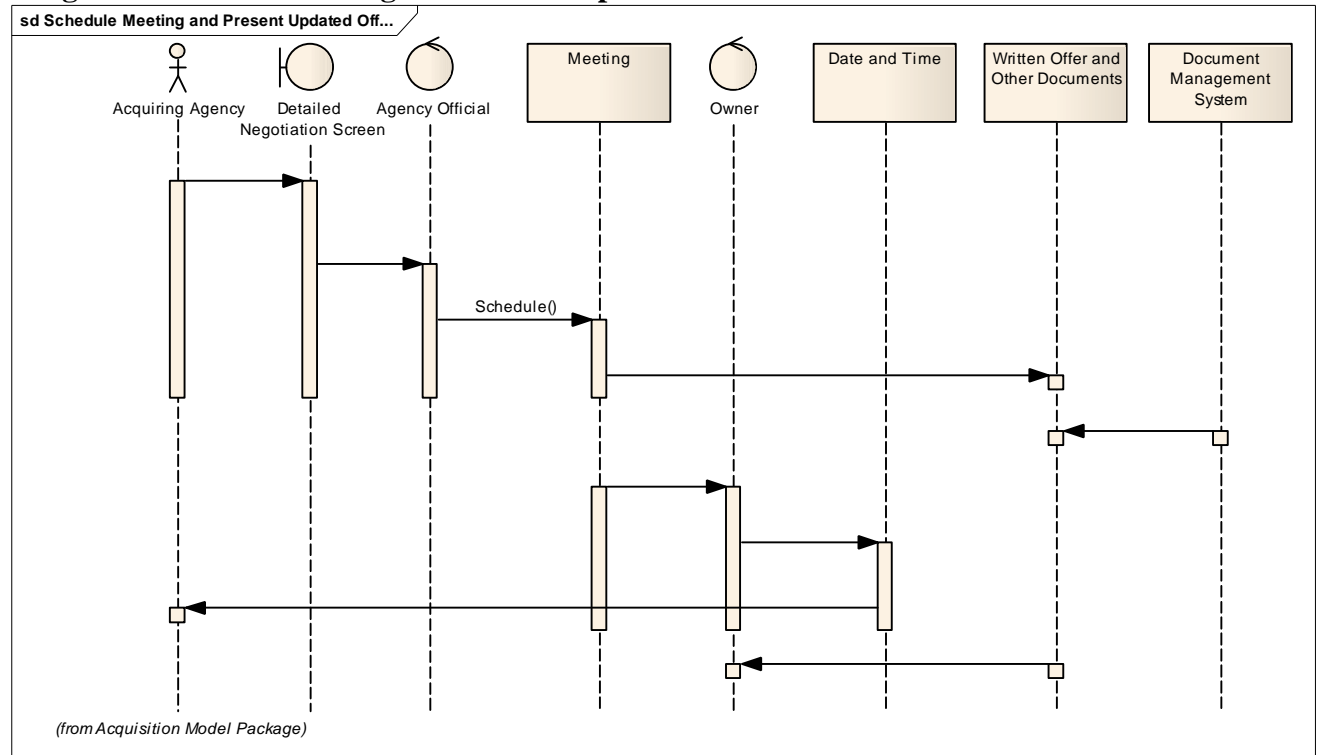
Diagram: Schedule Meeting and Present Updated Offer

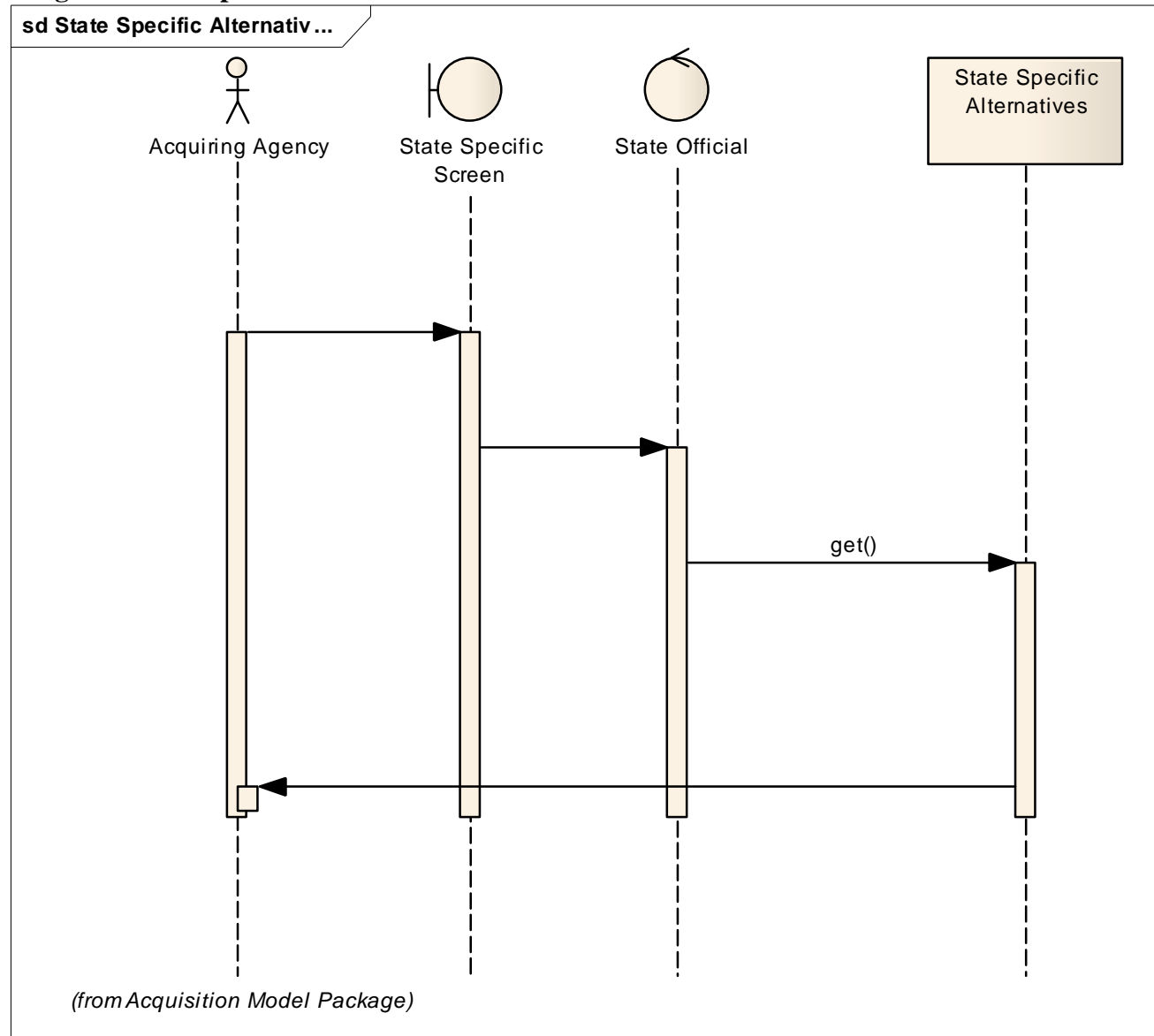
Diagram: State Specific Alternatives

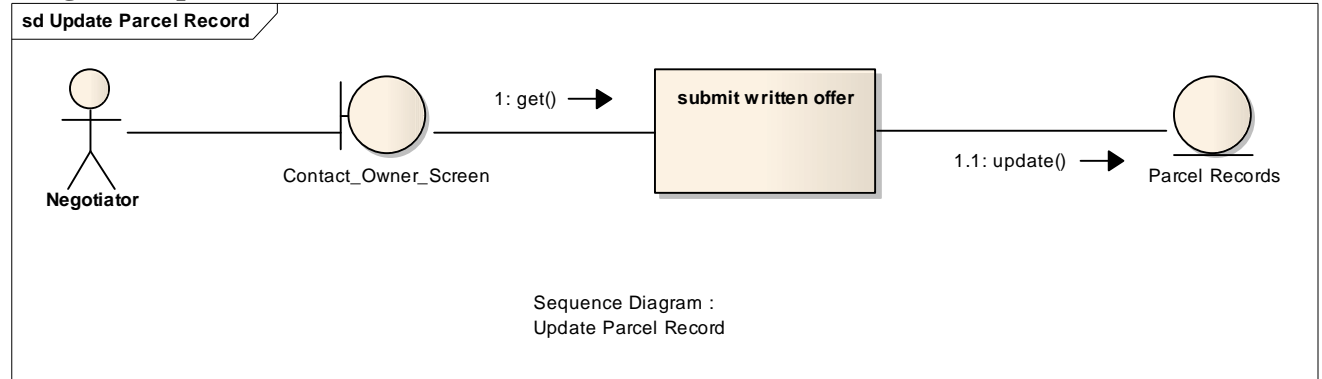
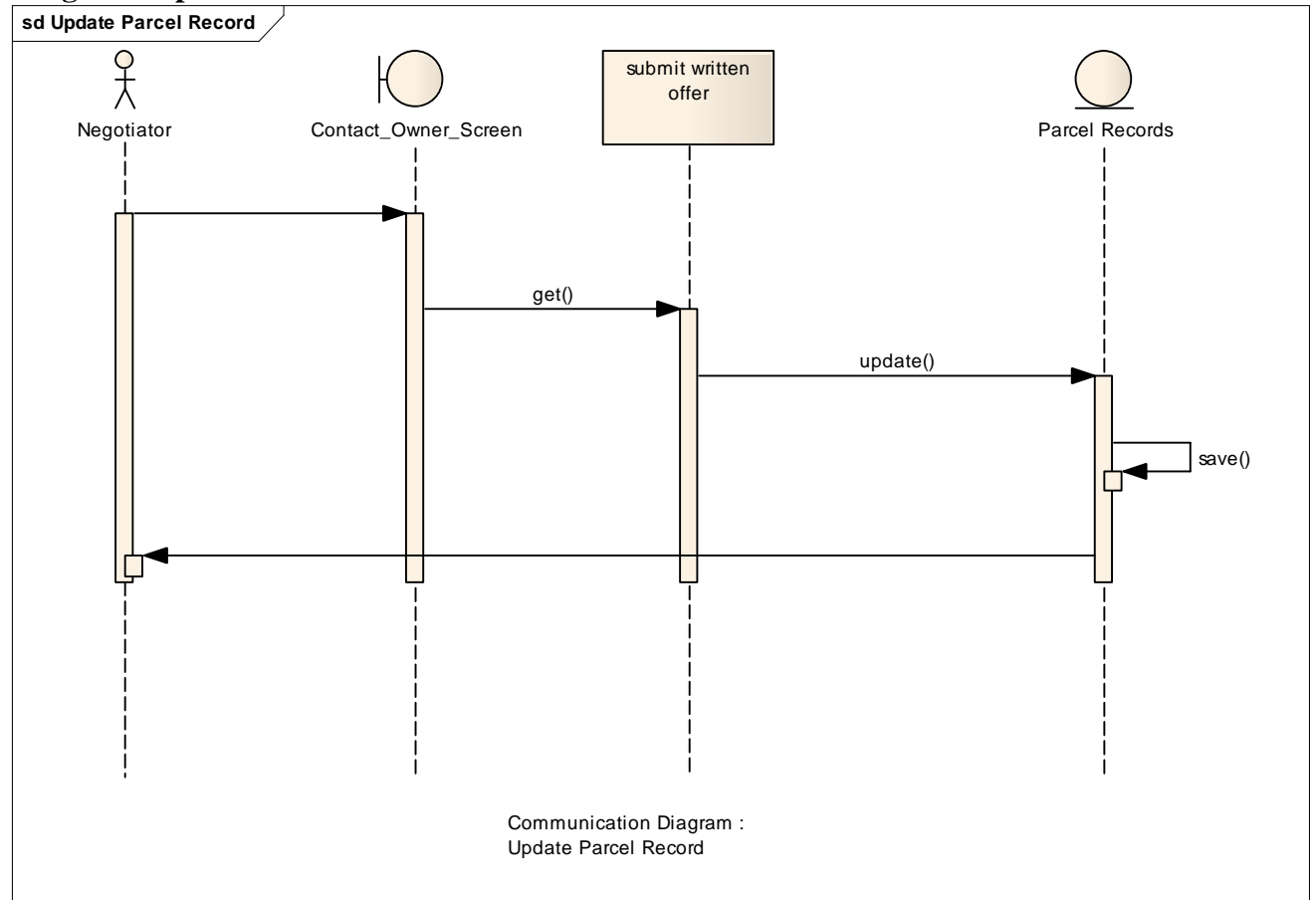
Diagram: Update Parcel Record**Diagram: Update Parcel Record**

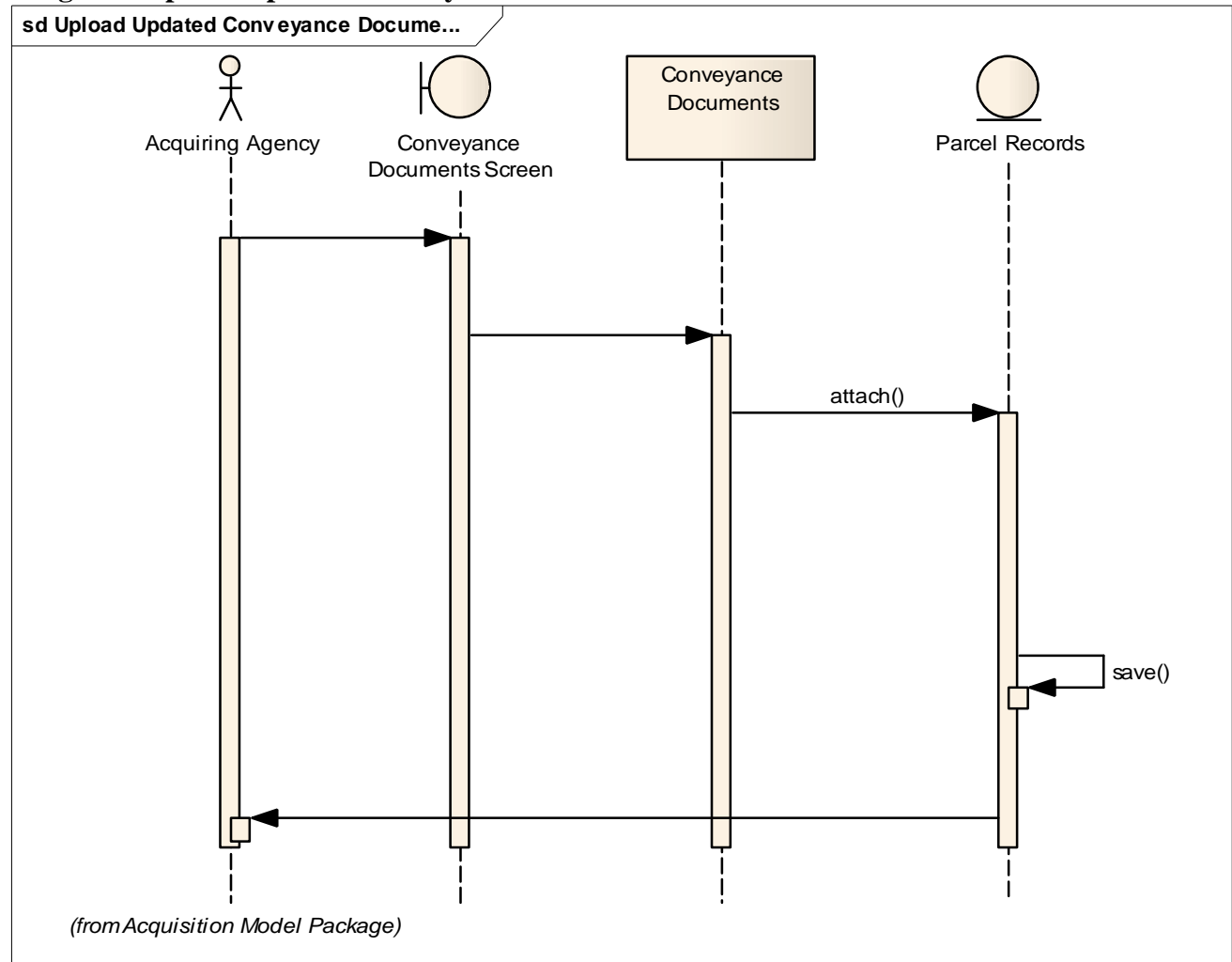
Diagram: Upload Updated Conveyance Documents

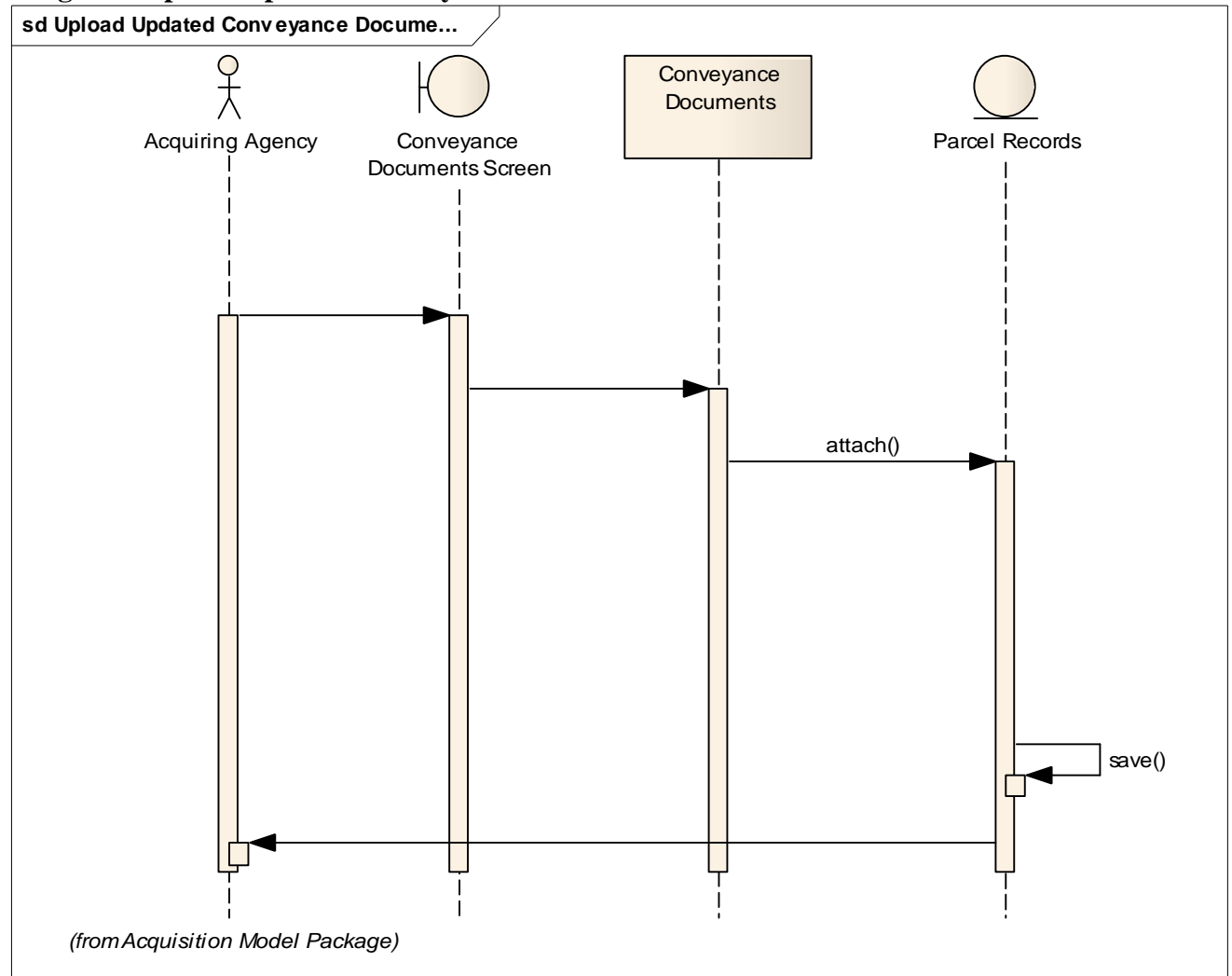
Diagram: Upload Updated Conveyance Documents

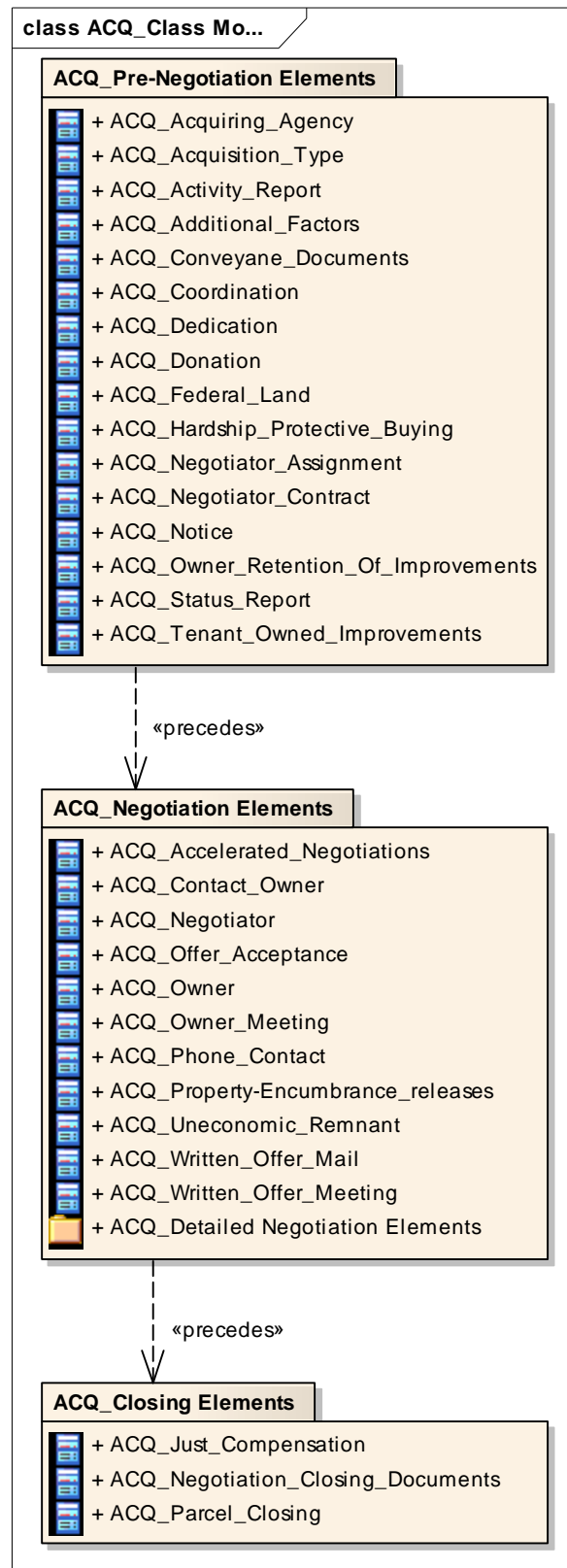
Diagram: ACQ_Class Model

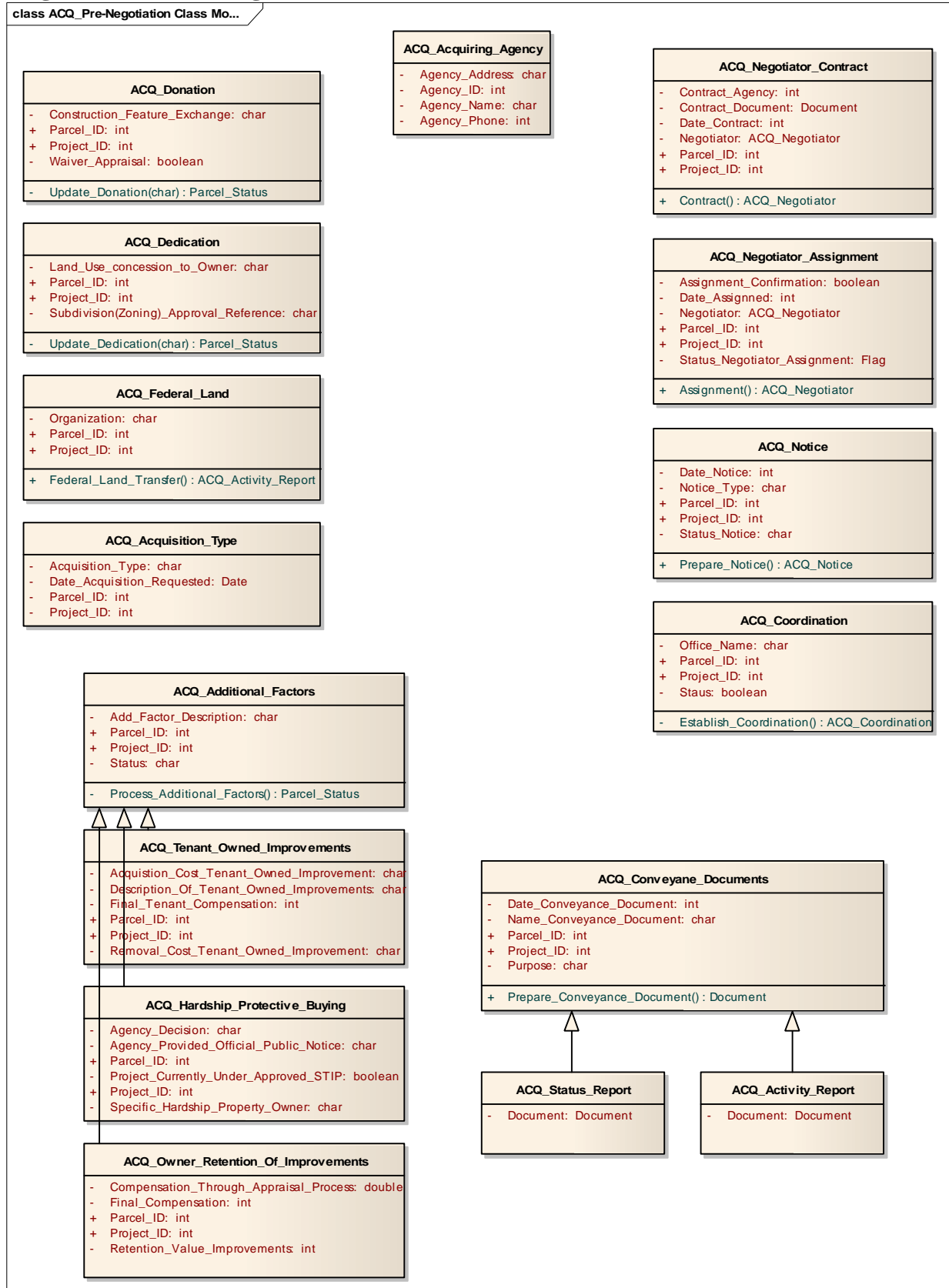
Diagram: ACQ_Pre-Negotiation Class Model

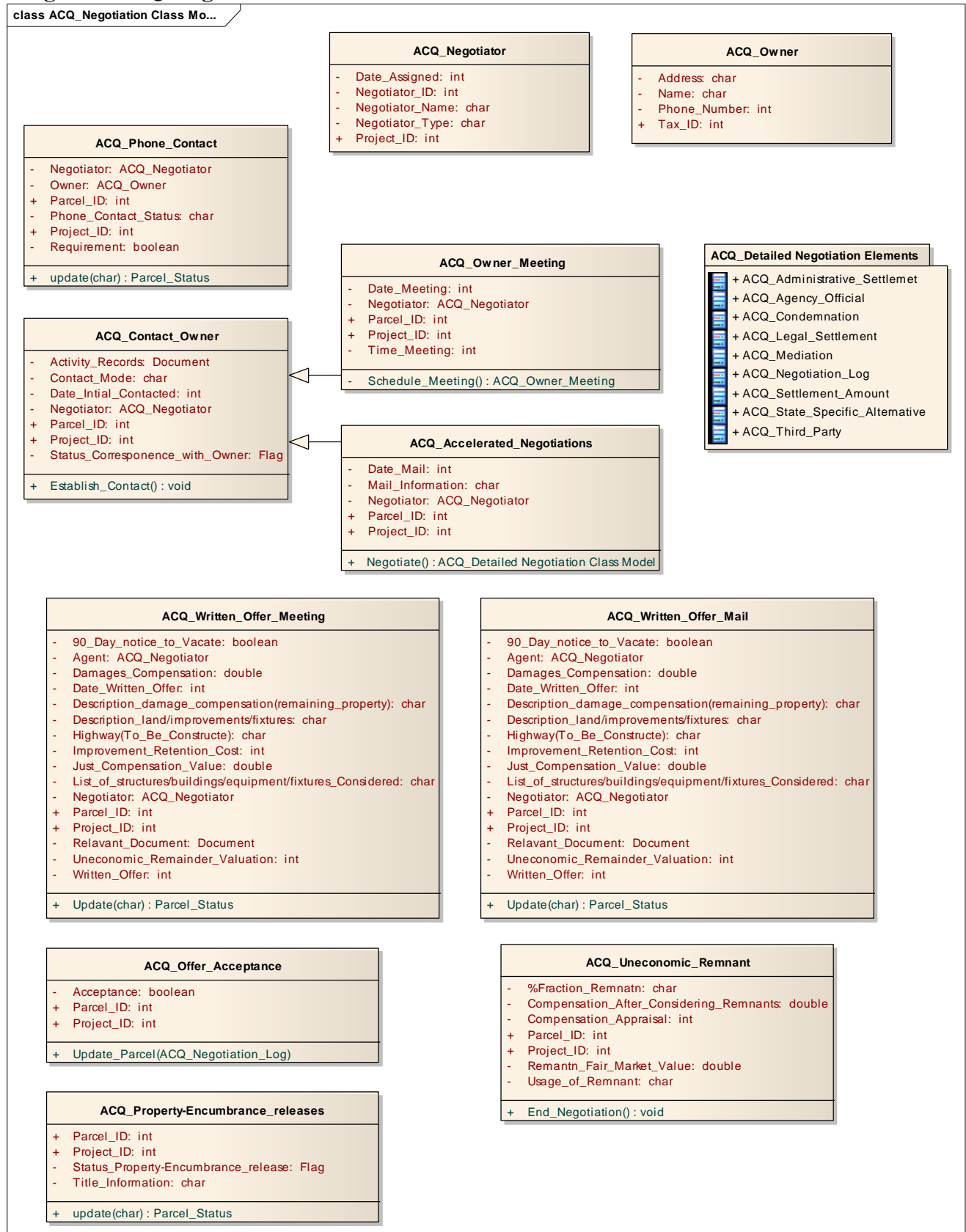
Diagram: ACQ_Negotiation Class Model

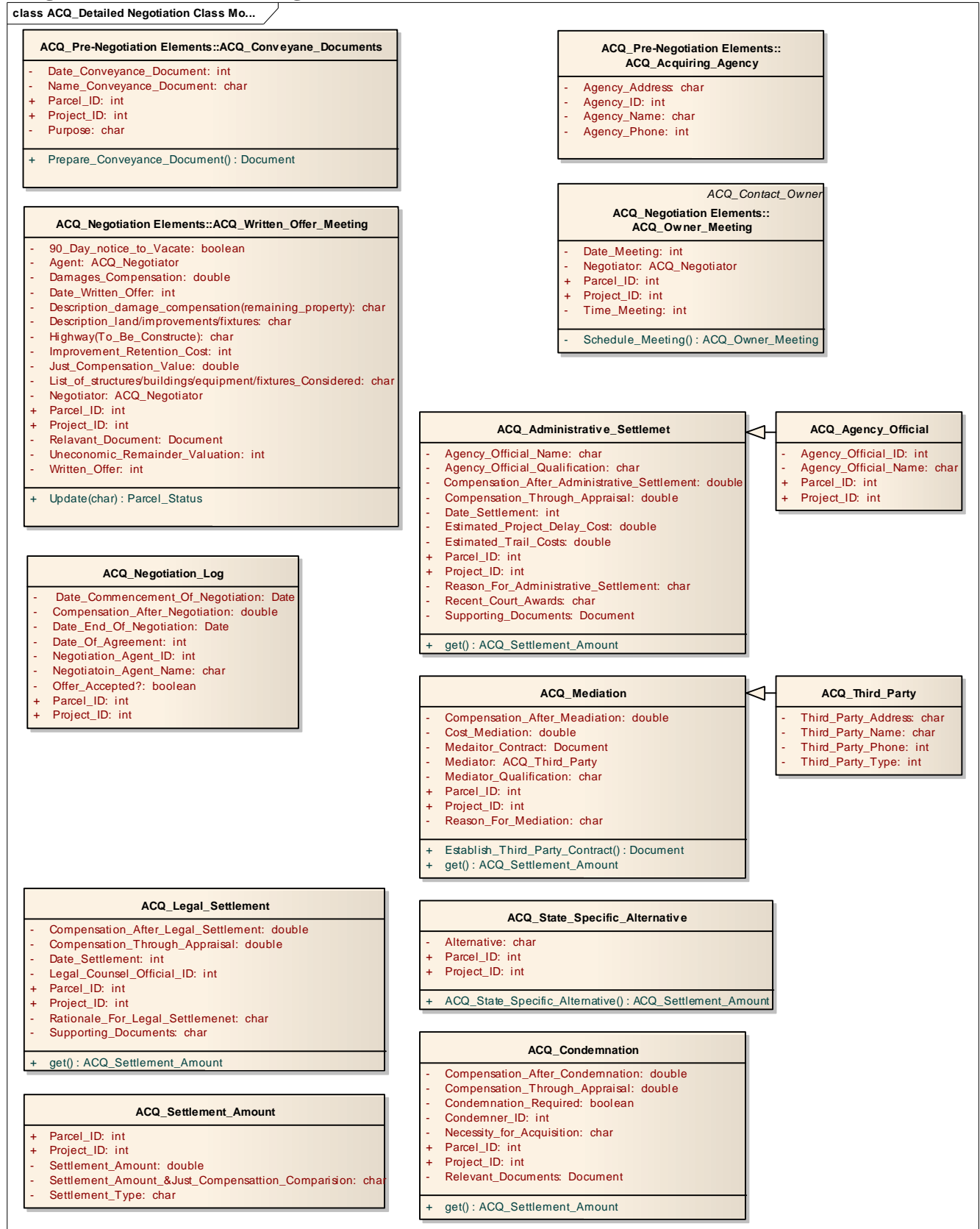
Diagram: ACQ_Detailed Negotiation Class Model

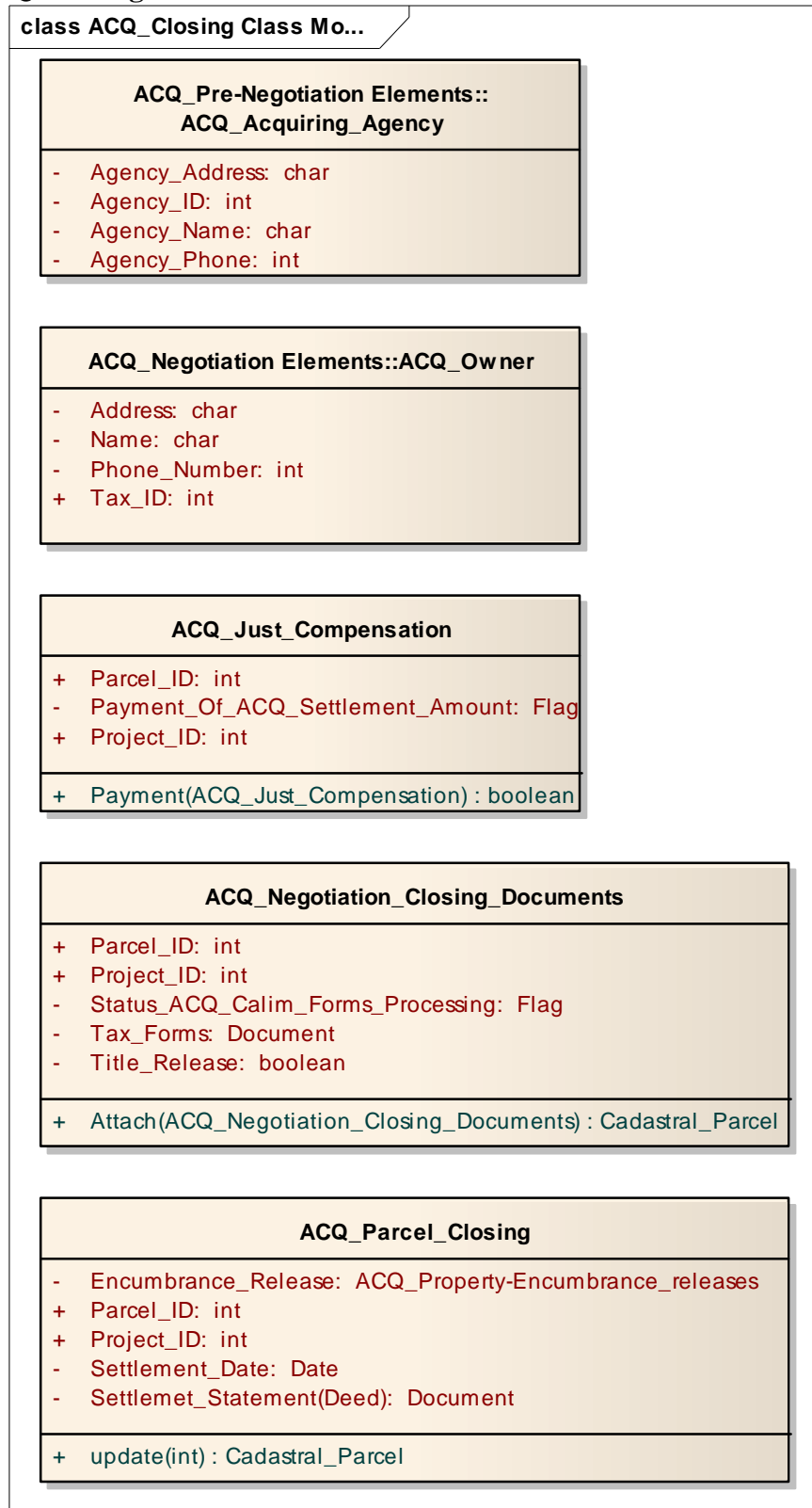
Diagram: ACQ_Closing Class Model

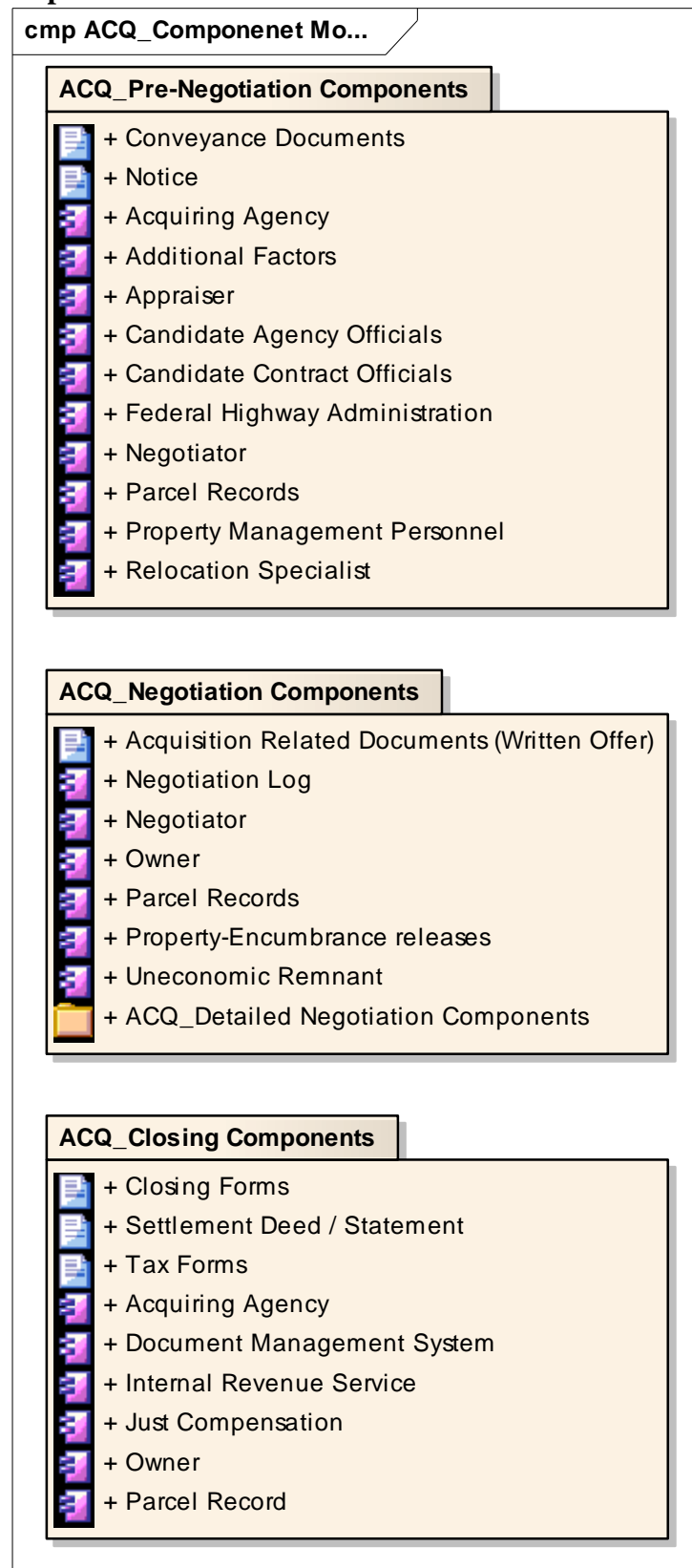
Diagram: ACQ_Componenet Model

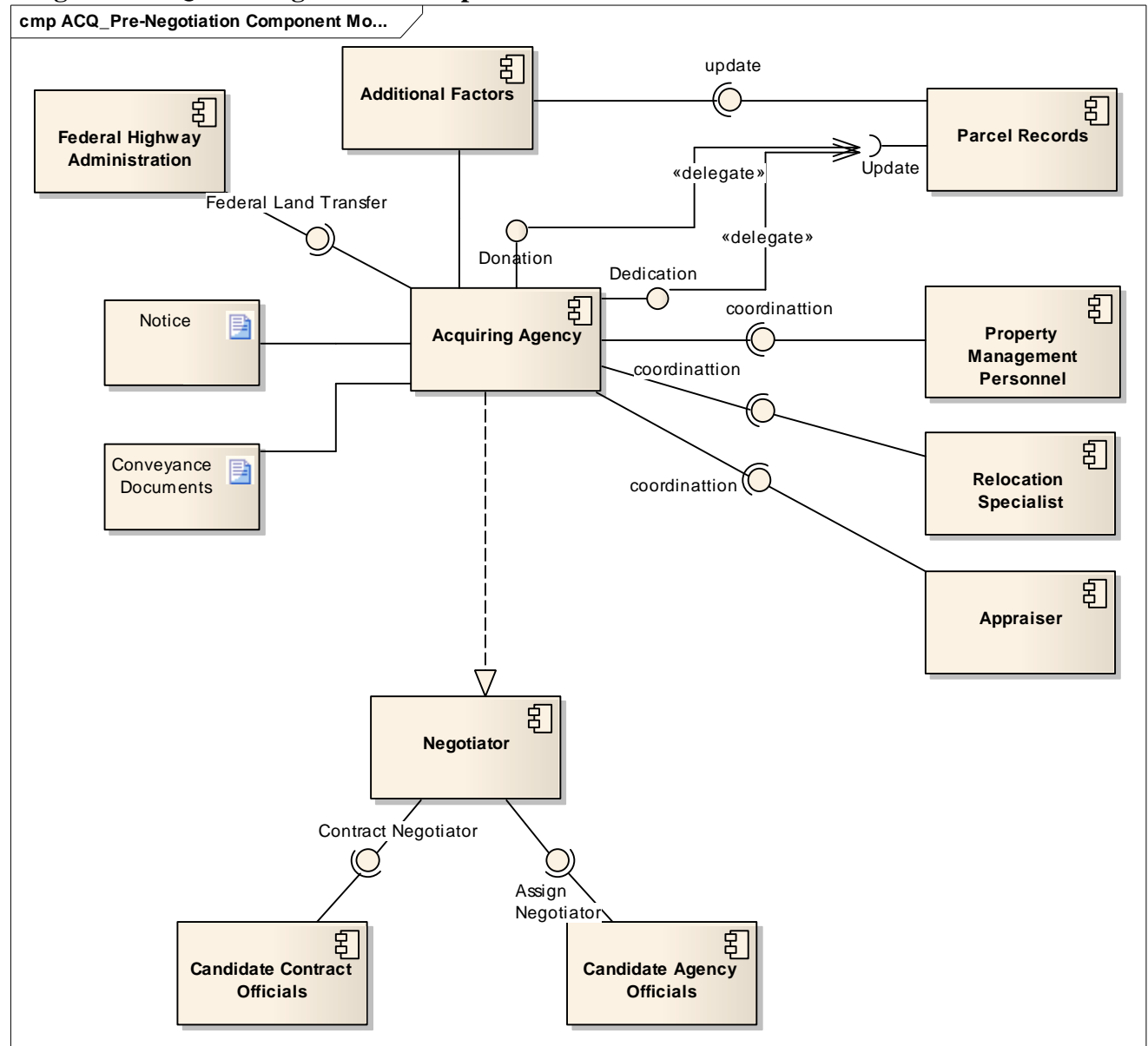
Diagram: ACQ_Pre-Negotiation Component Model

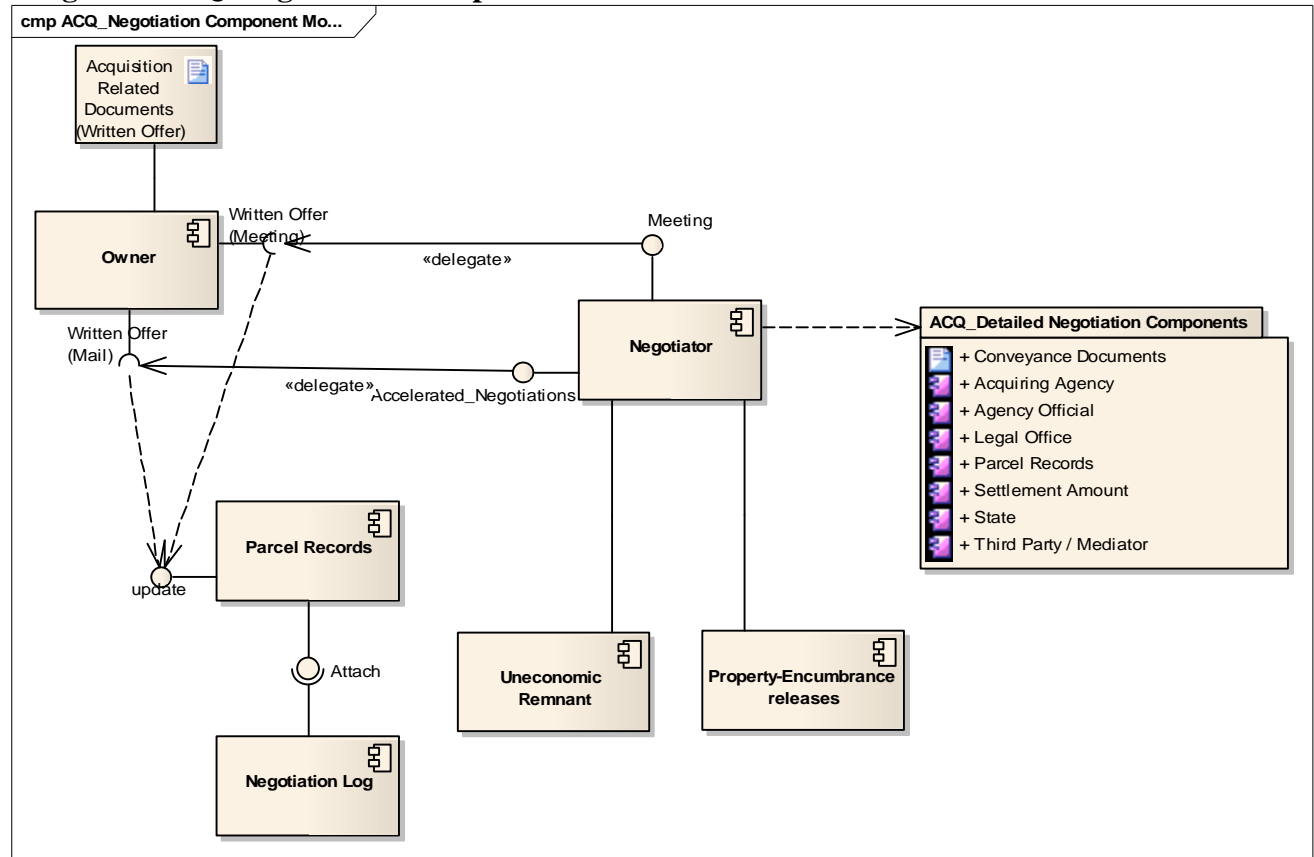
Diagram: ACQ_Negotiation Component Model

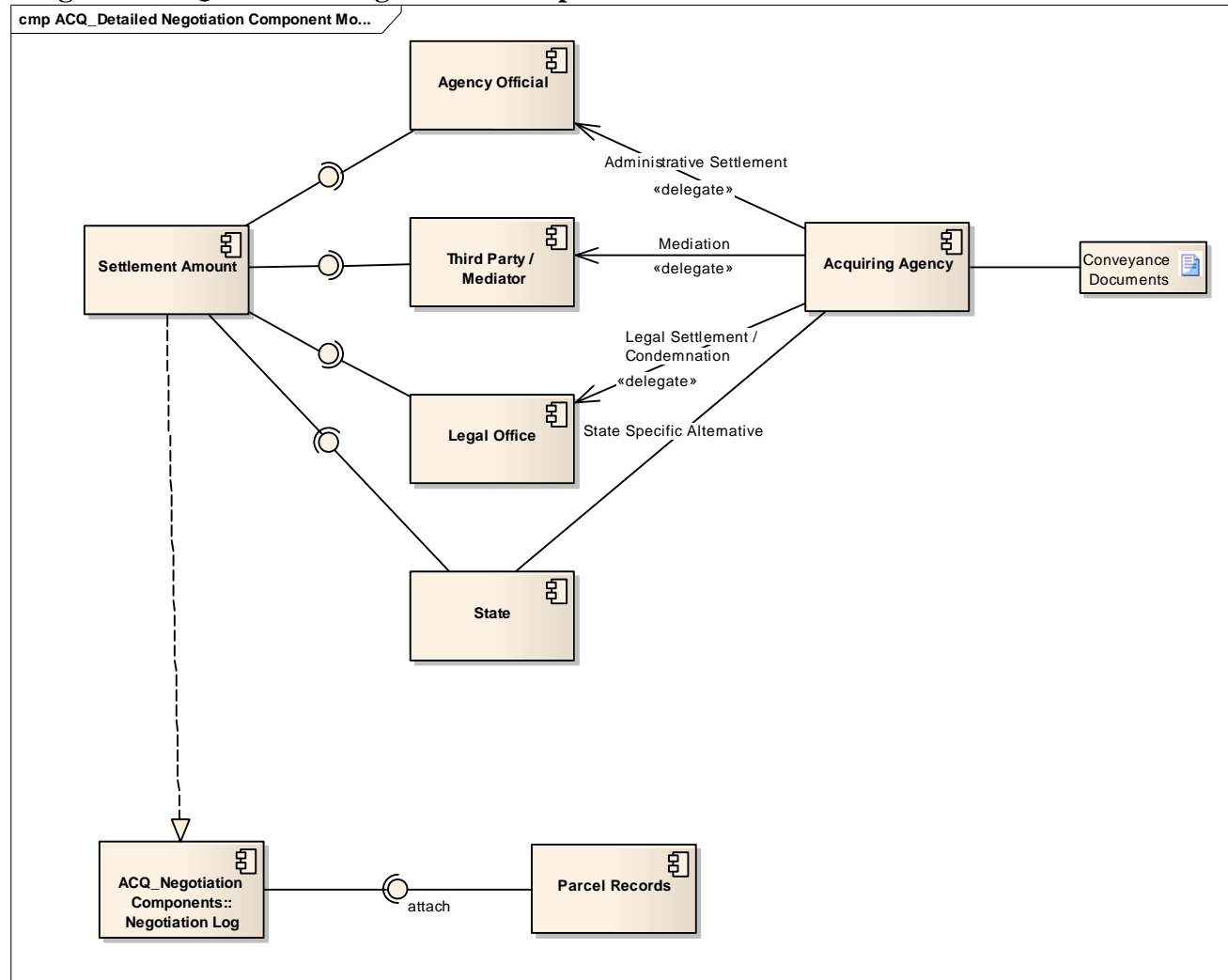
Diagram: ACQ_Detailed Negotiation Component Model

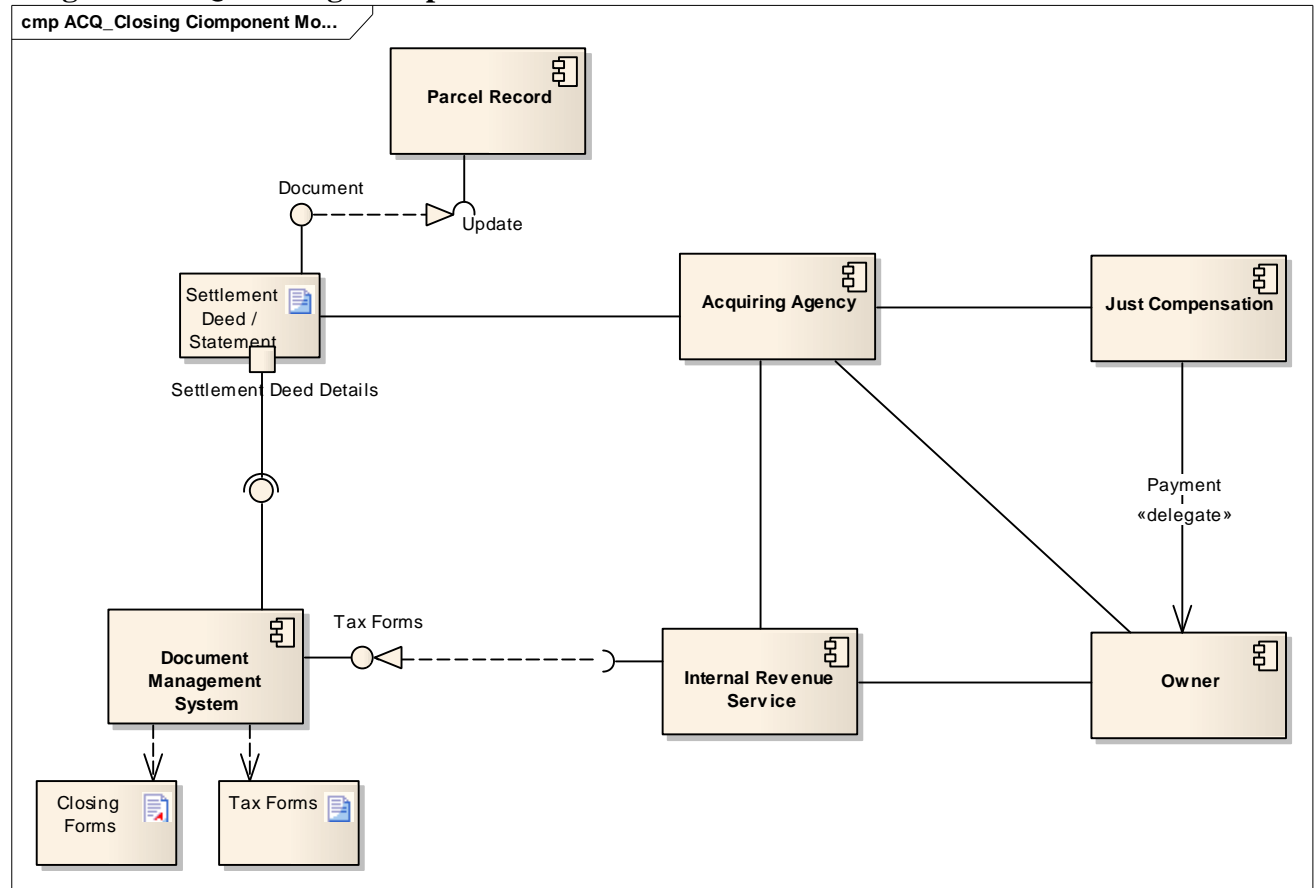
Diagram: ACQ_Closing Ciomponent Model

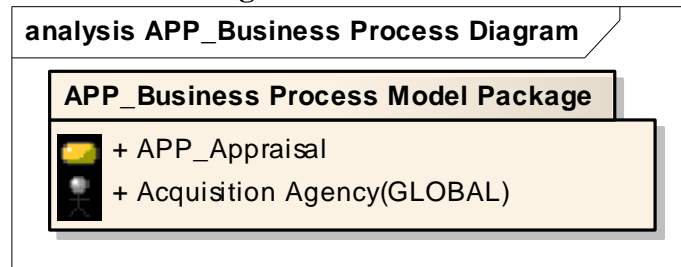
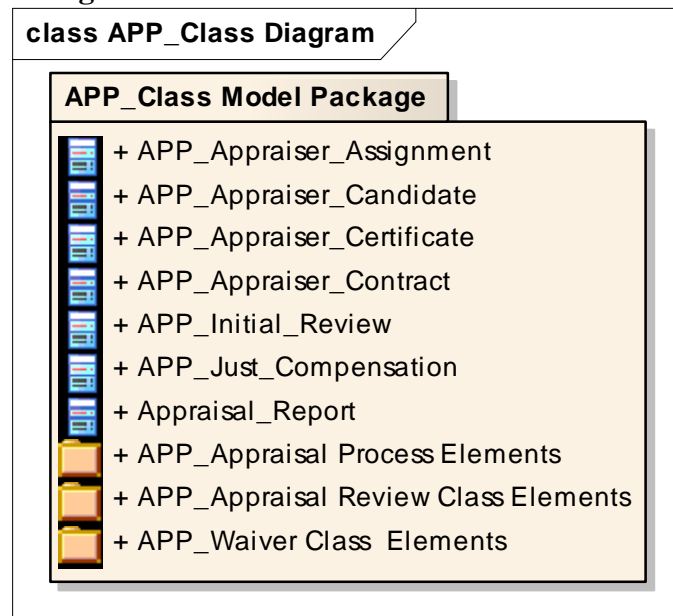
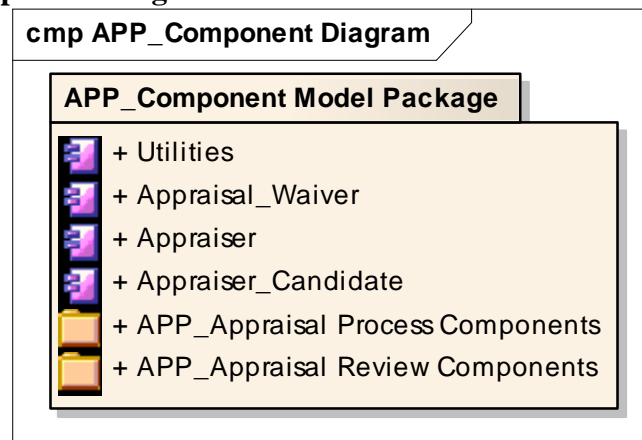
Diagram: APP_Business Process Diagram**Diagram: APP_Class Diagram****Diagram: APP_Component Diagram**

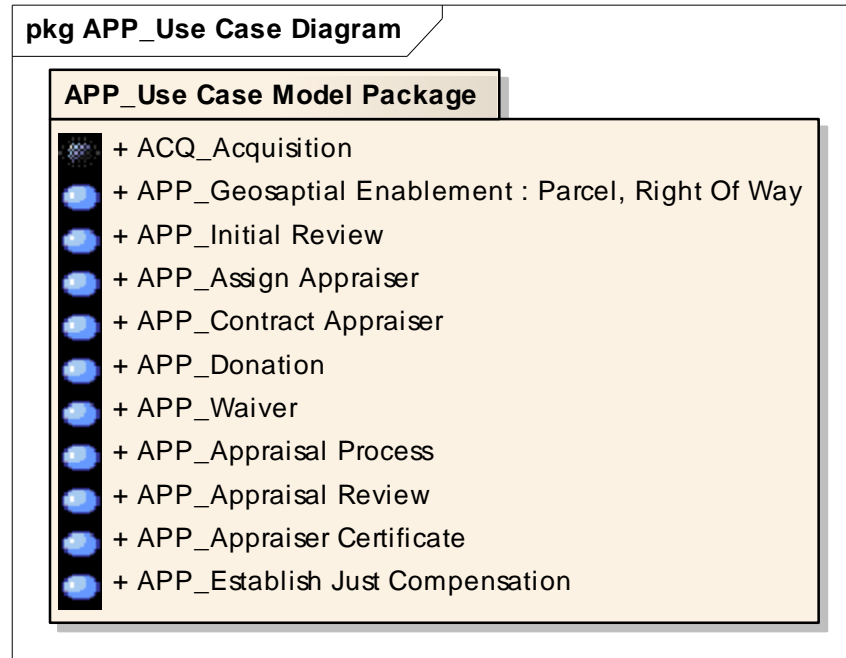
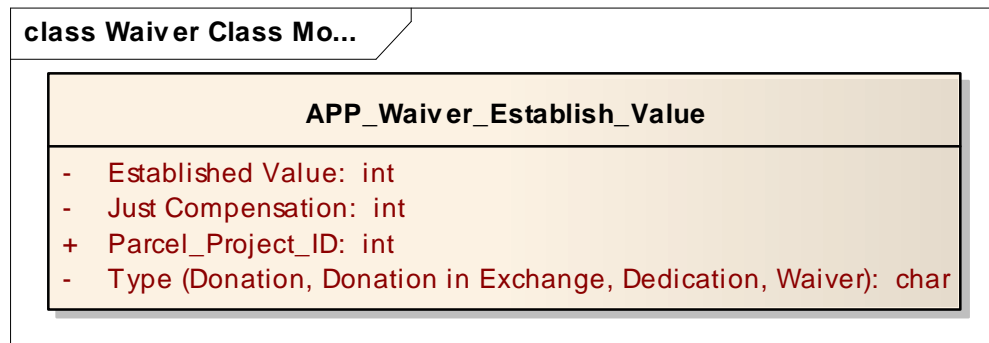
Diagram: APP_Use Case Diagram**Diagram: Waiver Class Model**

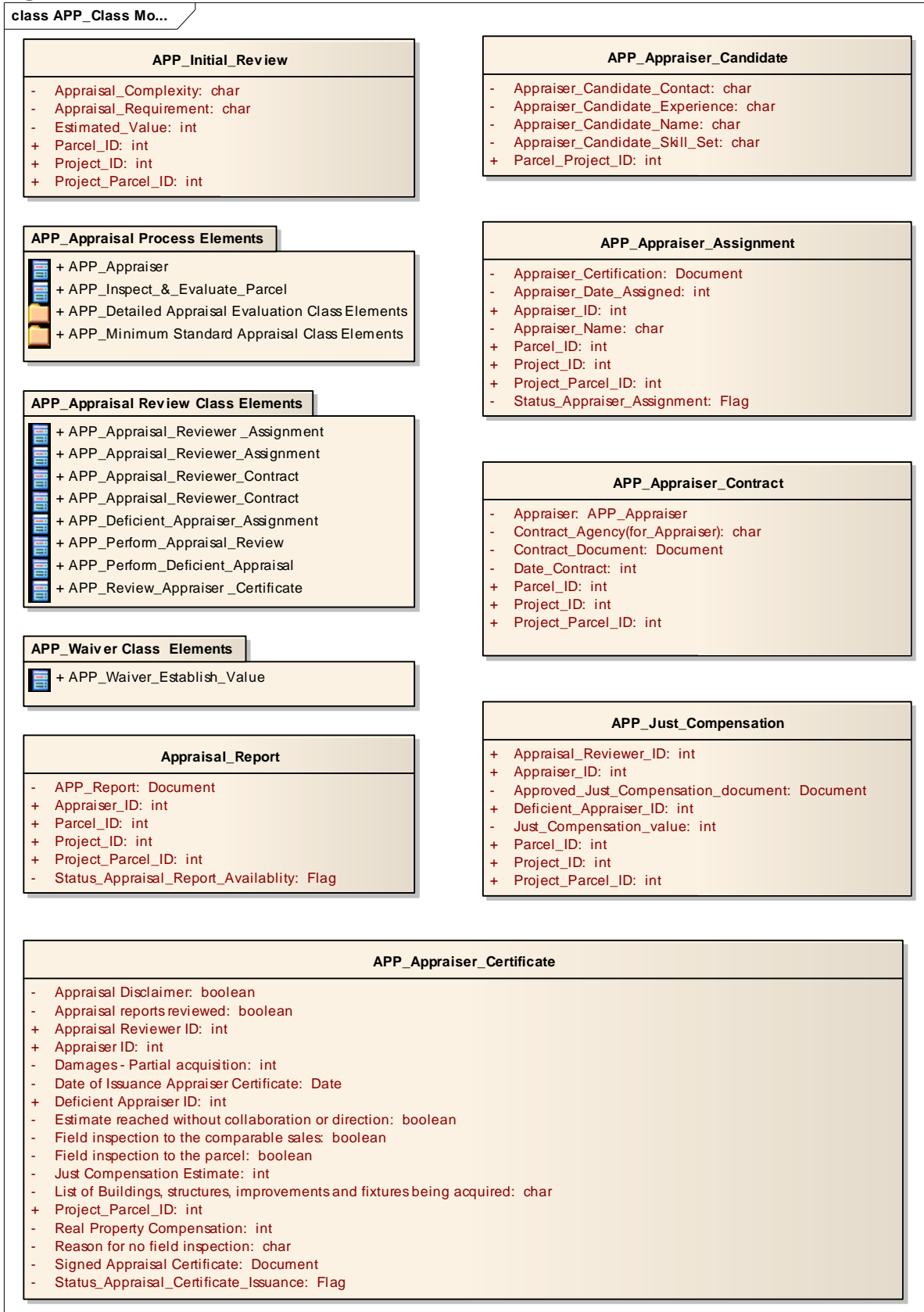
Diagram: APP_Class Model

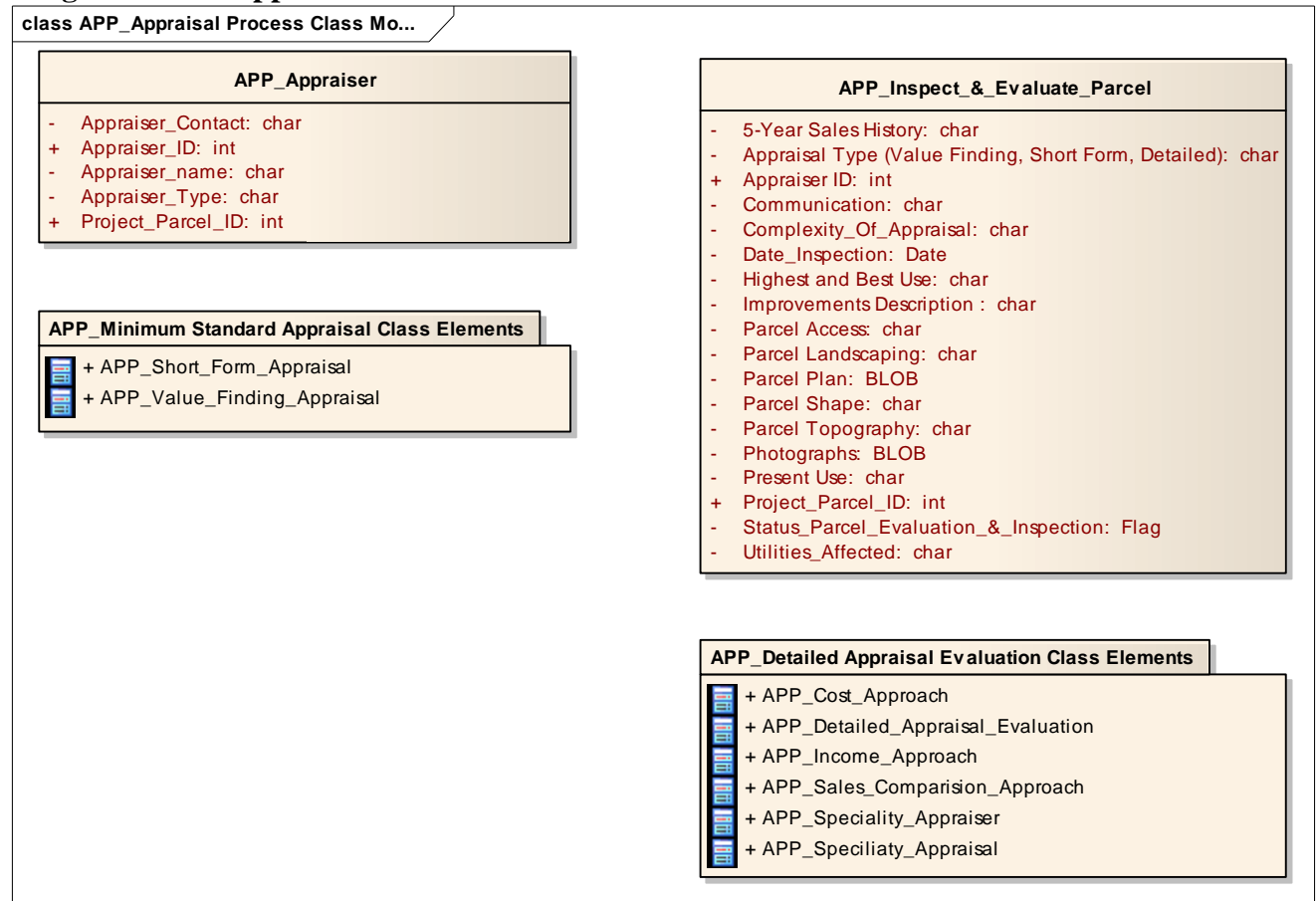
Diagram: APP_Appraisal Process Class Model

Diagram: APP_Minimum Standard Appraisal Class Model

class APP_Minimum Standard Appraisal Class Mo...

APP_Value_Finding_Appraisal
<ul style="list-style-type: none"> + Appraiser ID: int - Basis for Value: char - Brief Analysis: char - Date of Valuation: Date - Interest Acquired: int - Market Value: int + Project_Parcel_ID: int - Remarks: char - Value-Damages: int - Value-Improvement: int - Value-Land: int - Value-Takings: int - Value Appraised: int

APP_Short_Form_Appraisal
<ul style="list-style-type: none"> - All other Adjustments (Dollars or %): int - Appraisal Purpose: char + Appraiser ID: int - Date of Valuation: Date - Date of Valuation of Appraisal: Date - Indicated Value: int - Interest being Acquired: int - Interest to be Acquired: int - Lease Terms: char - Market Data Approach: char - Net Adjustment: int - Partial acquisition Improvements Value: int - Partial acquisition Land Value: int - Partial acquisition Statement of Value - Damages: int - Partial acquisition Statement of Value - Prope: int - Price per Unit of Comp: int - Problem to be Solved: char + Project_Parcel_ID: int - Property Value Justification: char - Remarks: char - Rights to be Appraised: char - Sale Price: int - Sale Price adjusted for Time: int - Tenant Names: char - Tenant Owned Buildings Value: int - Tenant Owned Improvements Value: int - Tenant Owned Structures Value: int - Time Adjustment: int - Title Information: char - Total Adjustments Explanation: char - Total Damage Explanation: char - Value-Damages: int - Value-Improvement: int - Value-Land: int - Value-Takings: int - Value Appraised: int

Diagram: APP_Detailed Appraisal Class Model

class APP_Detailed Appraisal Class Mo...



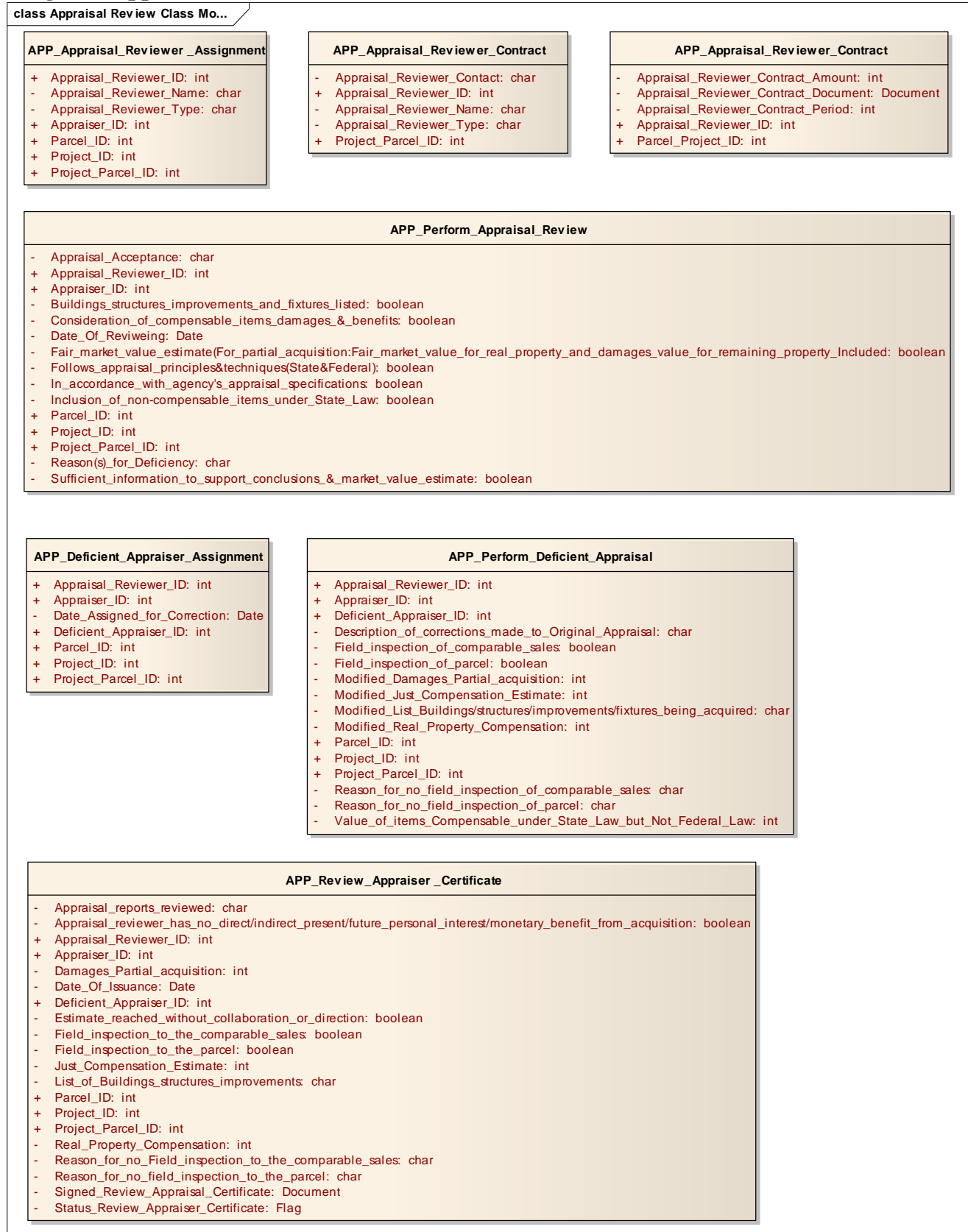
Diagram: Appraisal Review Class Model

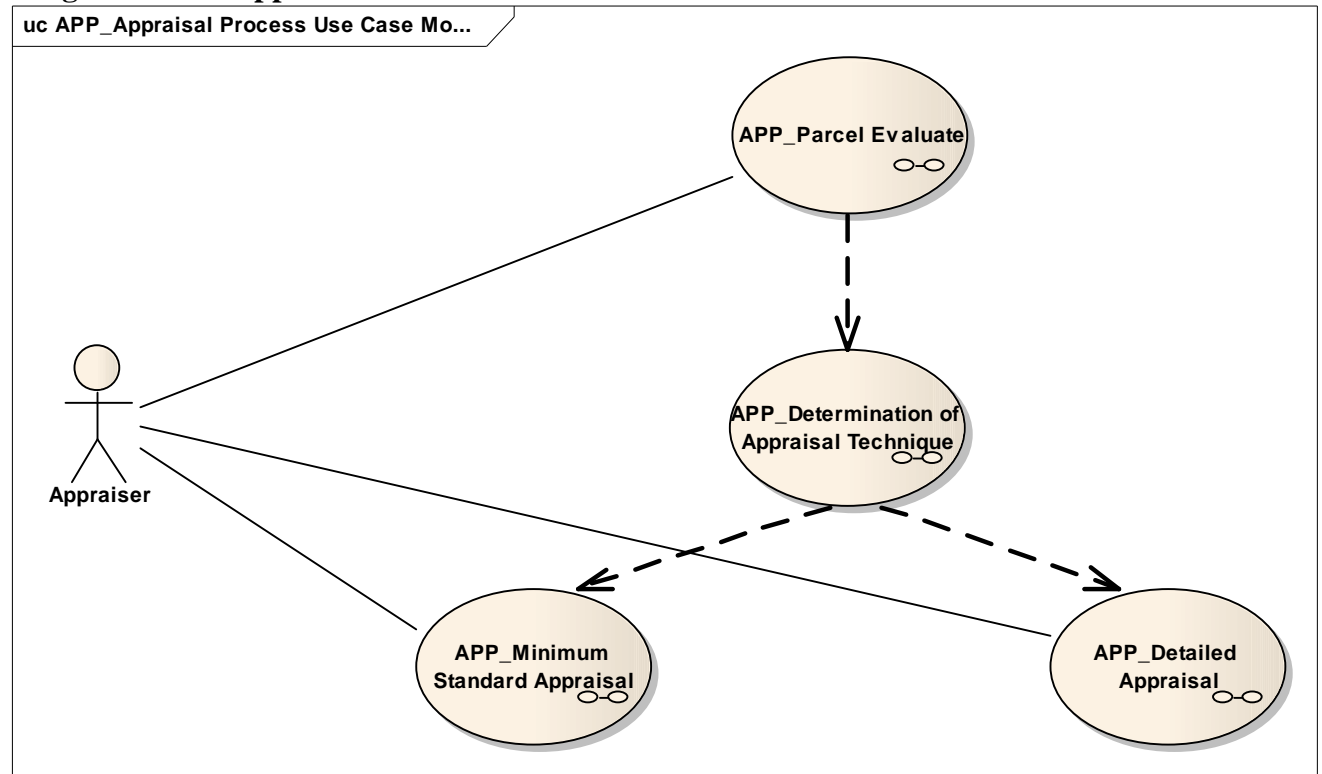
Diagram: APP_Appraisal Process Use Case Model

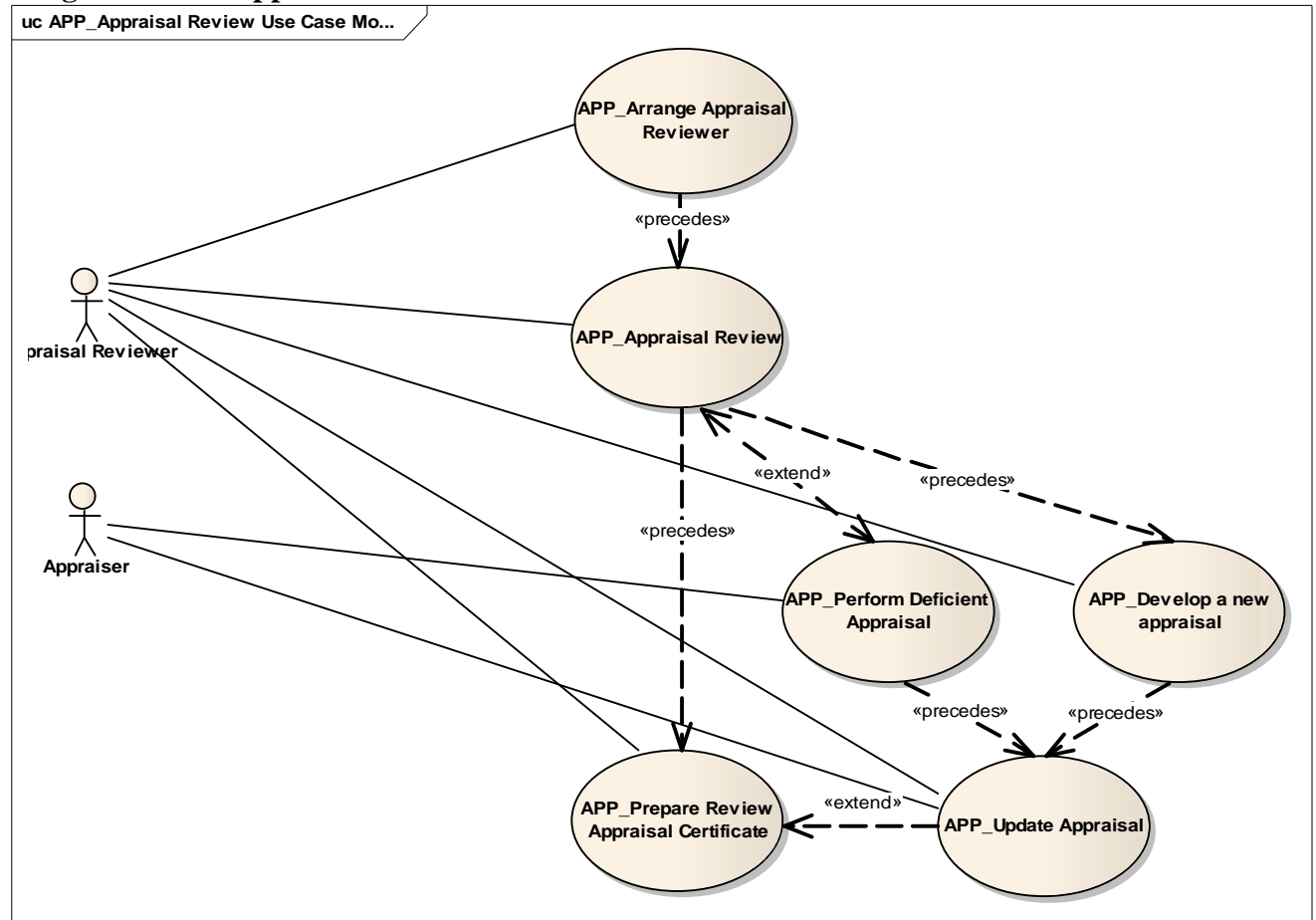
Diagram: APP_Appraisal Review Use Case Model

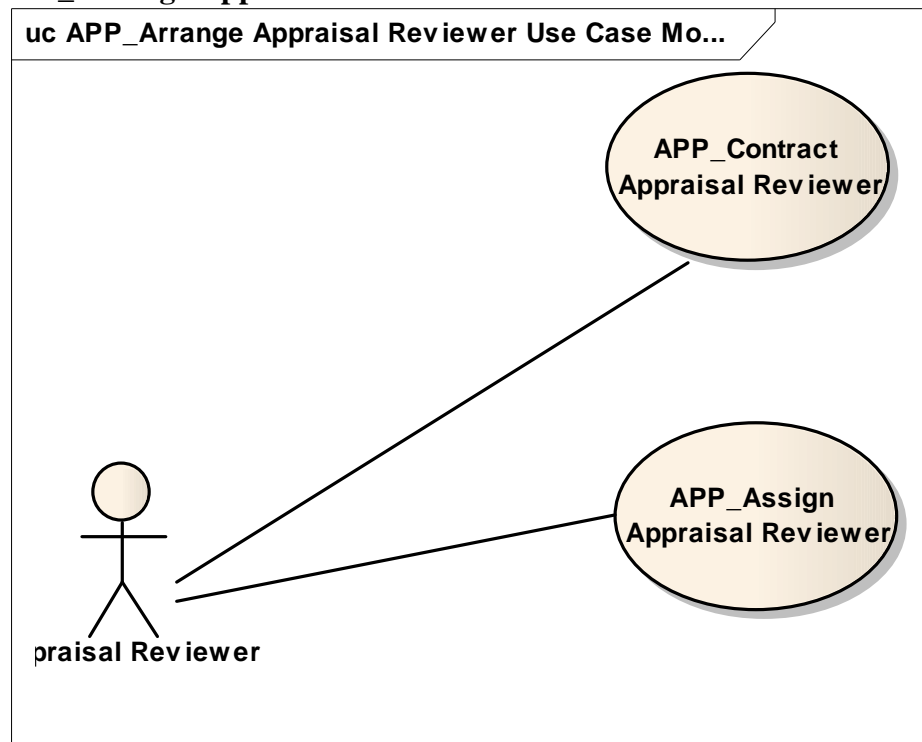
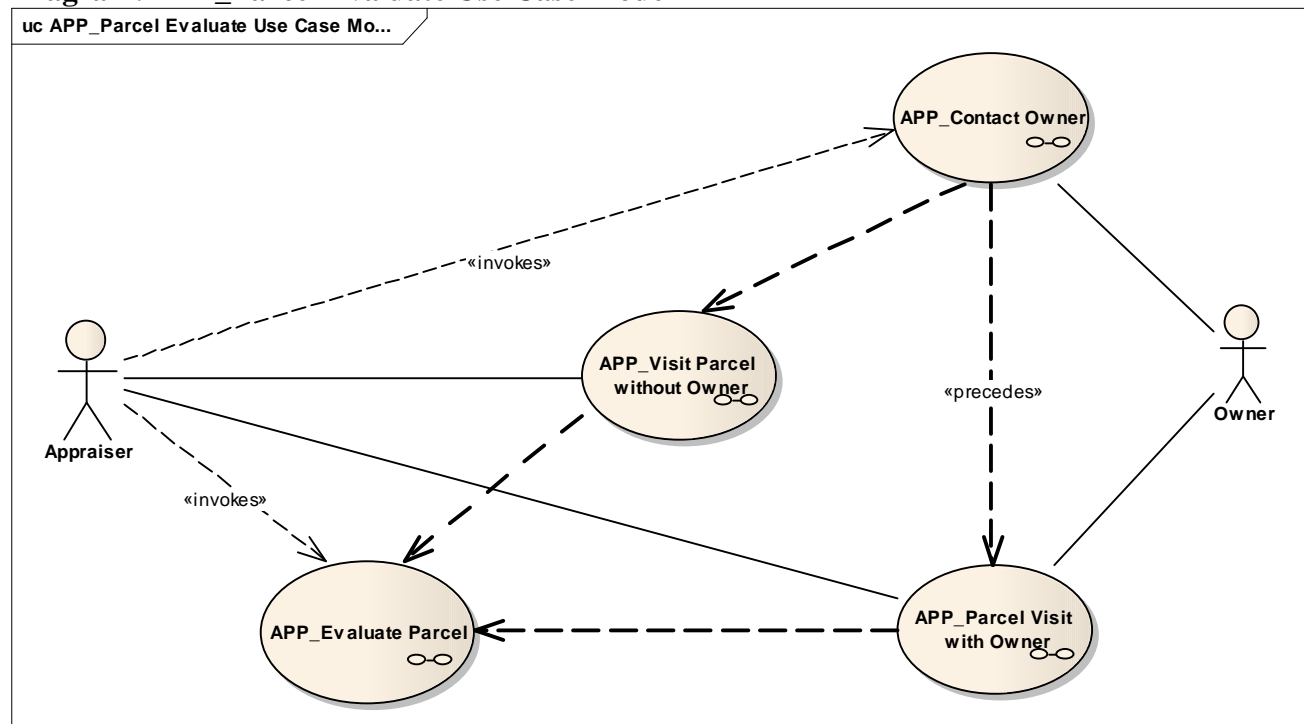
Diagram: APP_Arrange Appraisal Reviewer Use Case Model**Diagram: APP_Parcel Evaluate Use Case Model**

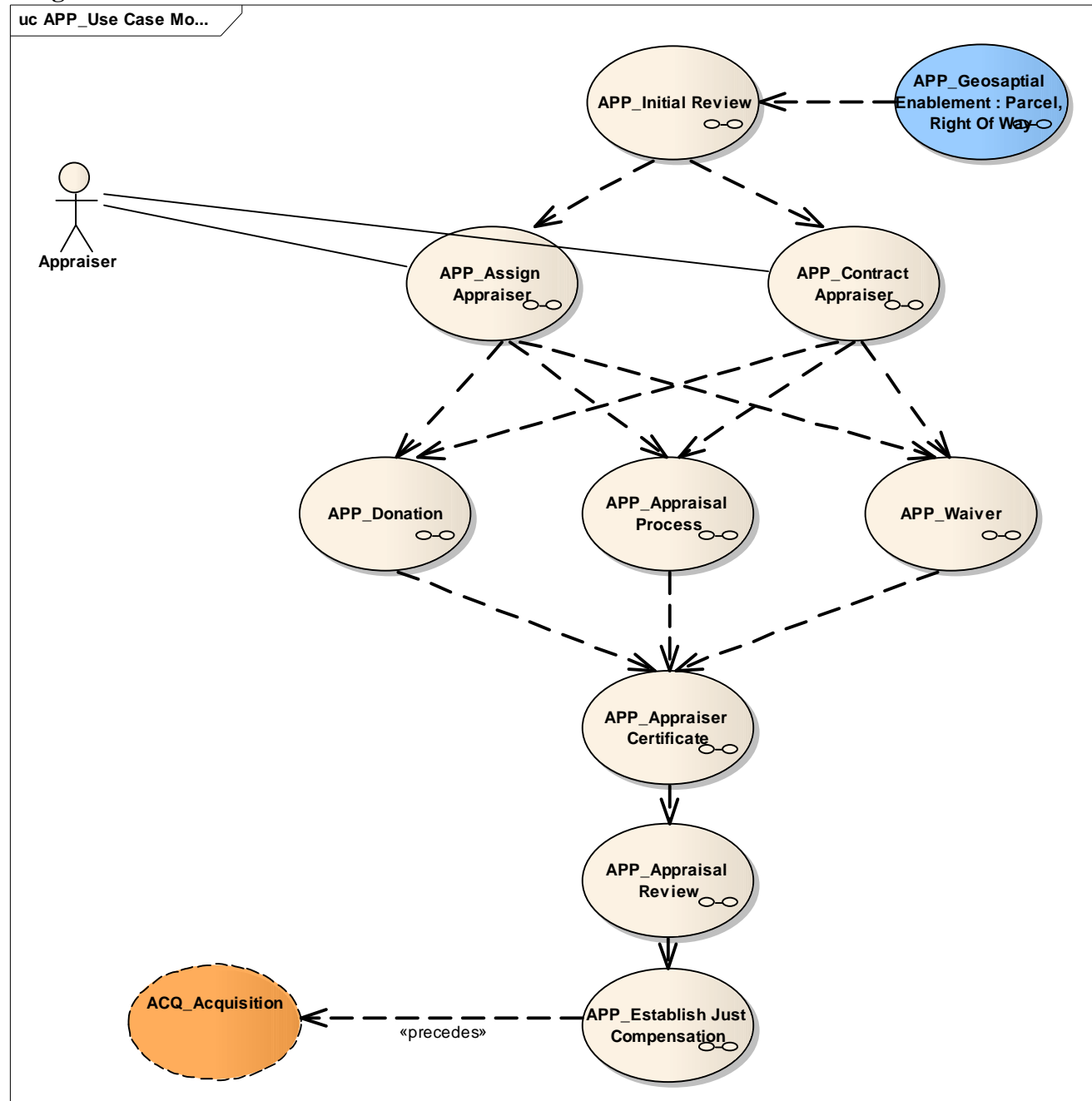
Diagram: APP_Use Case Model

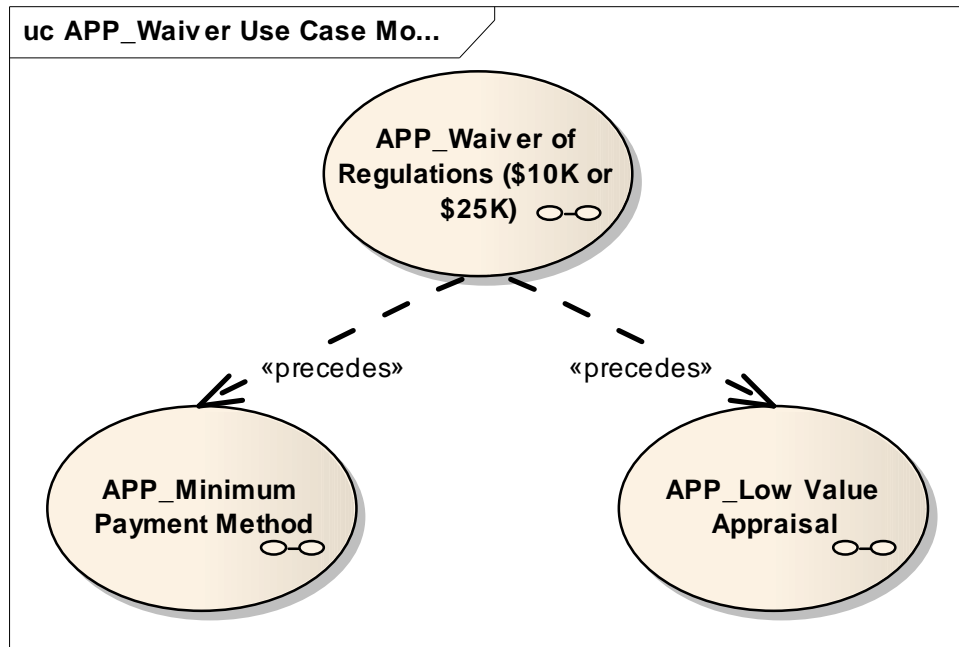
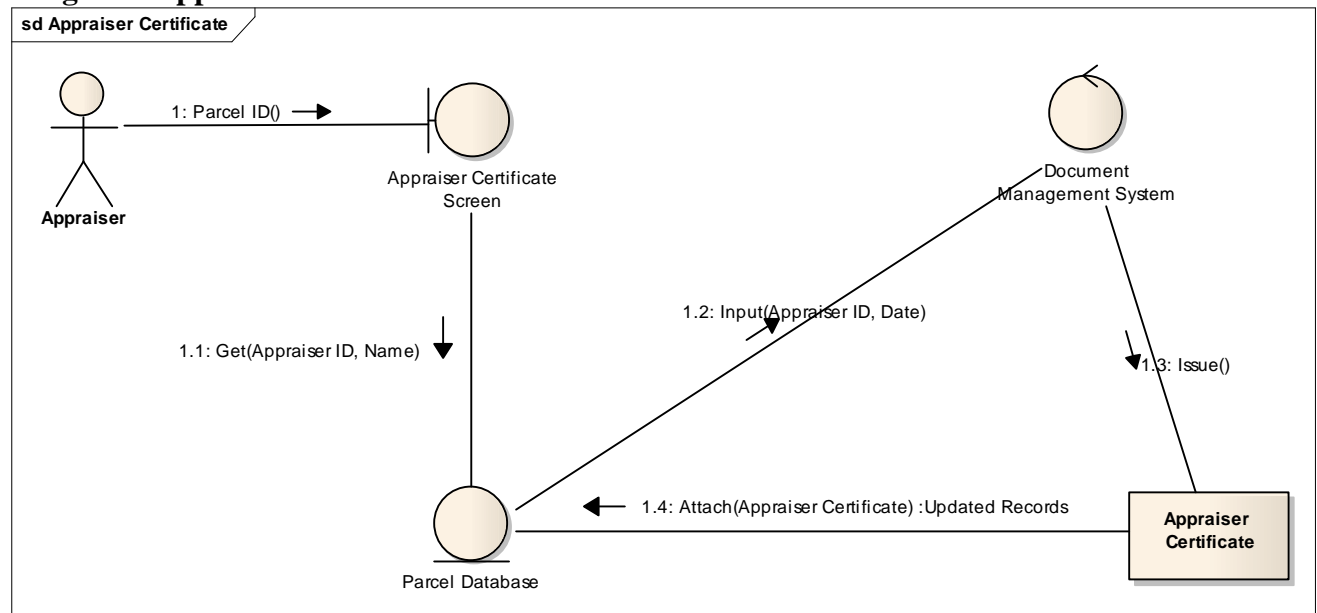
Diagram: APP_Waiver Use Case Model**Diagram: Appraiser Certificate**

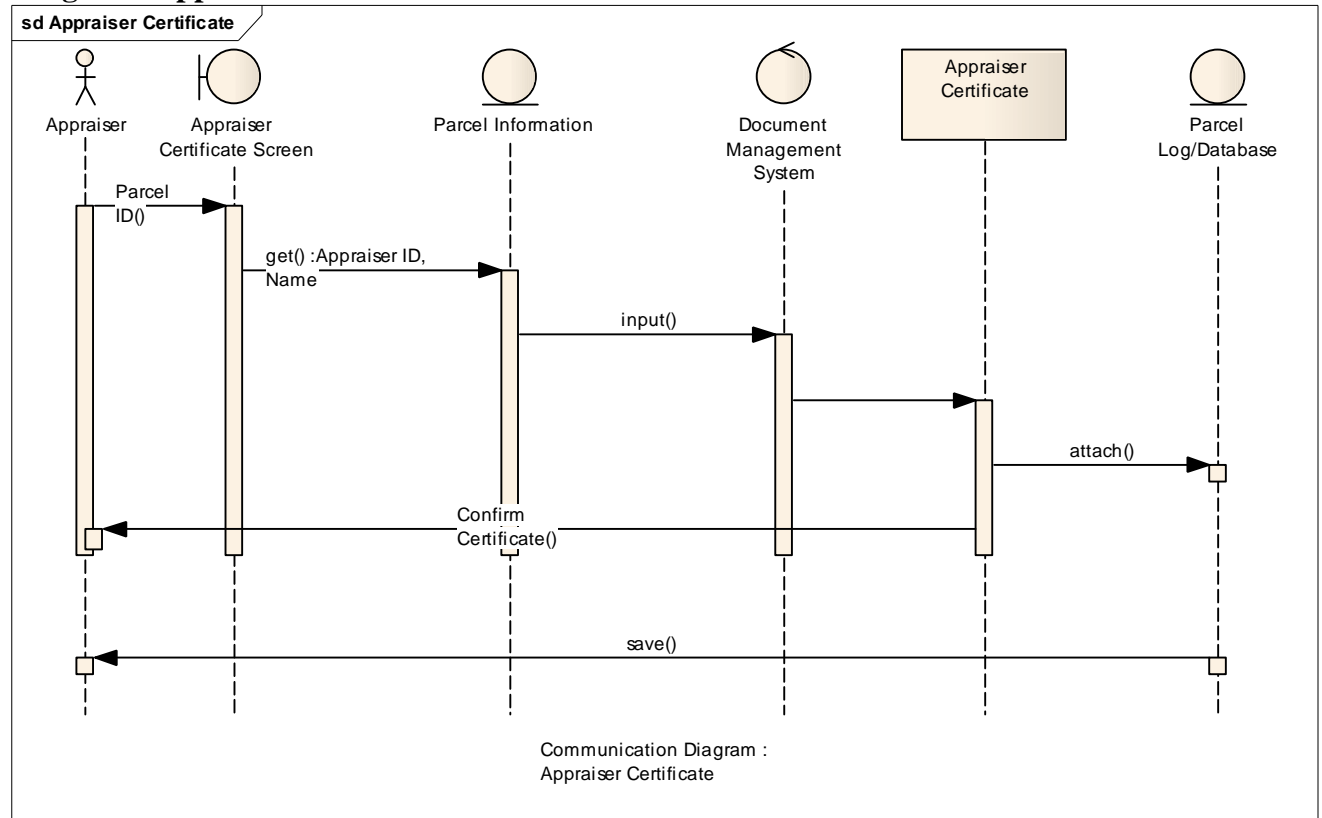
Diagram: Appraiser Certificate

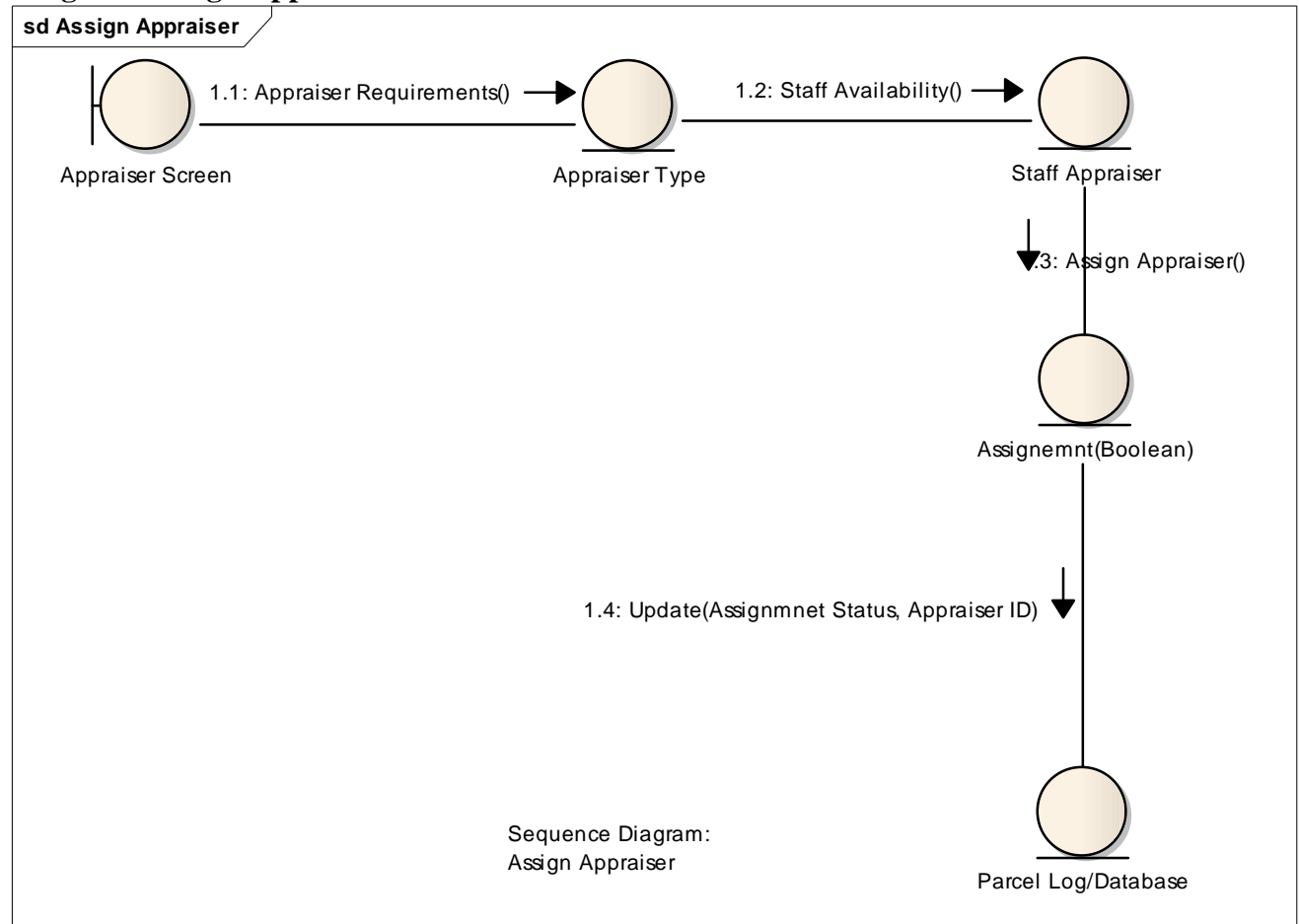
Diagram: Assign Appraiser

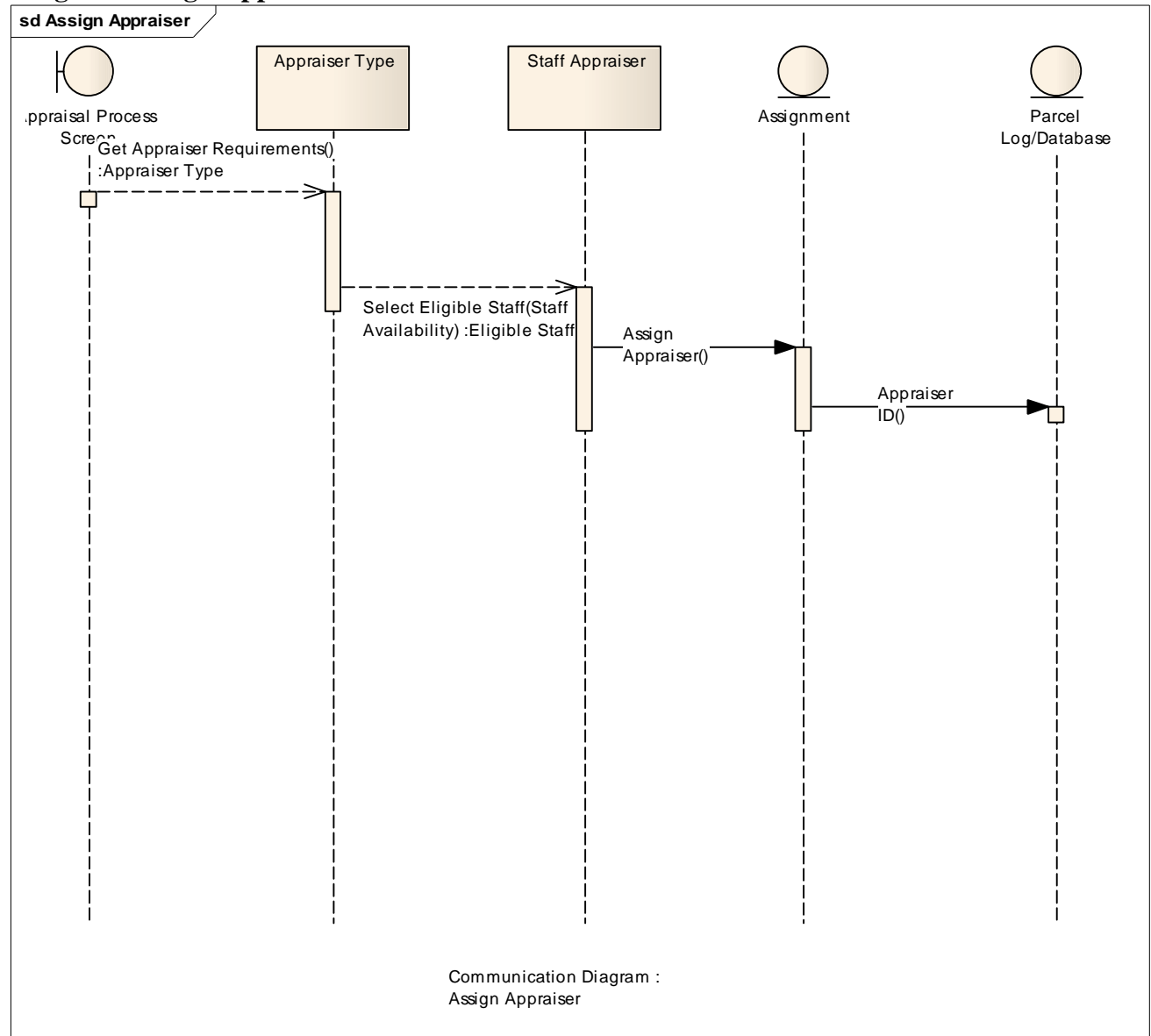
Diagram: Assign Appraiser

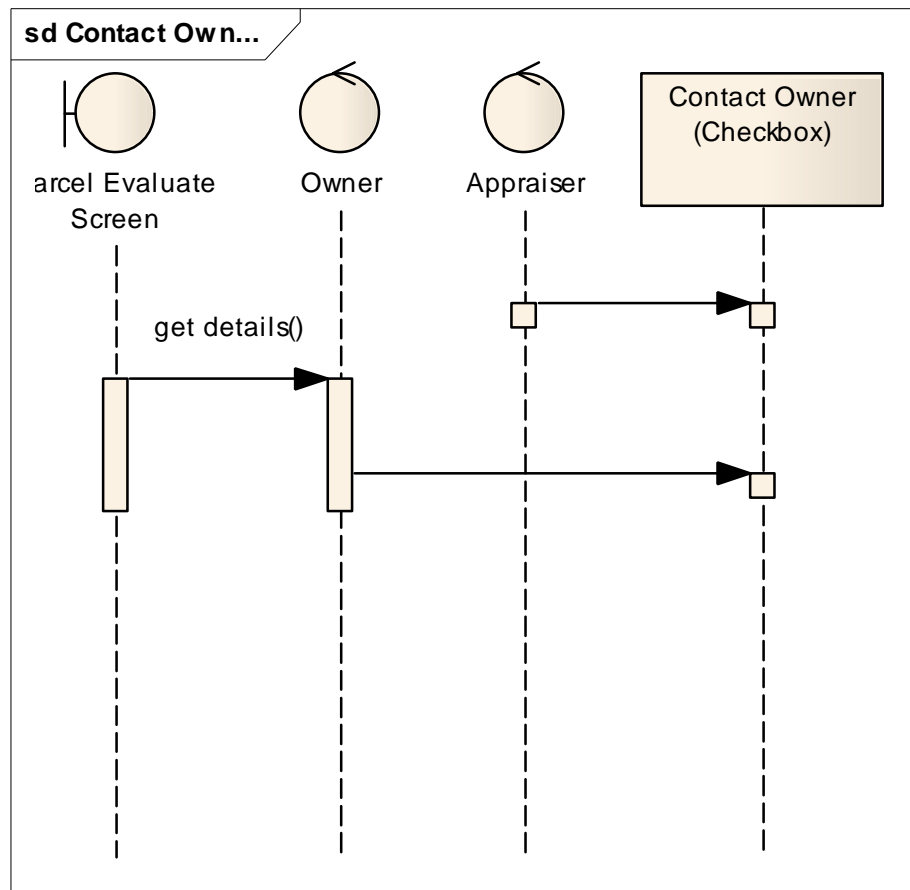
Diagram: Contact Owner

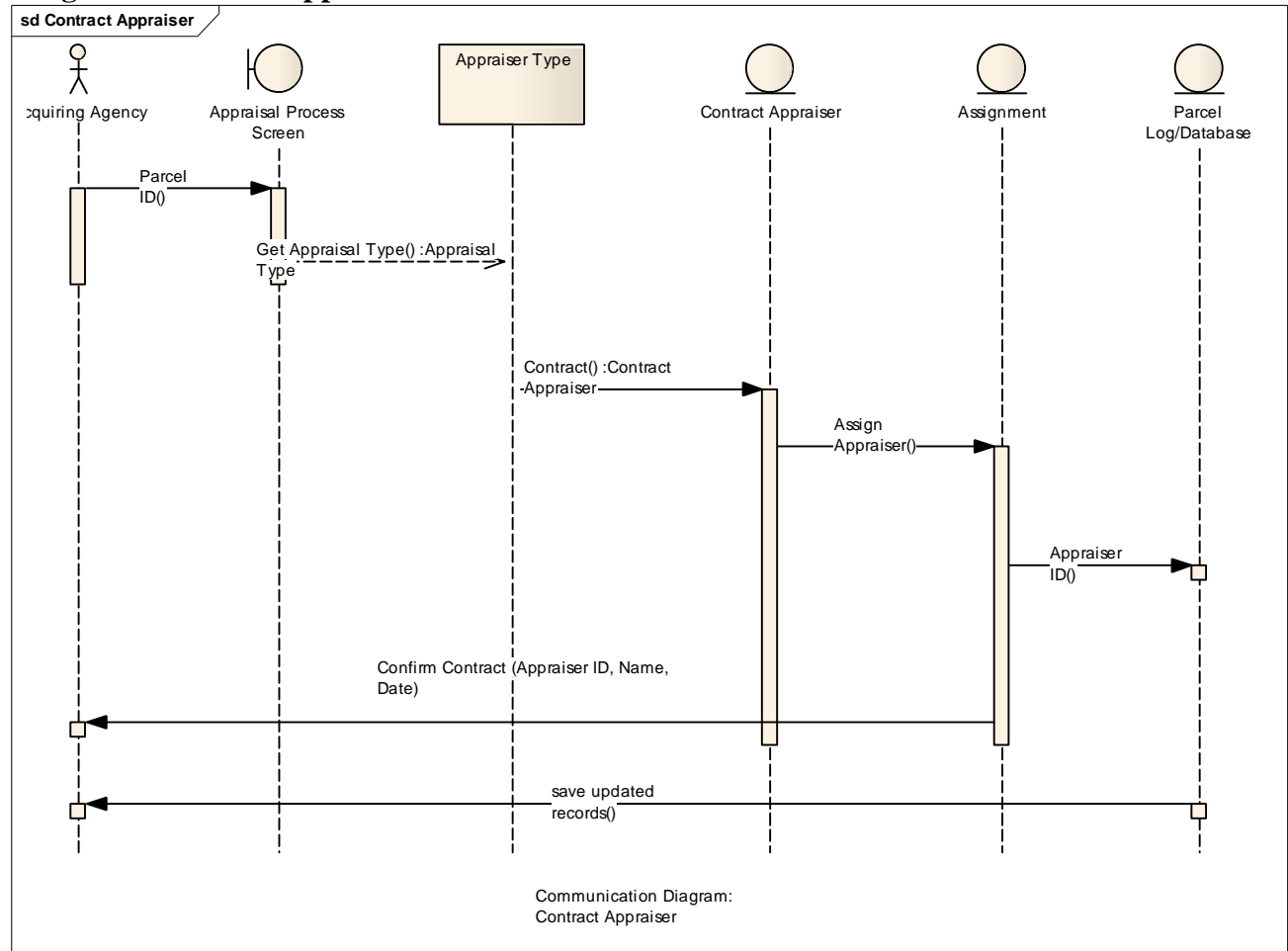
Diagram: Contract Appraiser

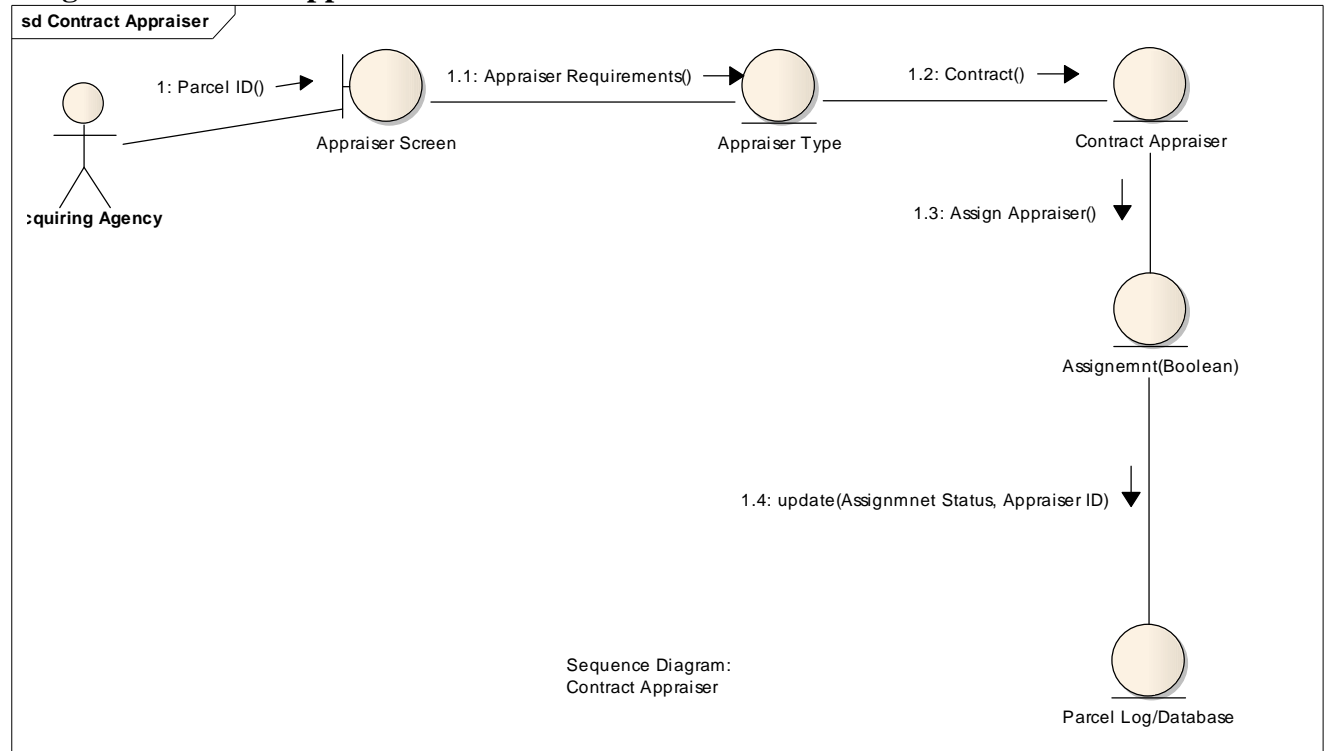
Diagram: Contract Appraiser

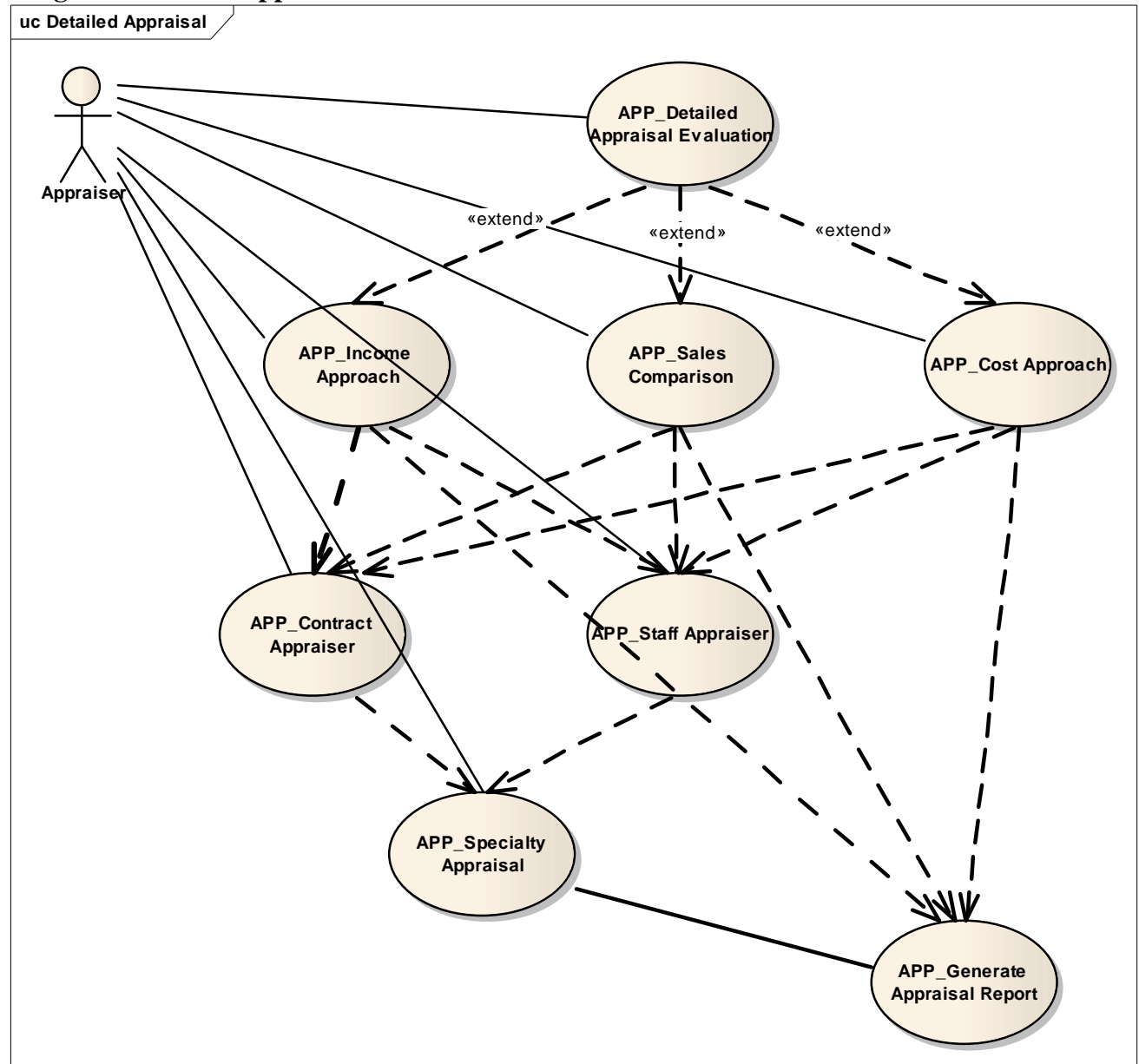
Diagram: Detailed Appraisal

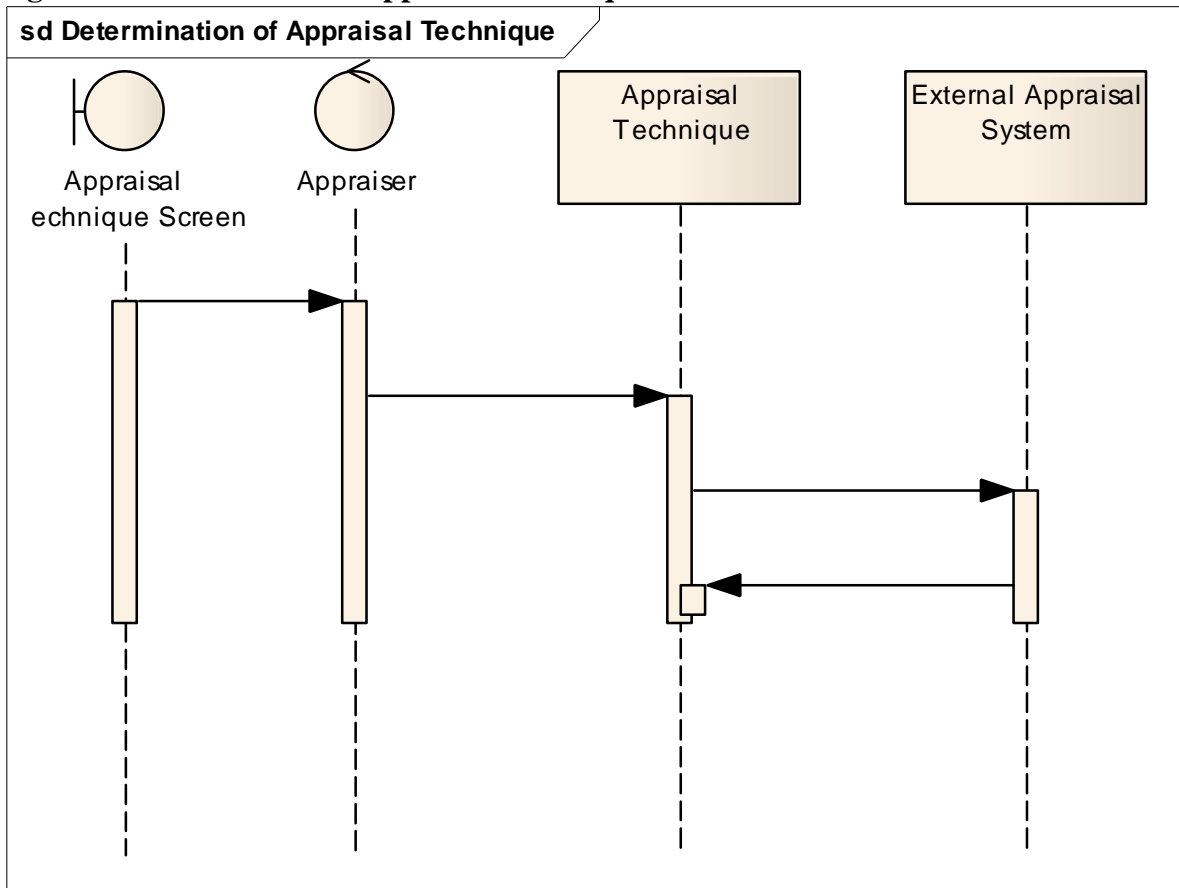
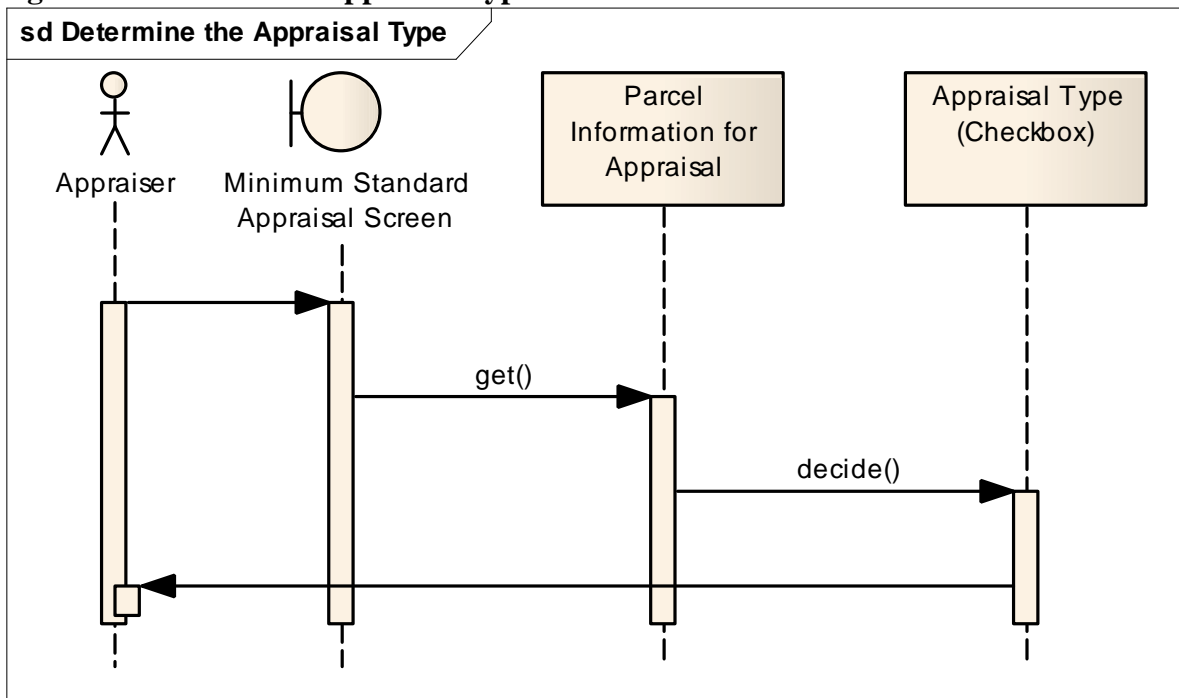
Diagram: Determination of Appraisal Technique**Diagram: Determine the Appraisal Type**

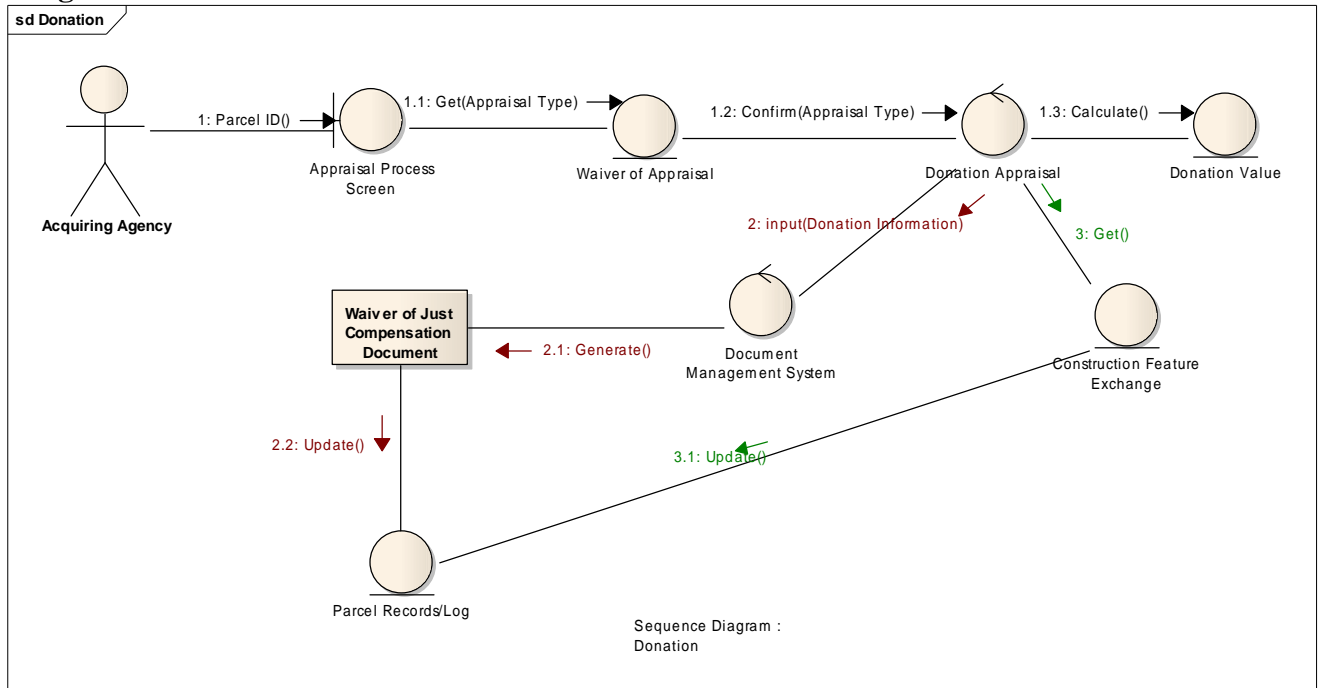
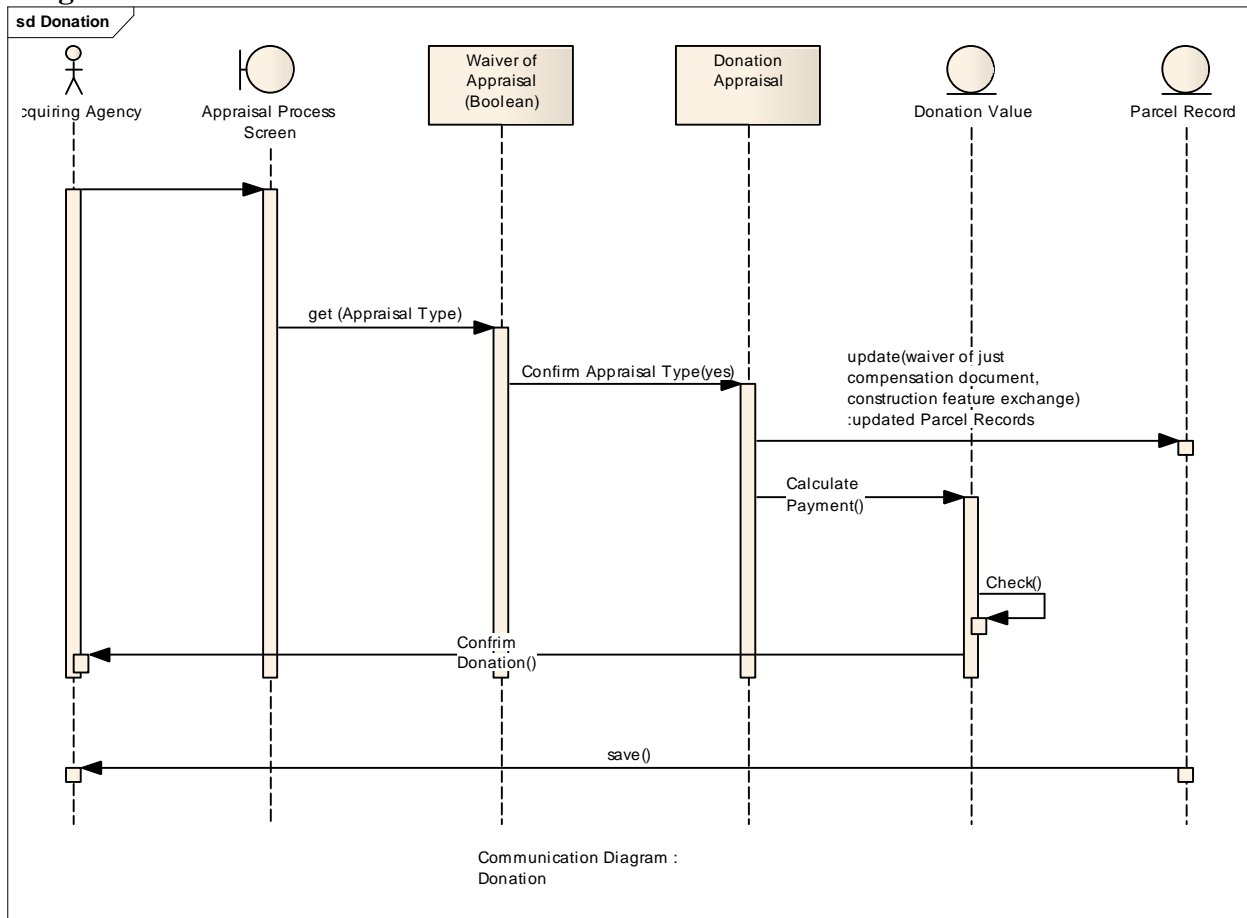
Diagram: Donation**Diagram: Donation**

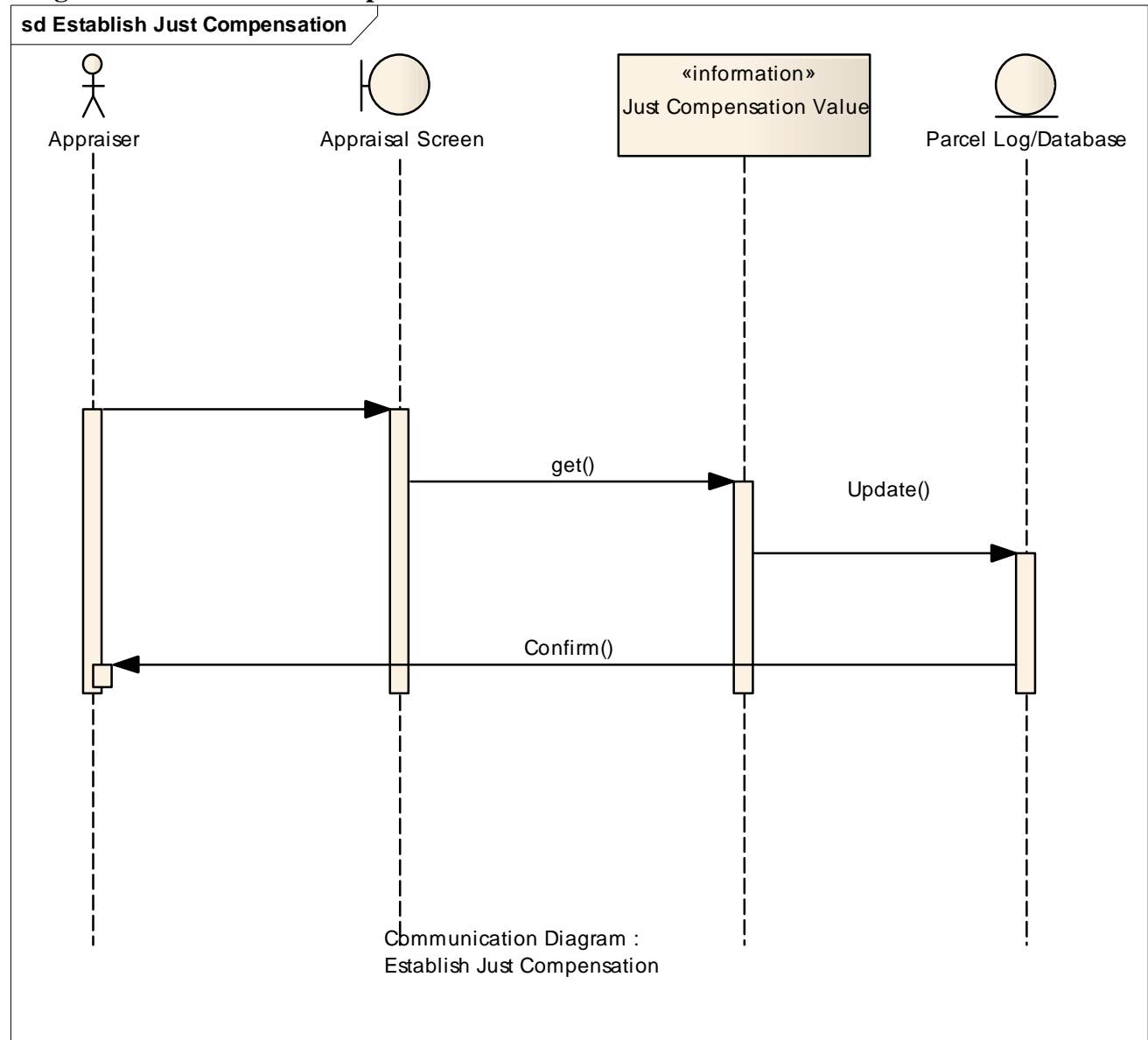
Diagram: Establish Just Compensation

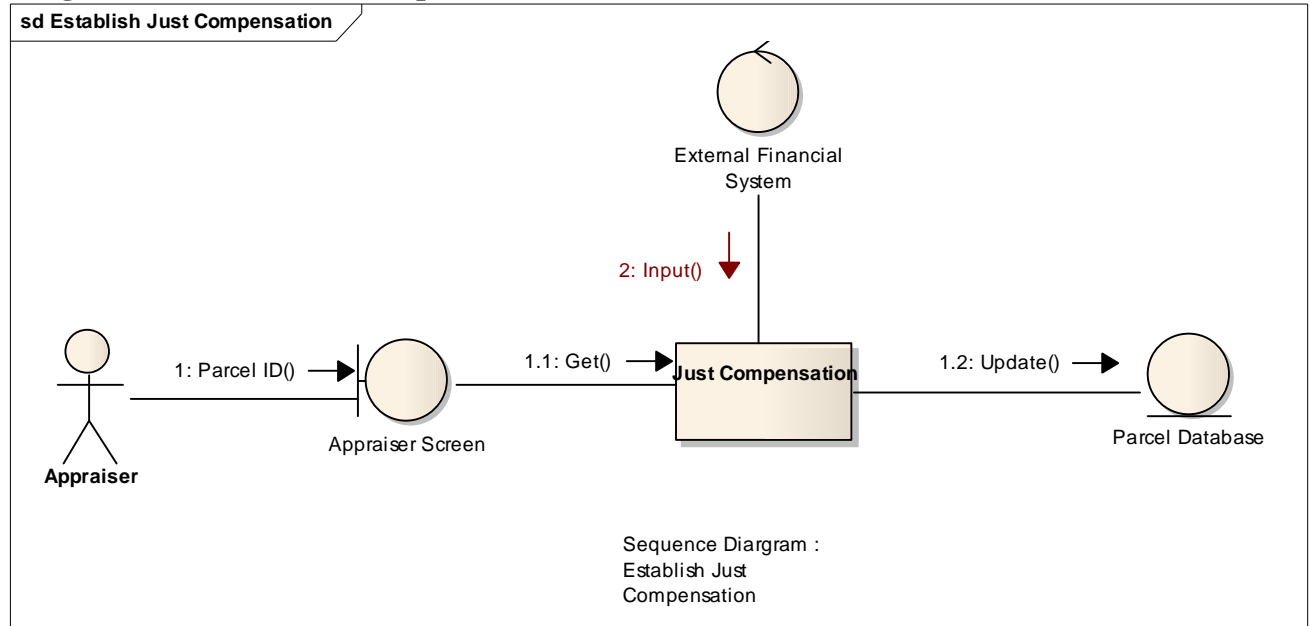
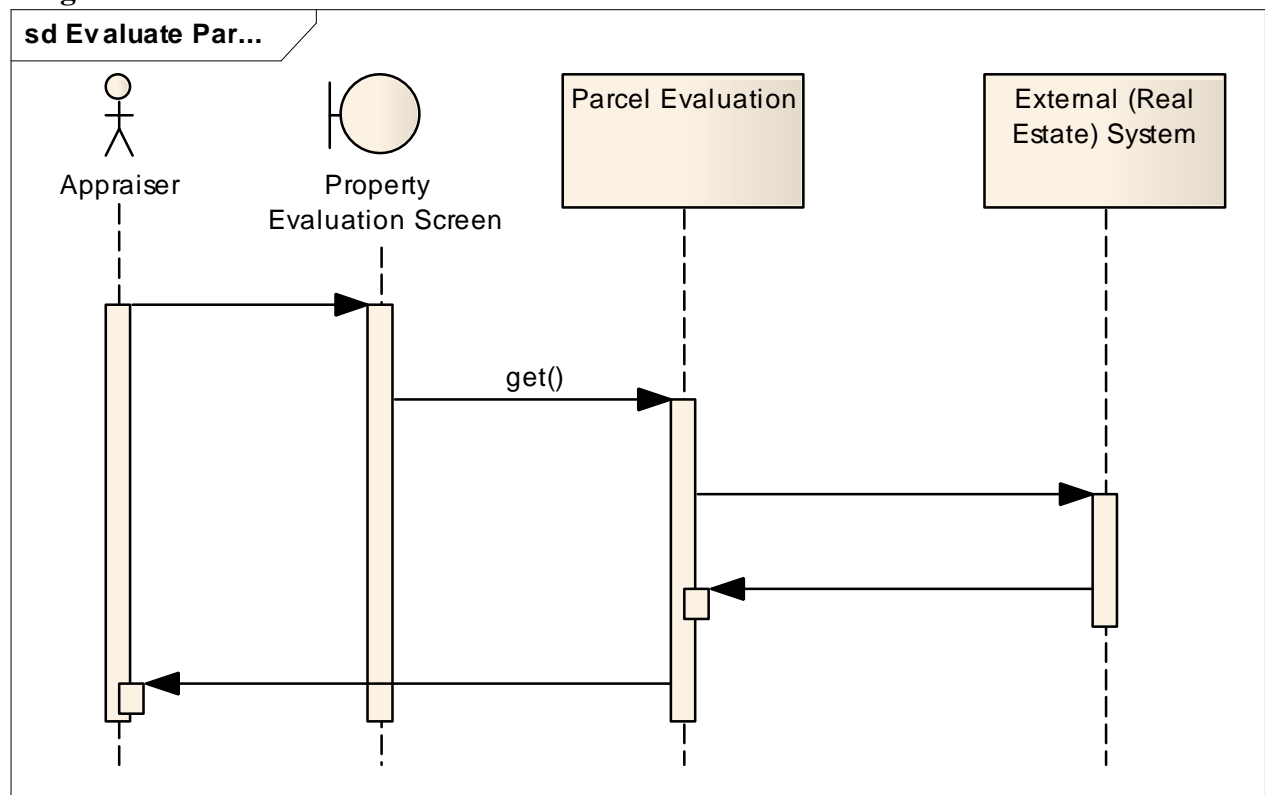
Diagram: Establish Just Compensation**Diagram: Evaluate Parcel**

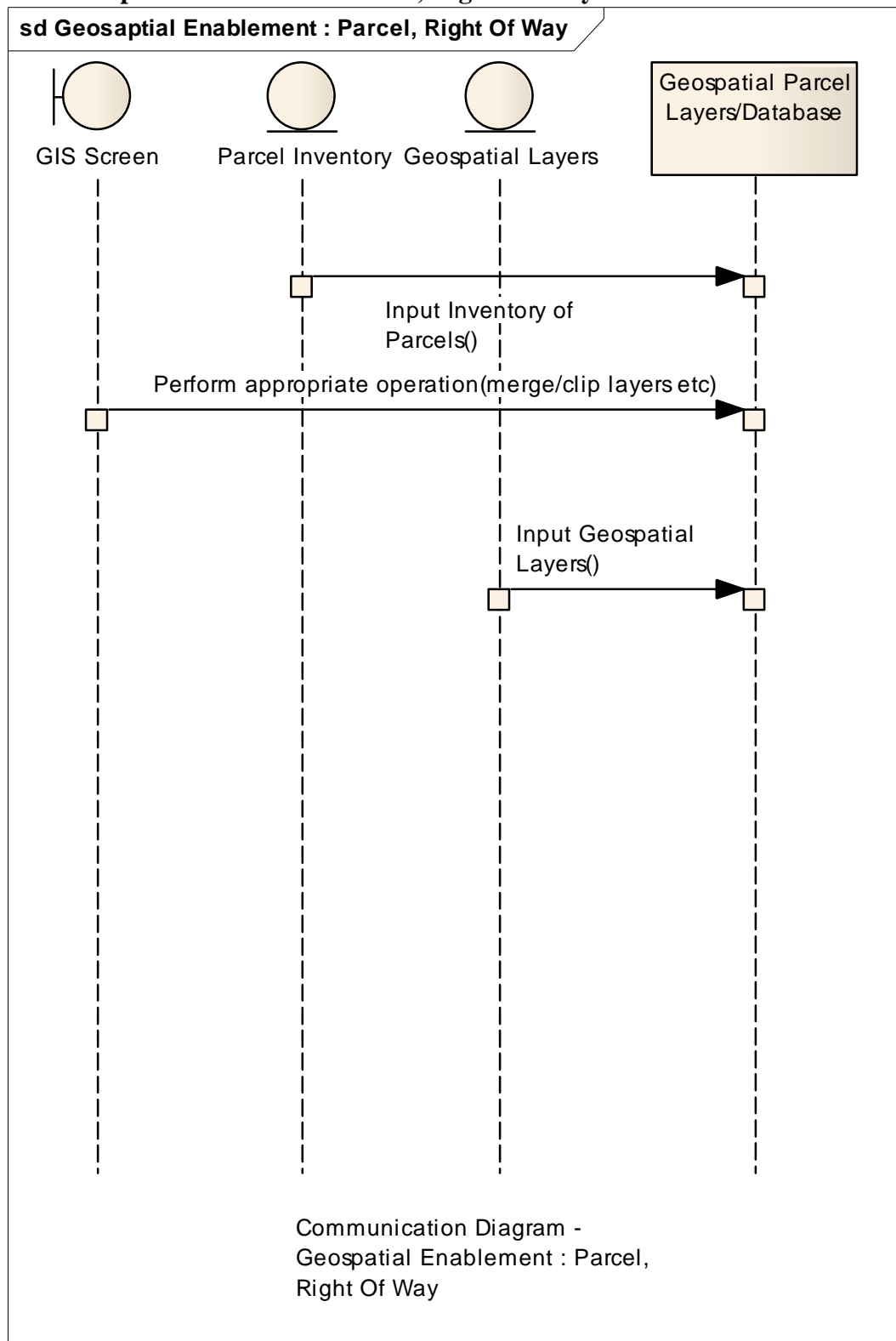
Diagram: Geospatial Enablement : Parcel, Right Of Way

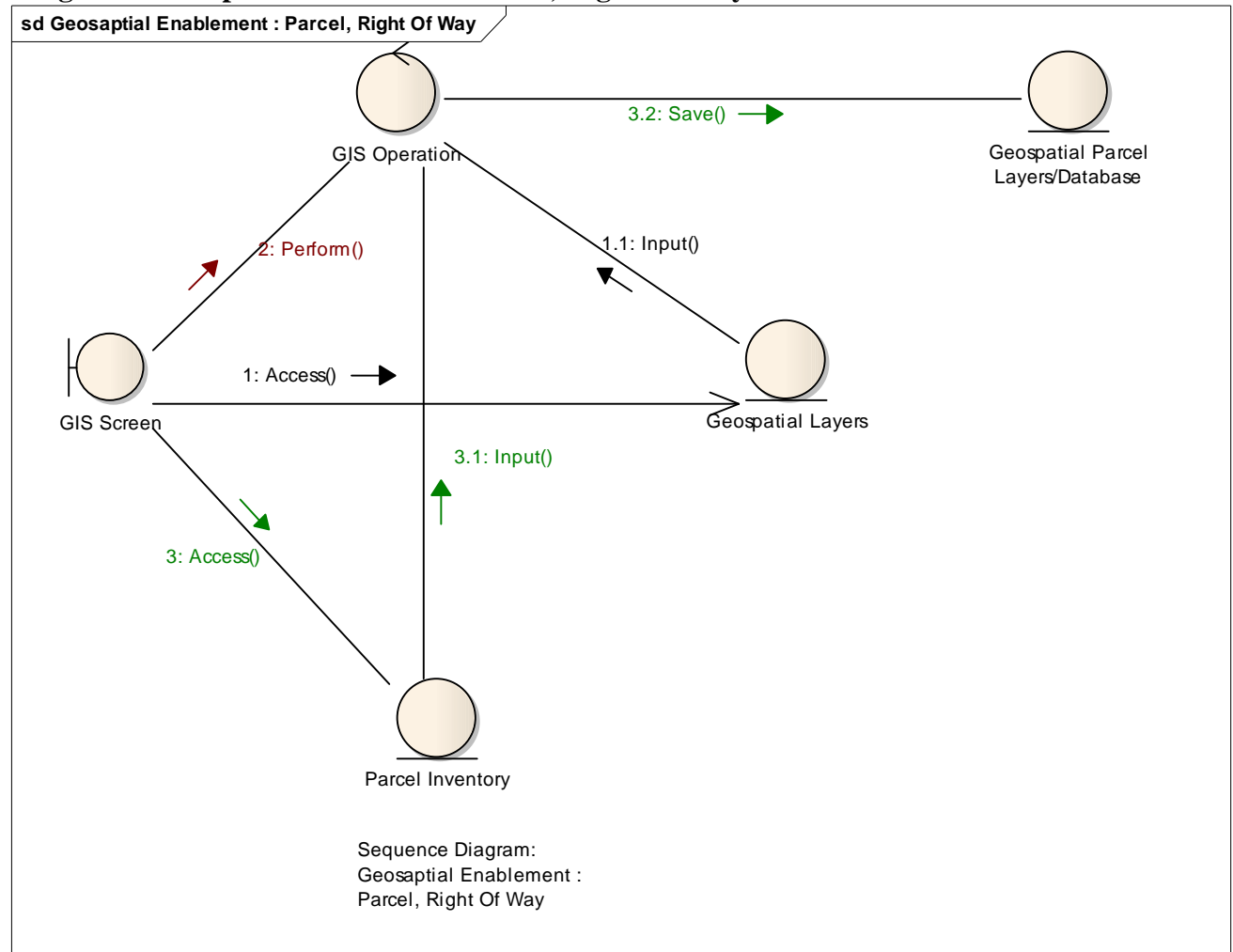
Diagram: Geospatial Enablement : Parcel, Right Of Way

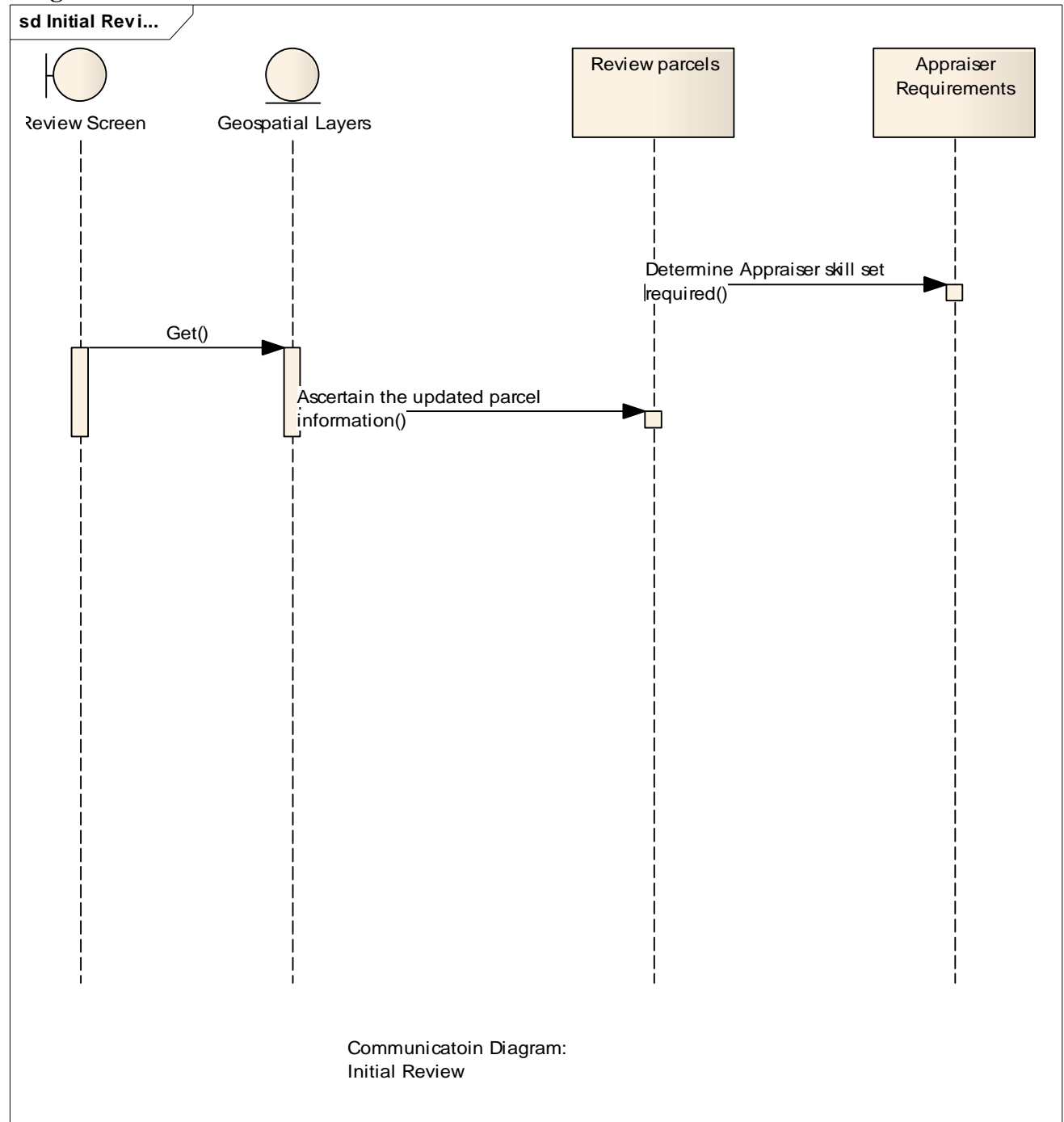
Diagram: Initial Review

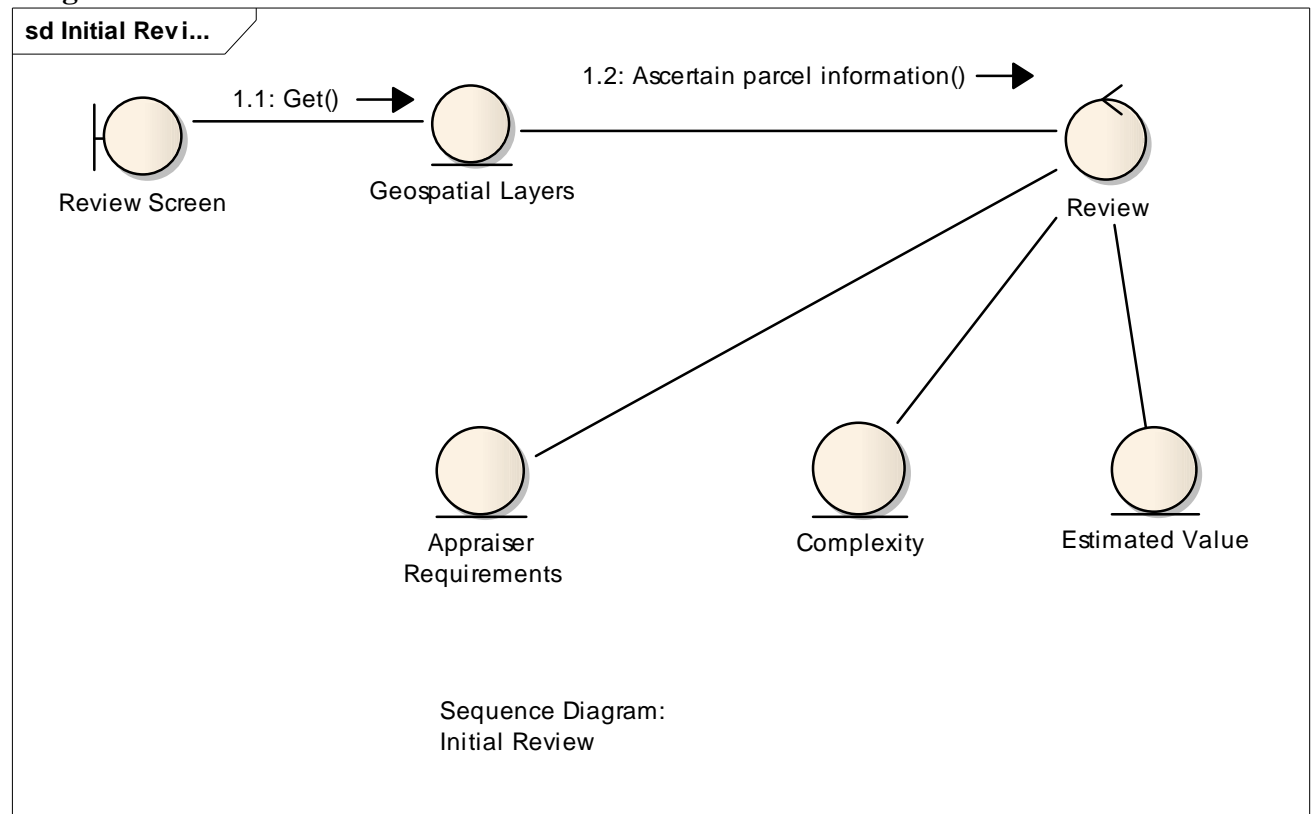
Diagram: Initial Review

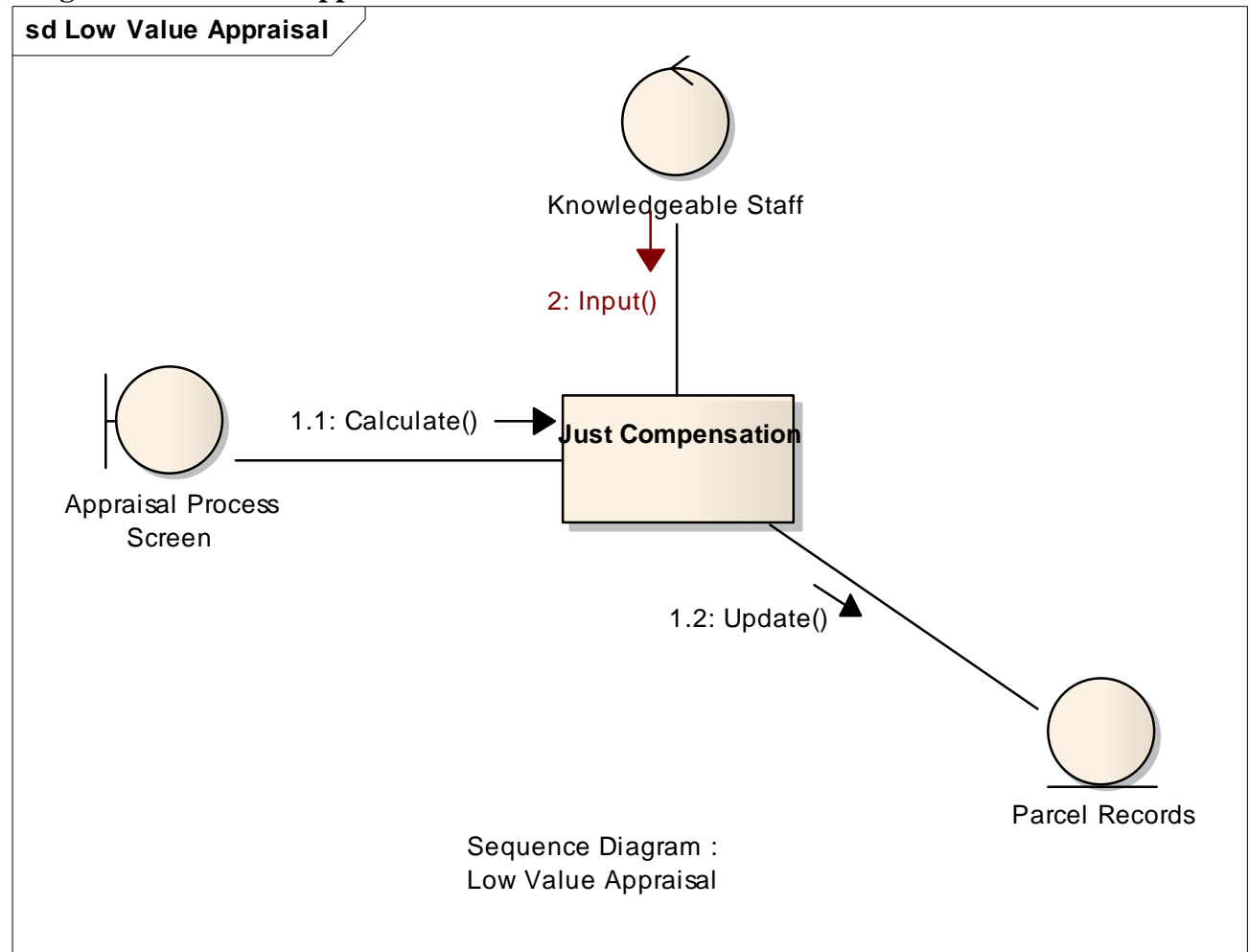
Diagram: Low Value Appraisal

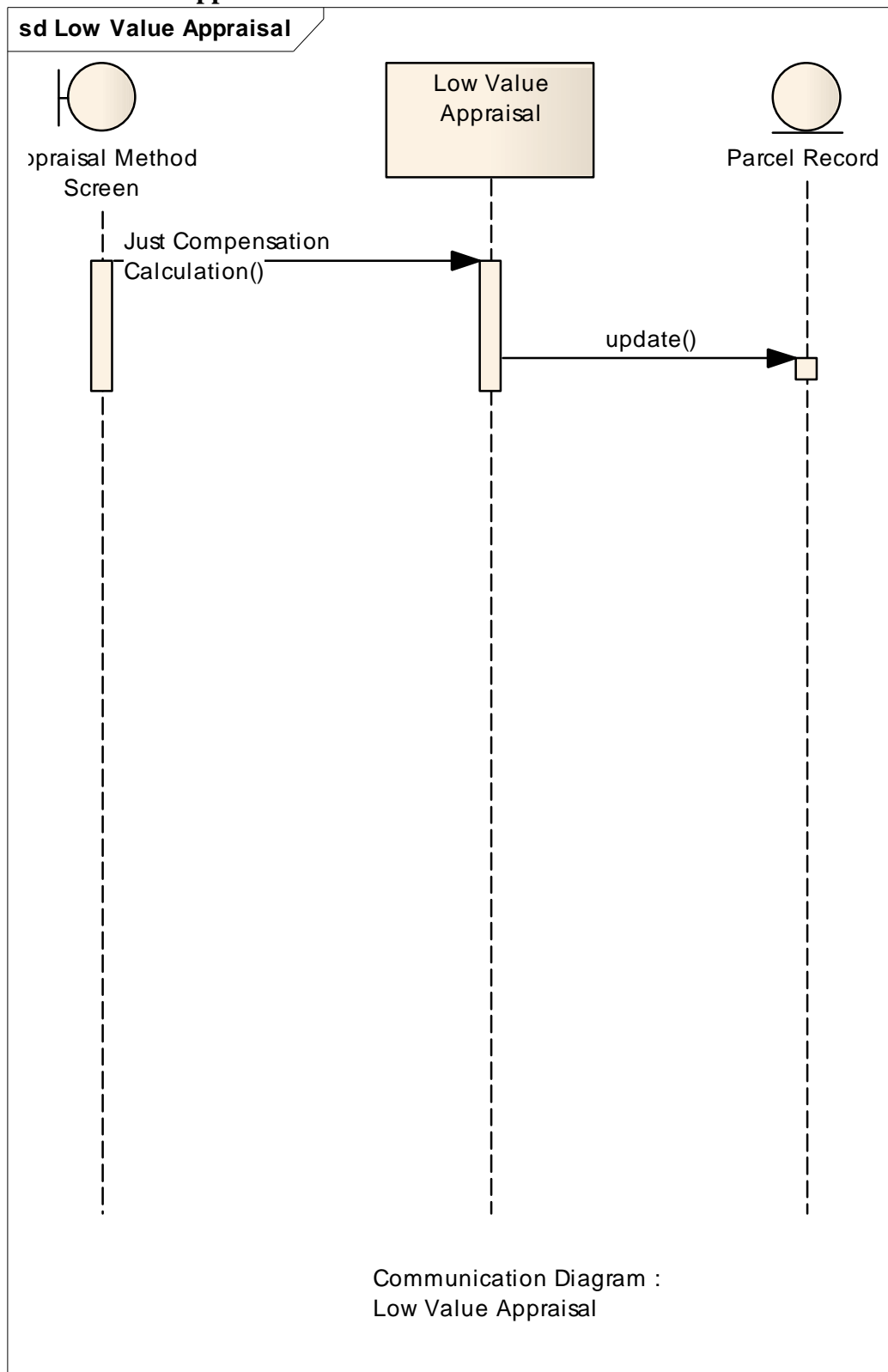
Diagram: Low Value Appraisal

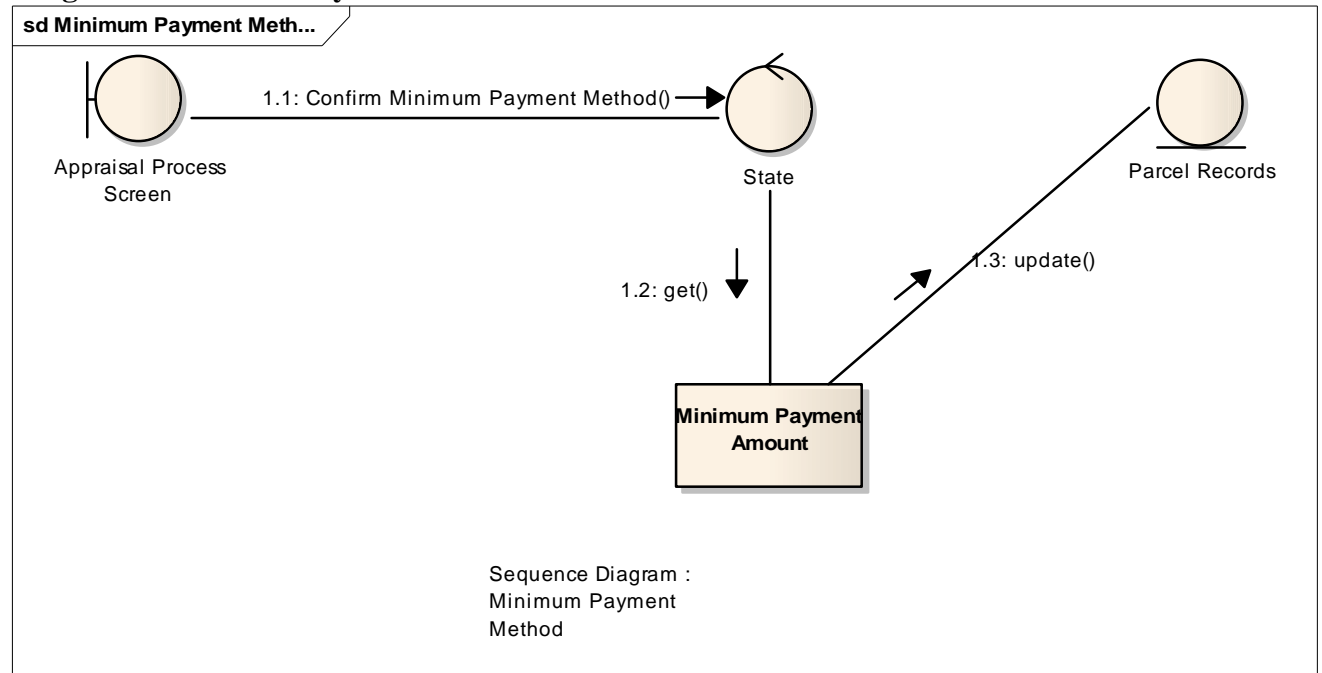
Diagram: Minimum Payment Method

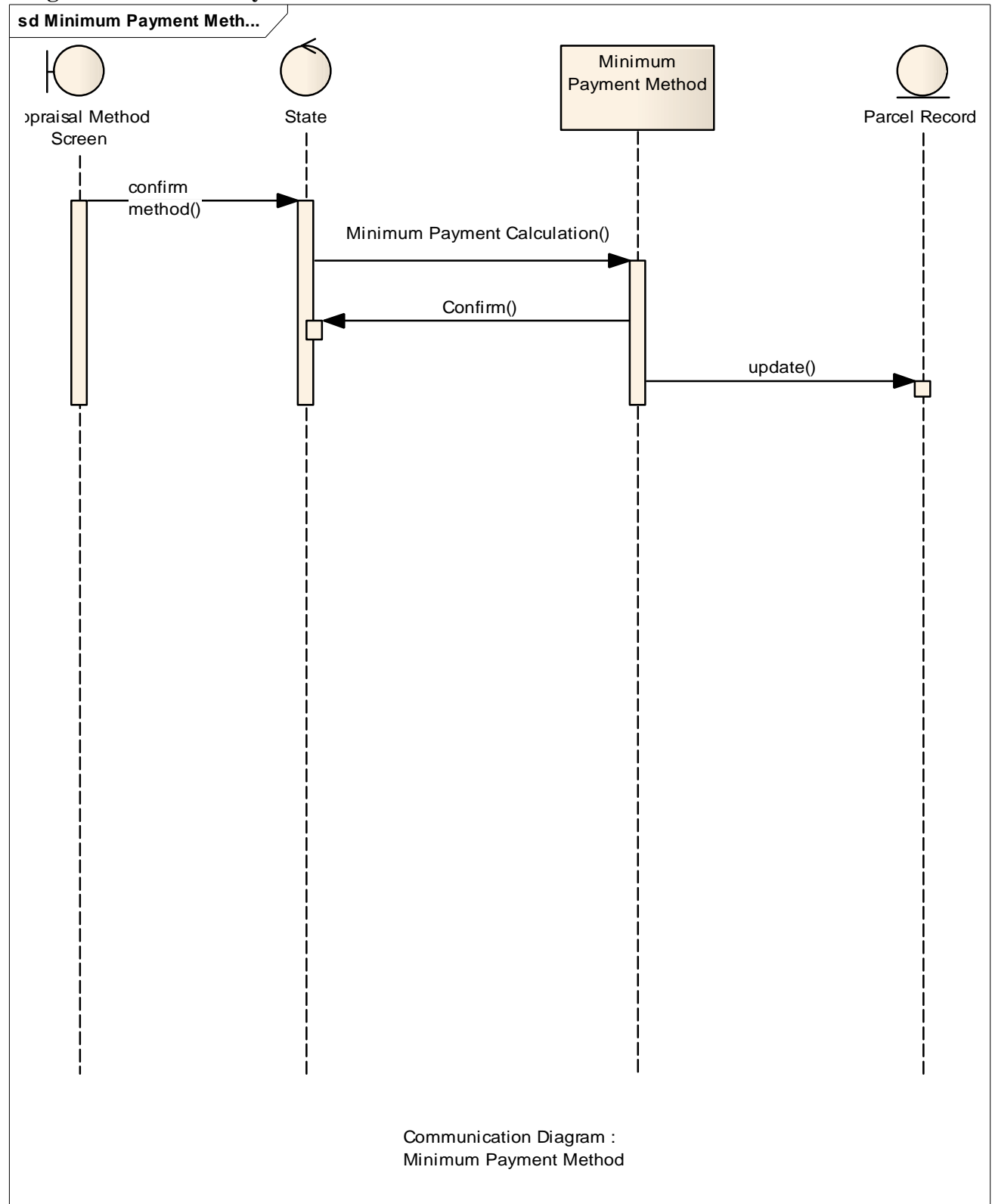
Diagram: Minimum Payment Method

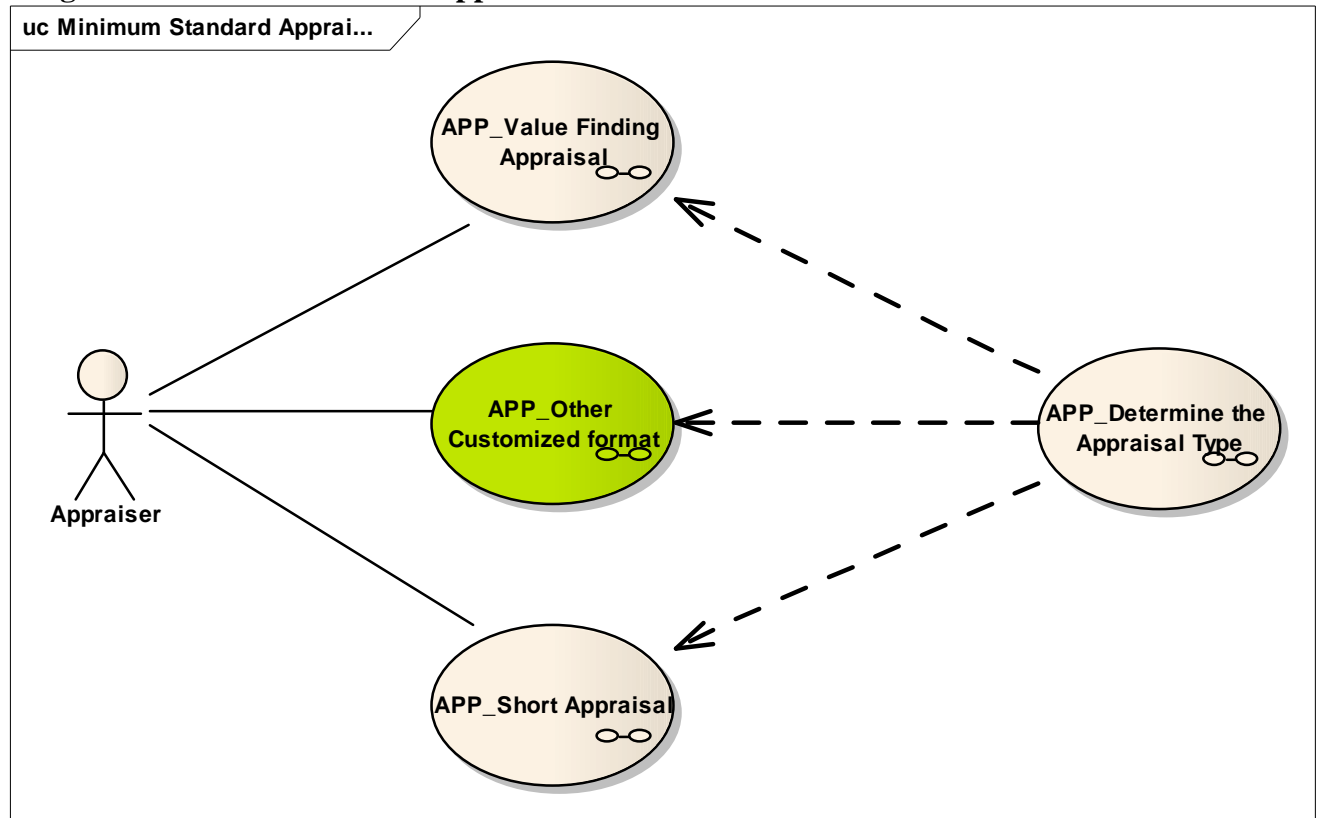
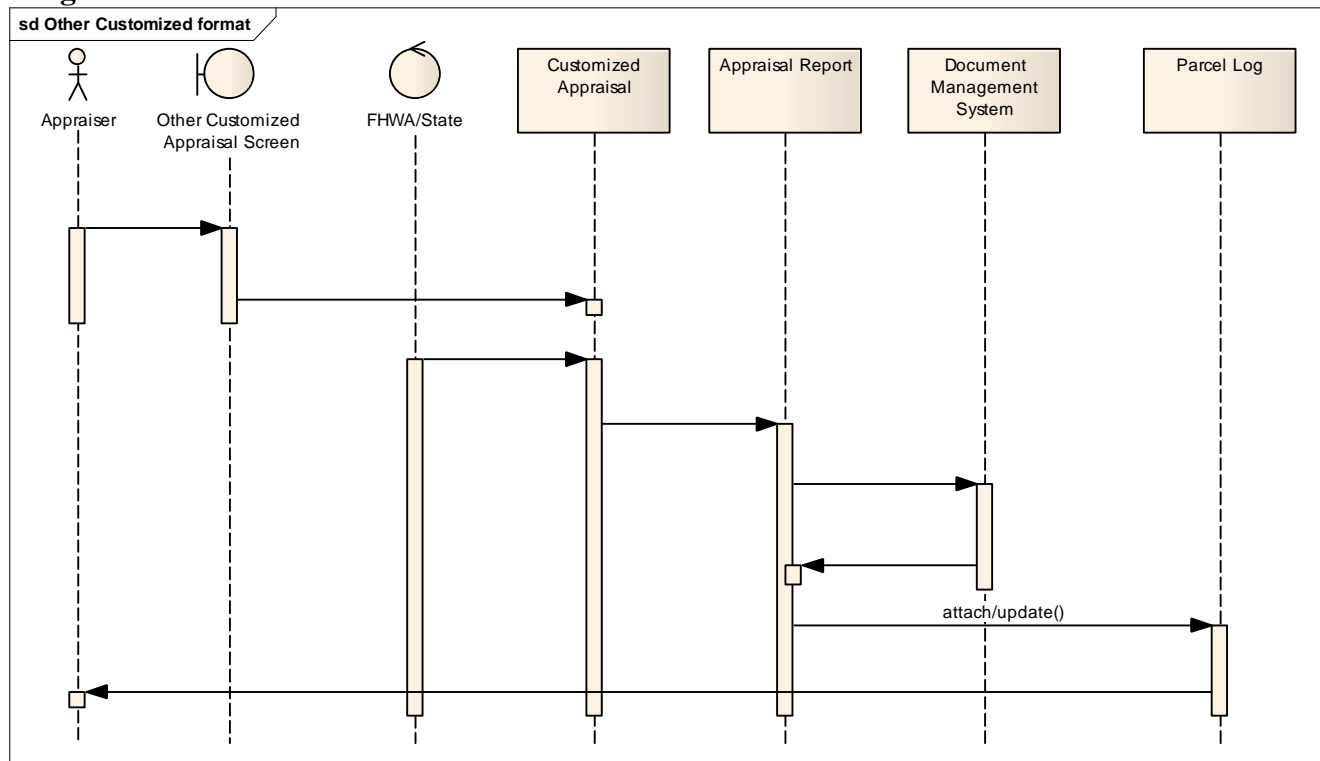
Diagram: Minimum Standard Appraisal**Diagram: Other Customized format**

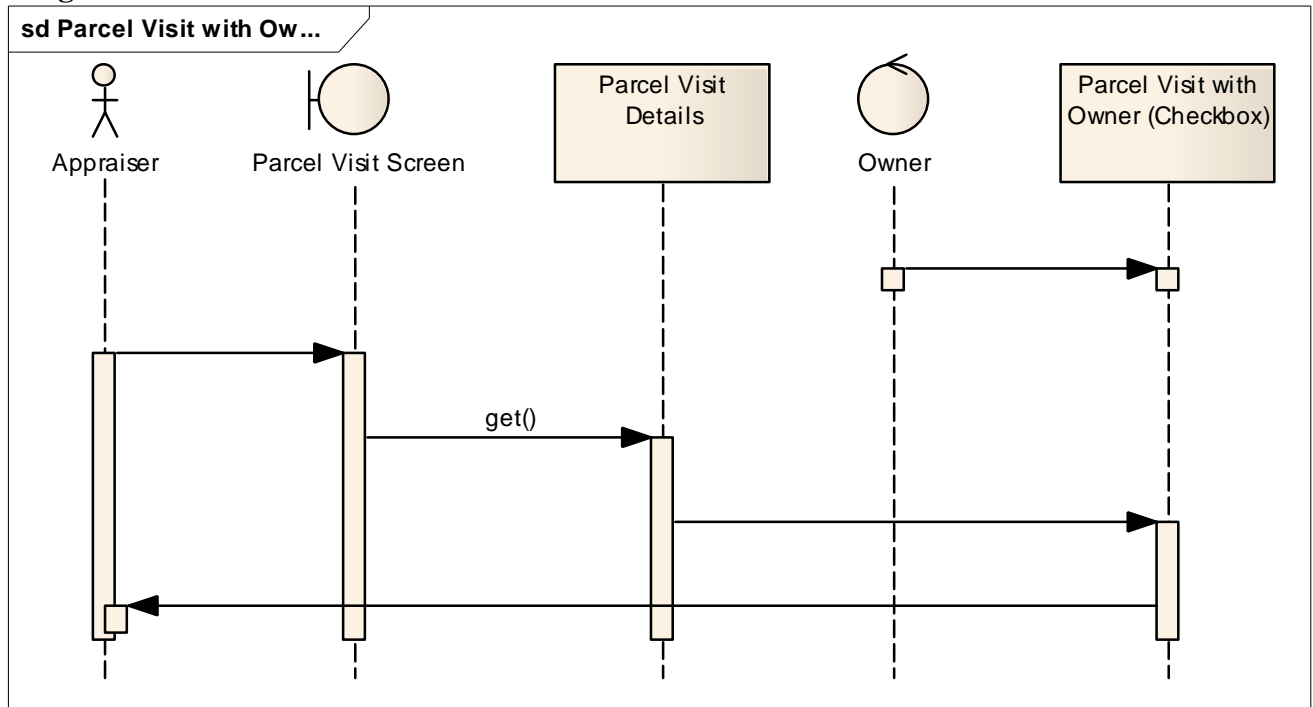
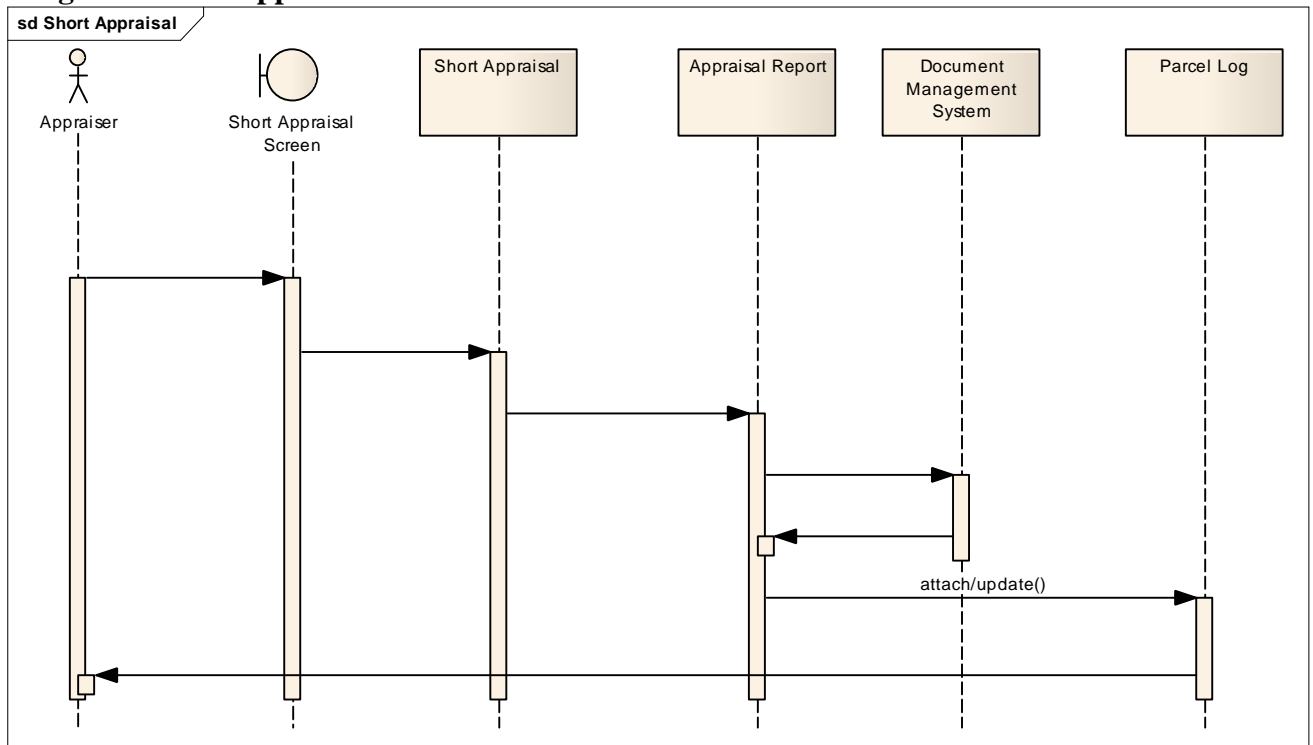
Diagram: Parcel Visit with Owner**Diagram: Short Appraisal**

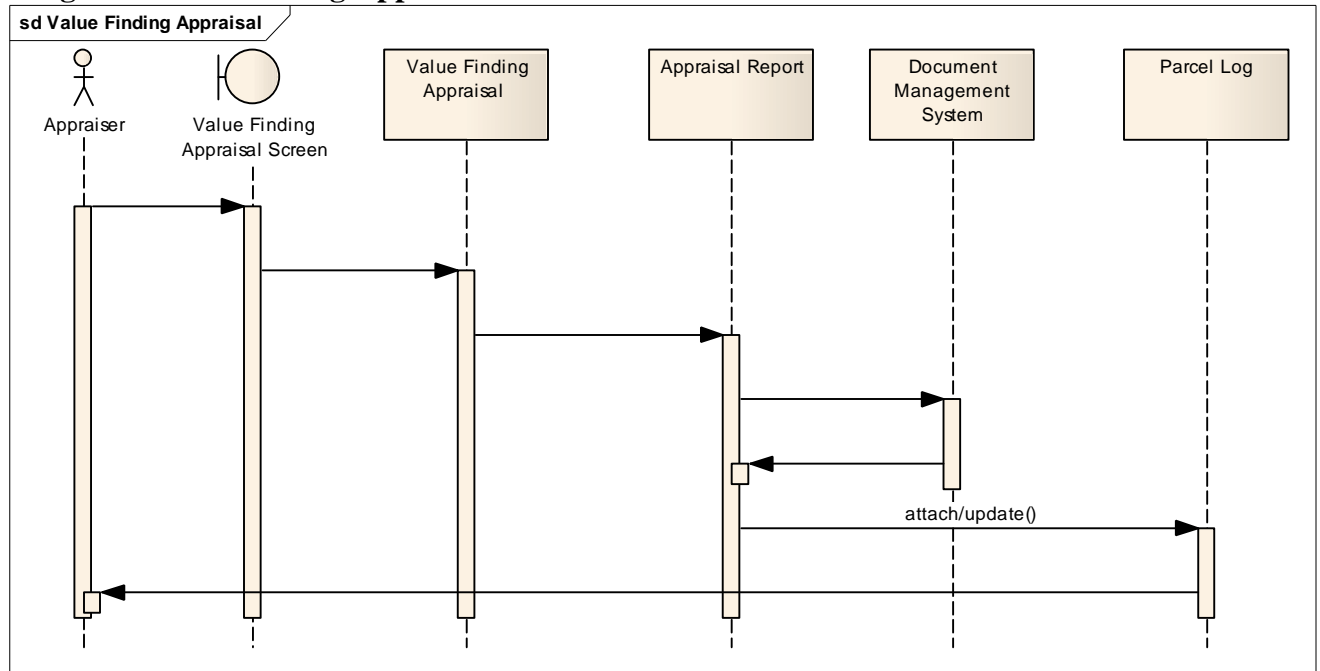
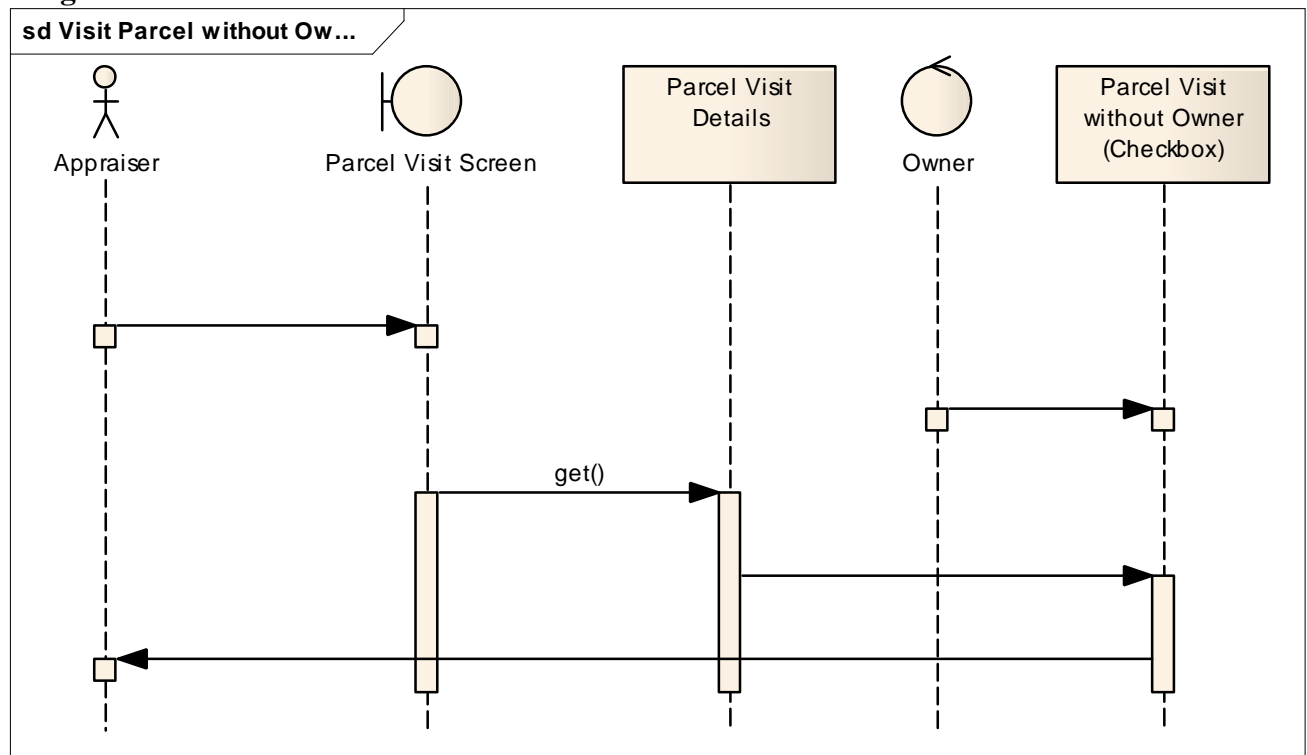
Diagram: Value Finding Appraisal**Diagram: Visit Parcel without Owner**

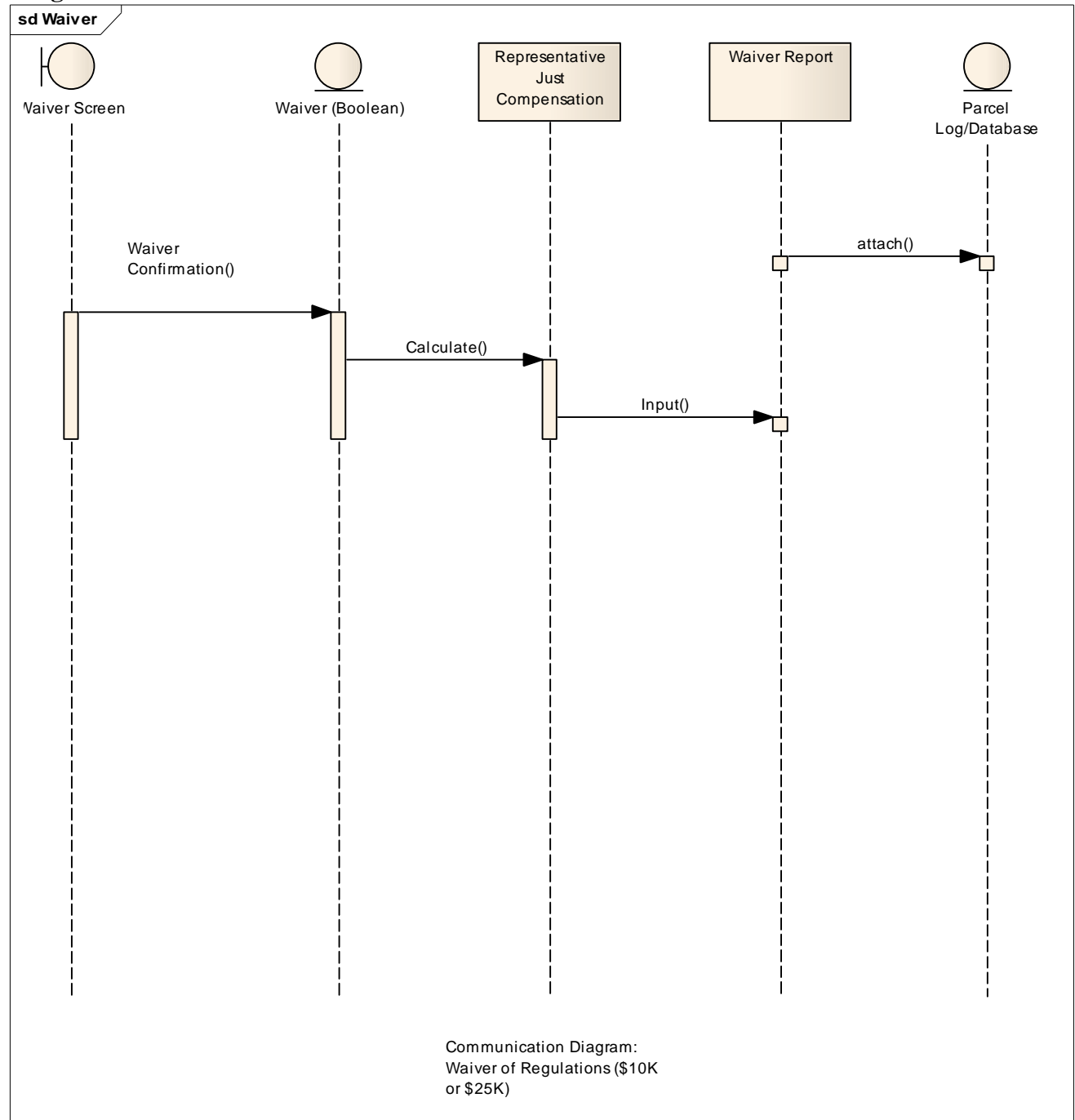
Diagram: Waiver

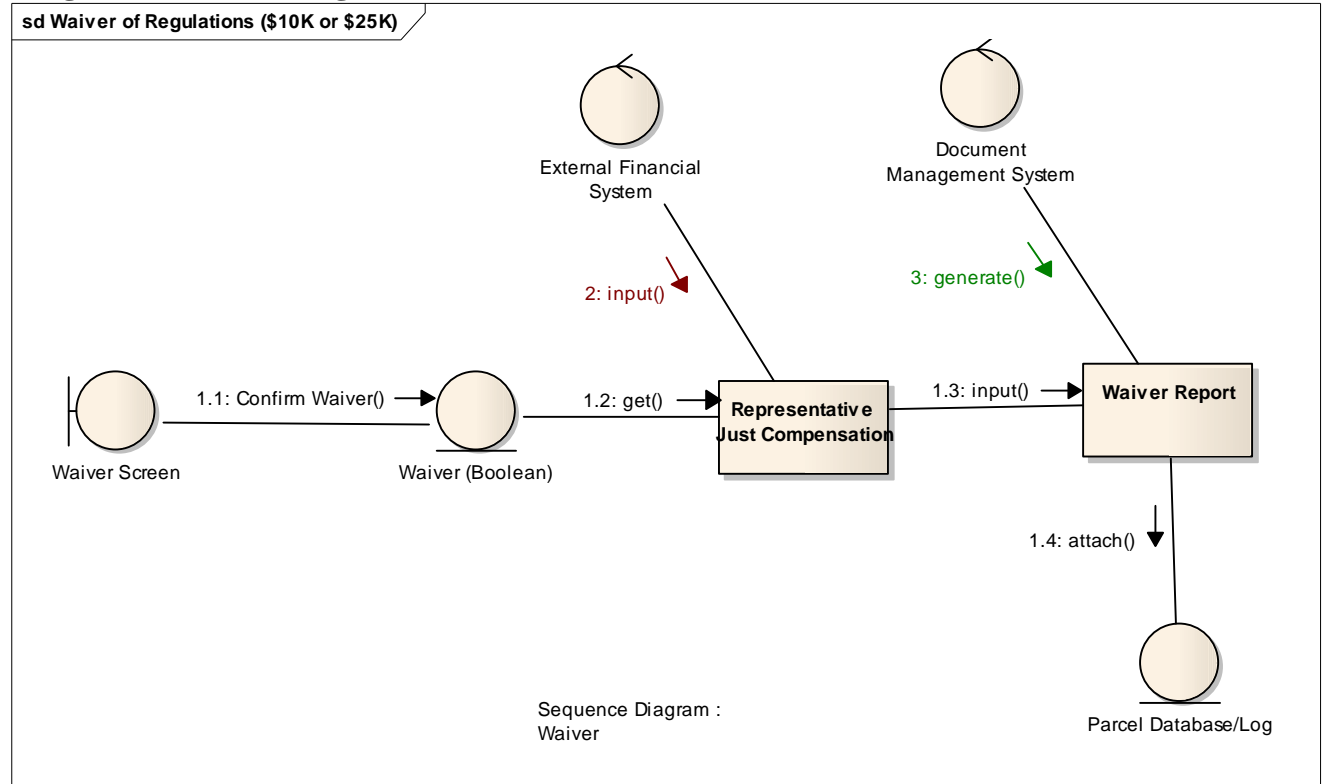
Diagram: Waiver of Regulations (\$10K or \$25K)

Diagram: APP_Appraisal

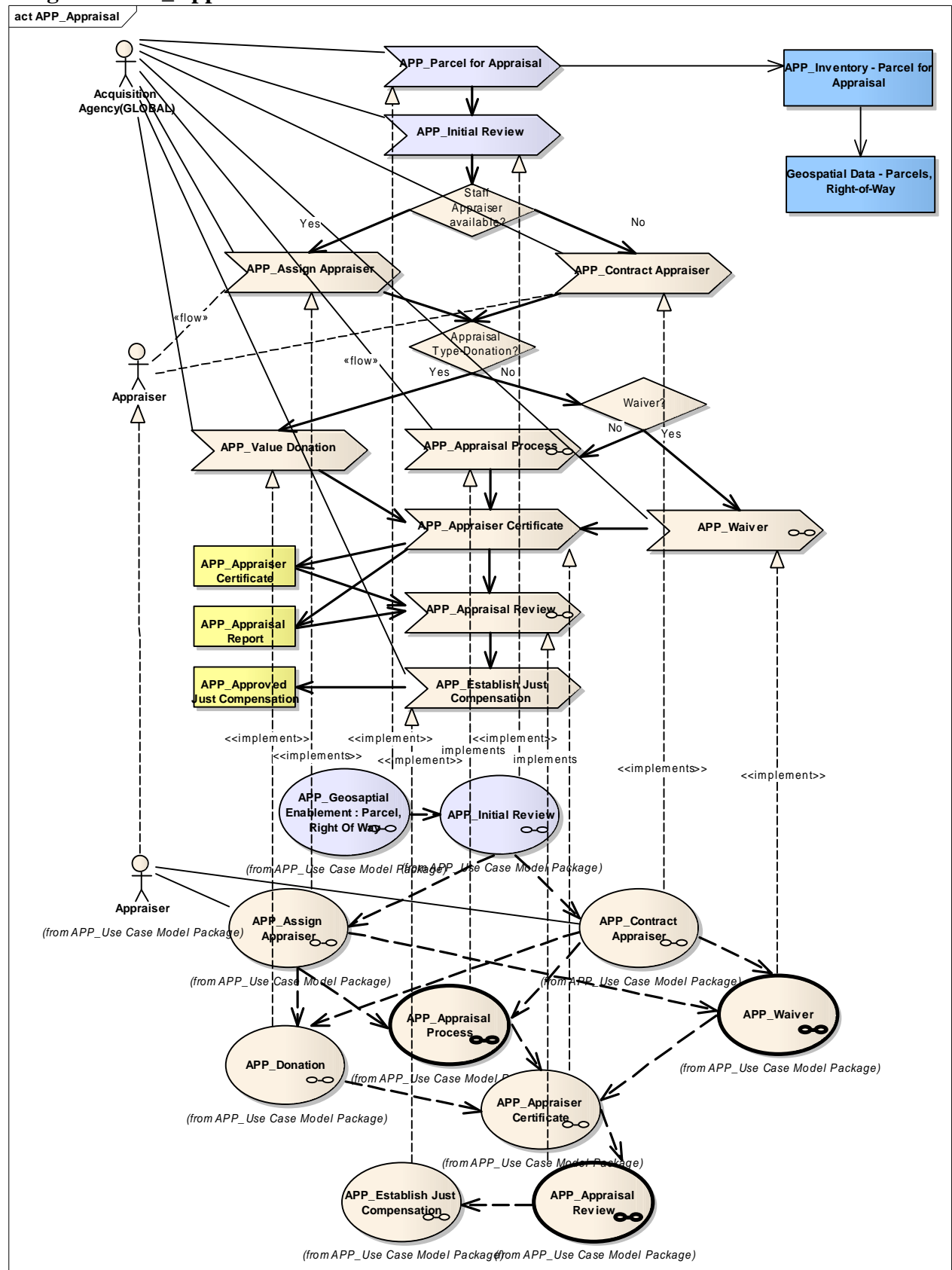


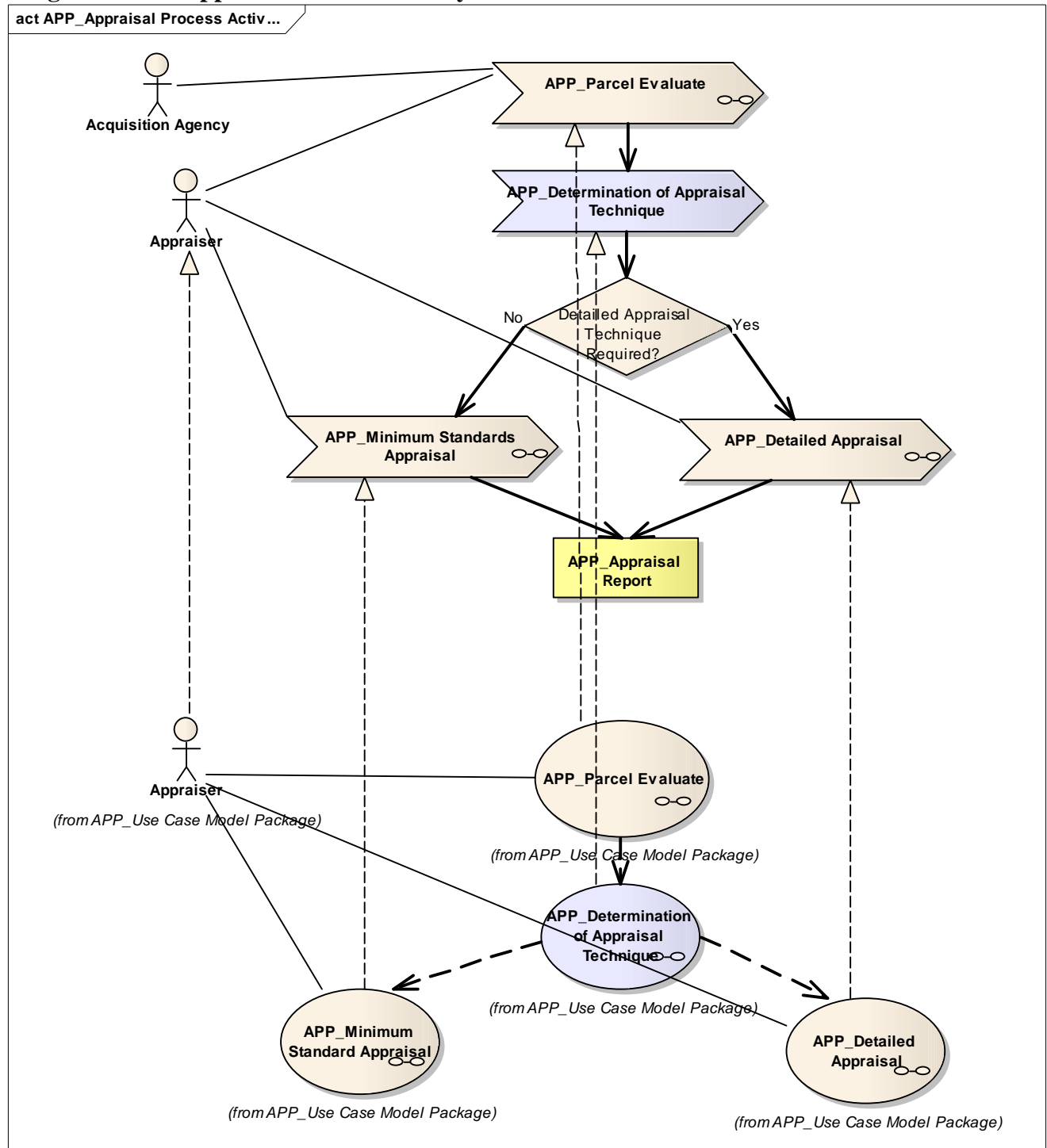
Diagram: APP_Appraisal Process Activity

Diagram: APP_Appraisal Review Activity

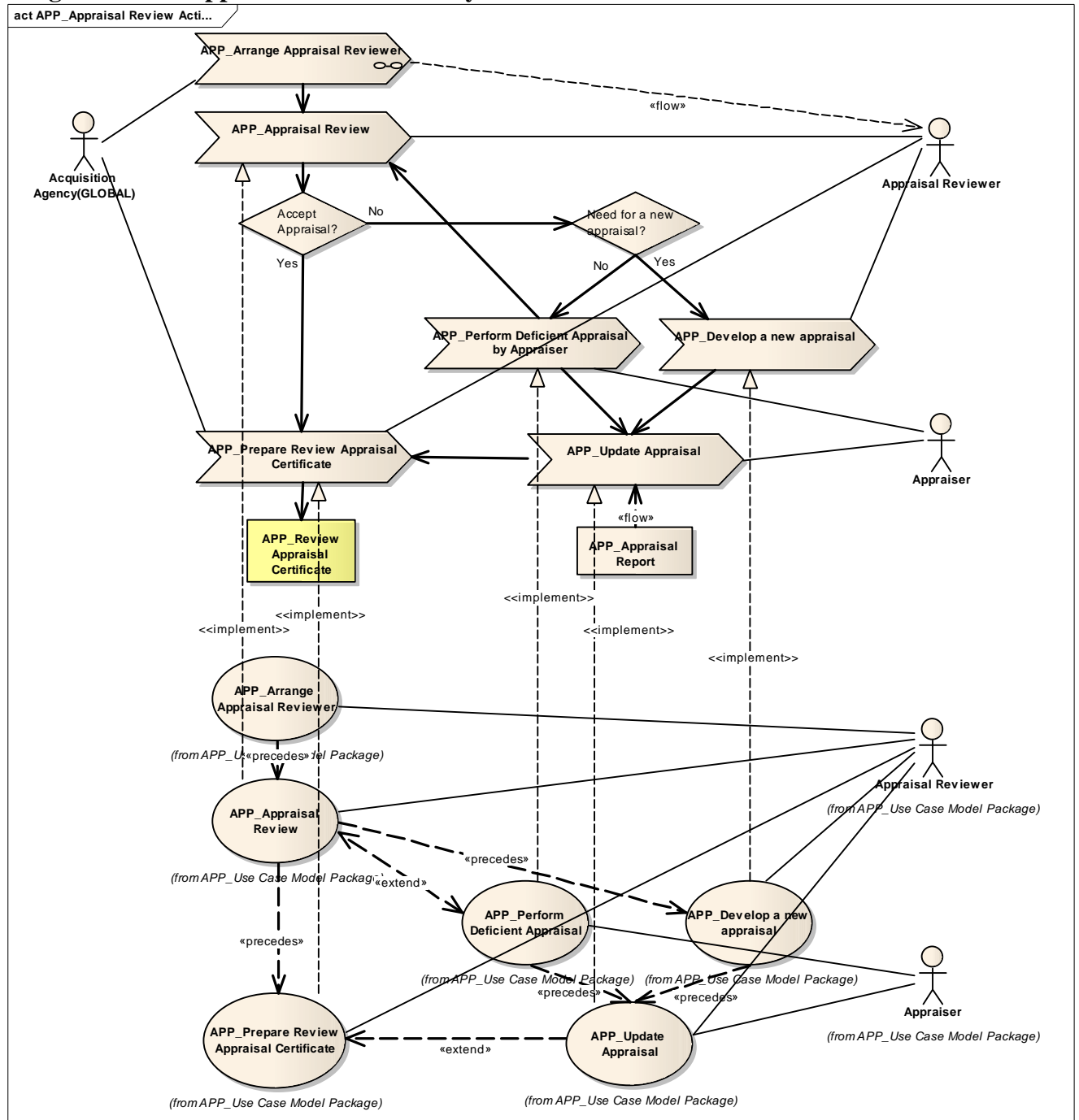


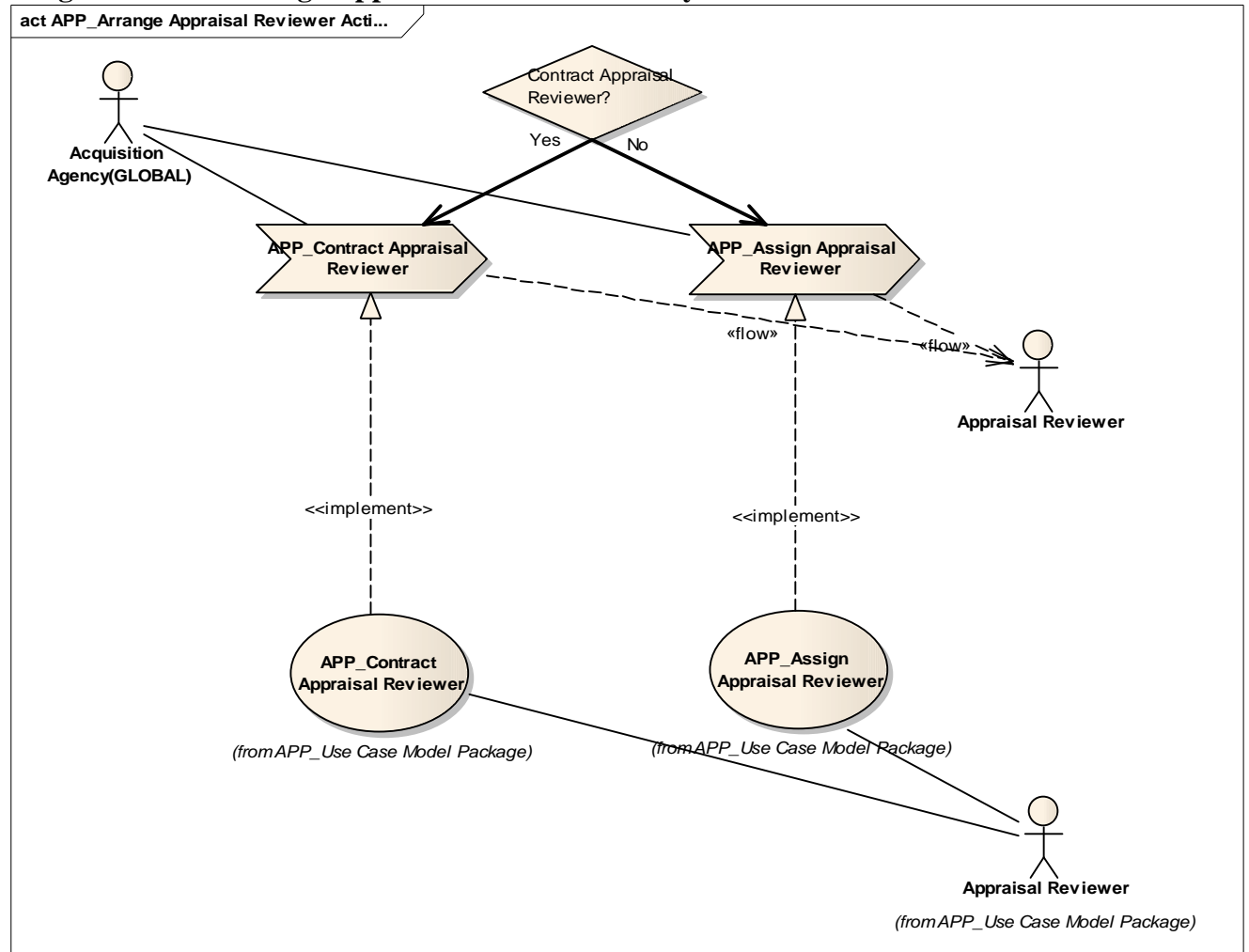
Diagram: APP_Arrange Appraisal Reviewer Activity

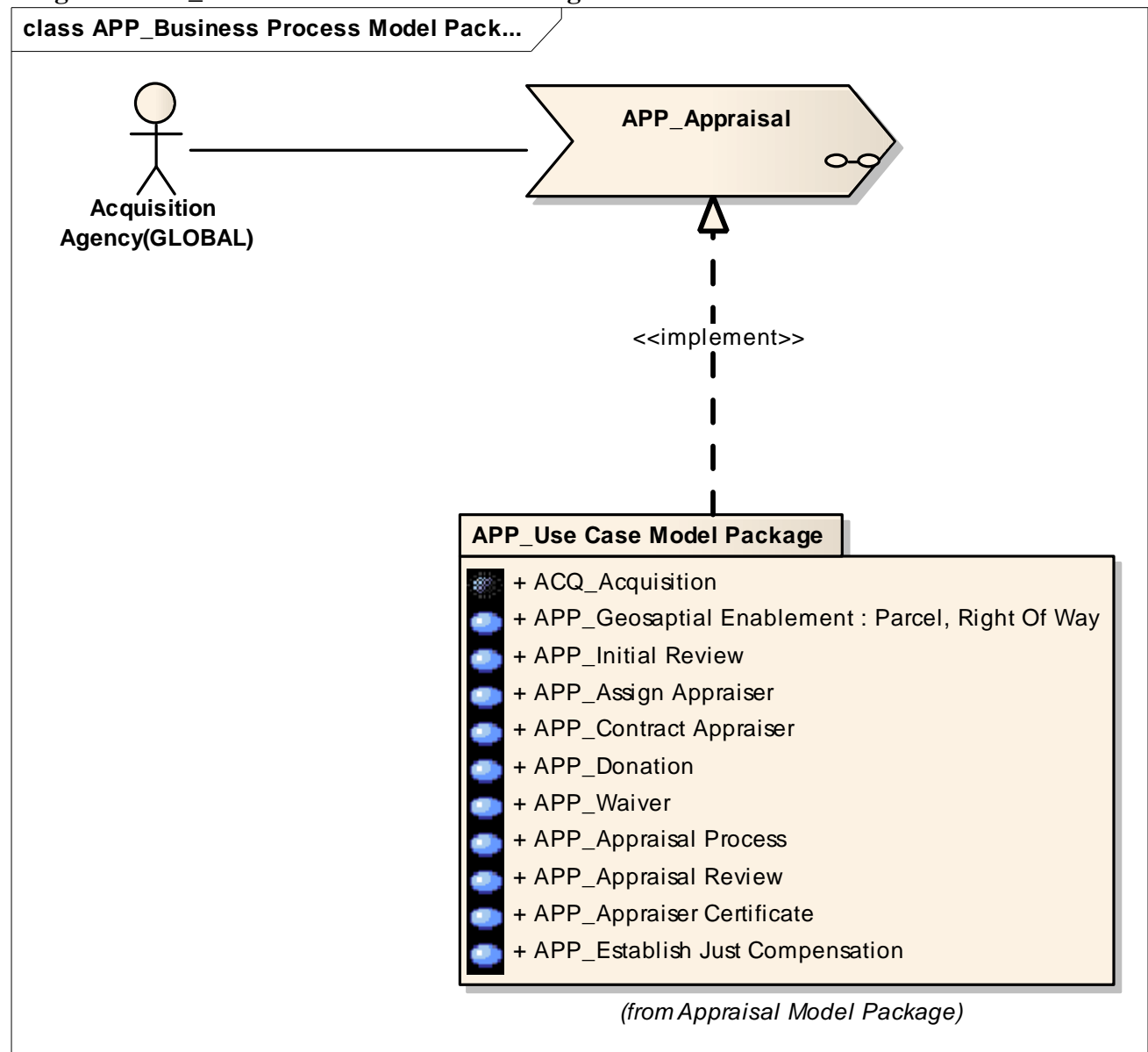
Diagram: APP_Business Process Model Packag

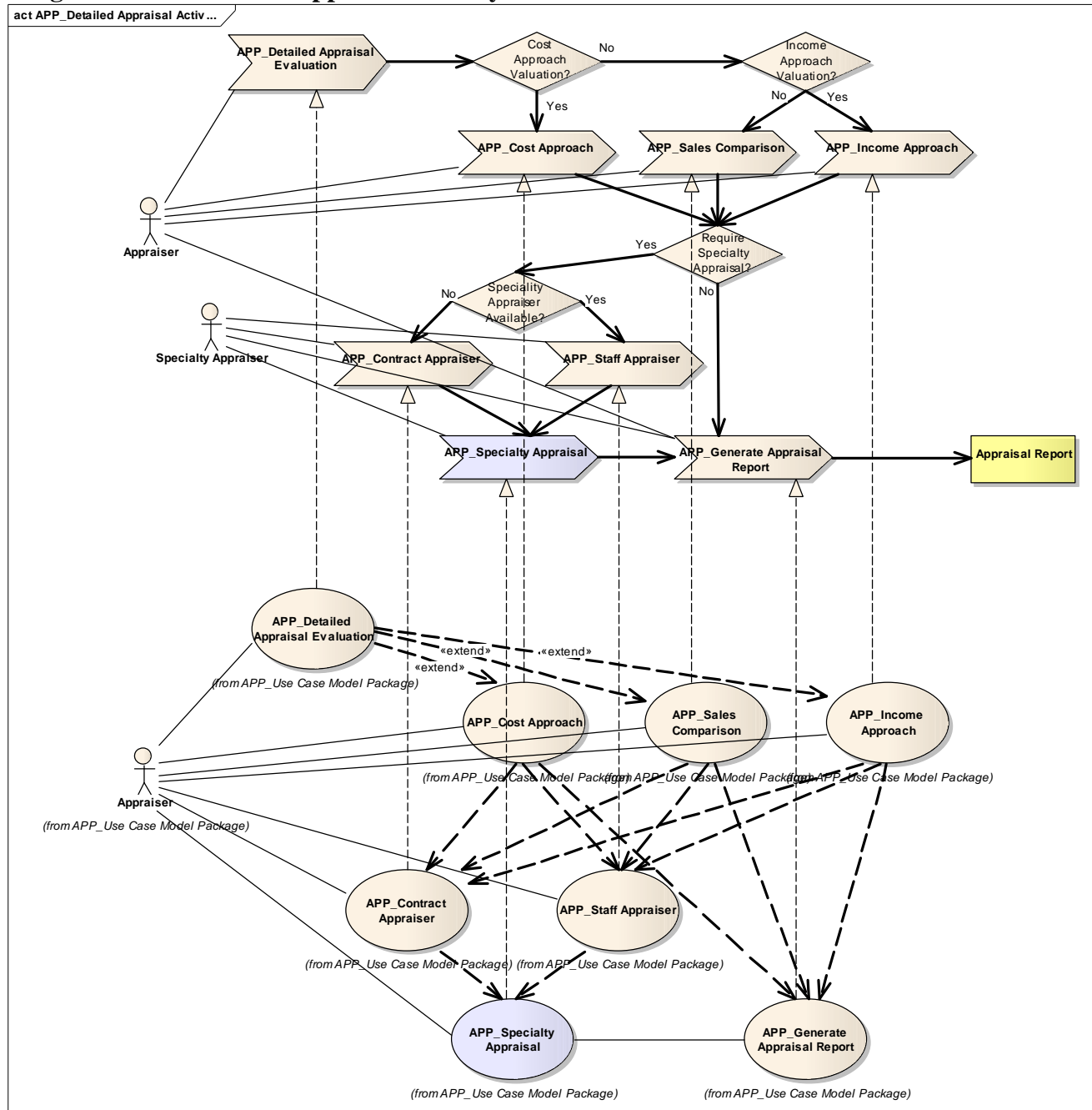
Diagram: APP_Detailed Appraisal Activity

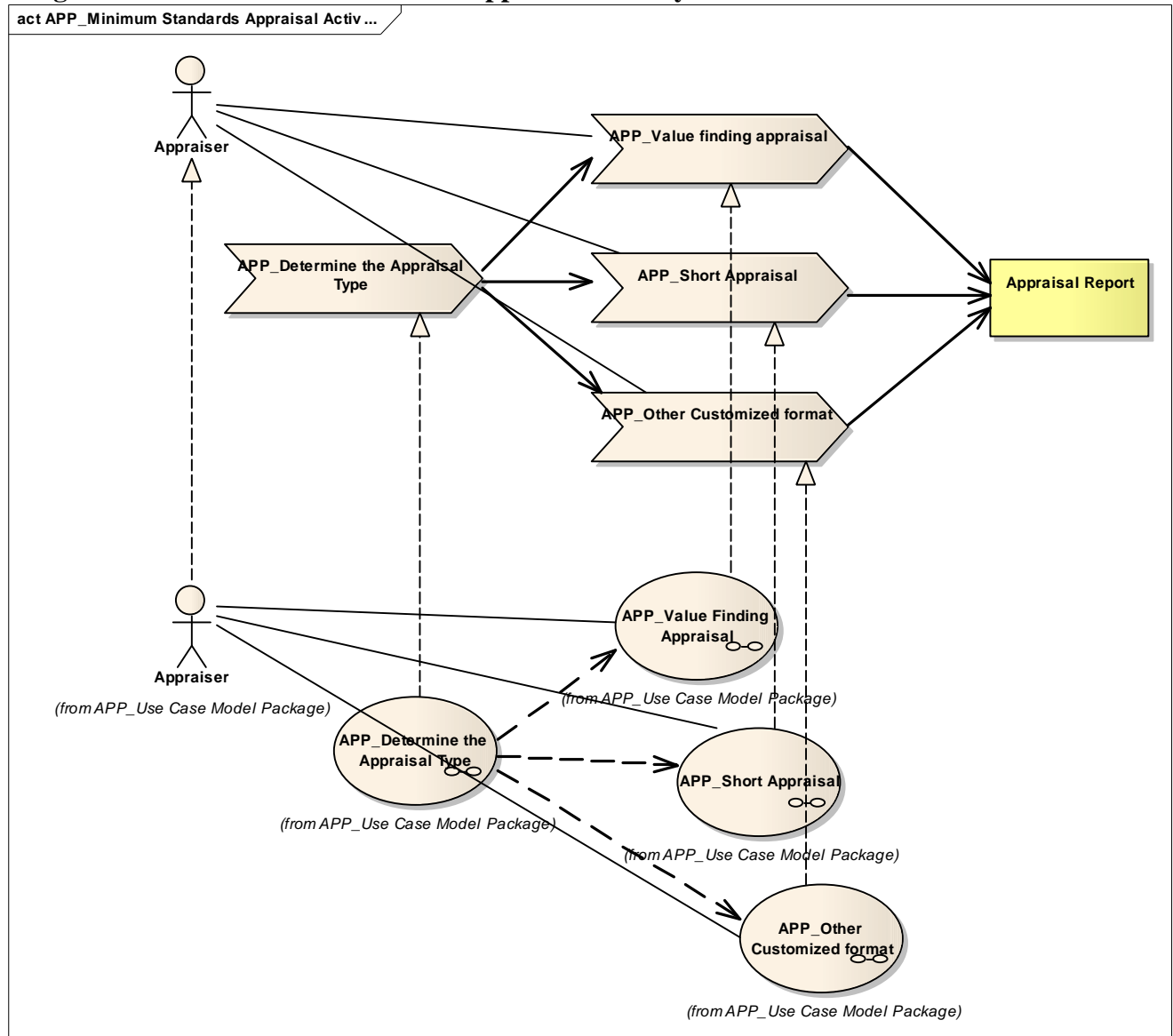
Diagram: APP_Minimum Standards Appraisal Activity

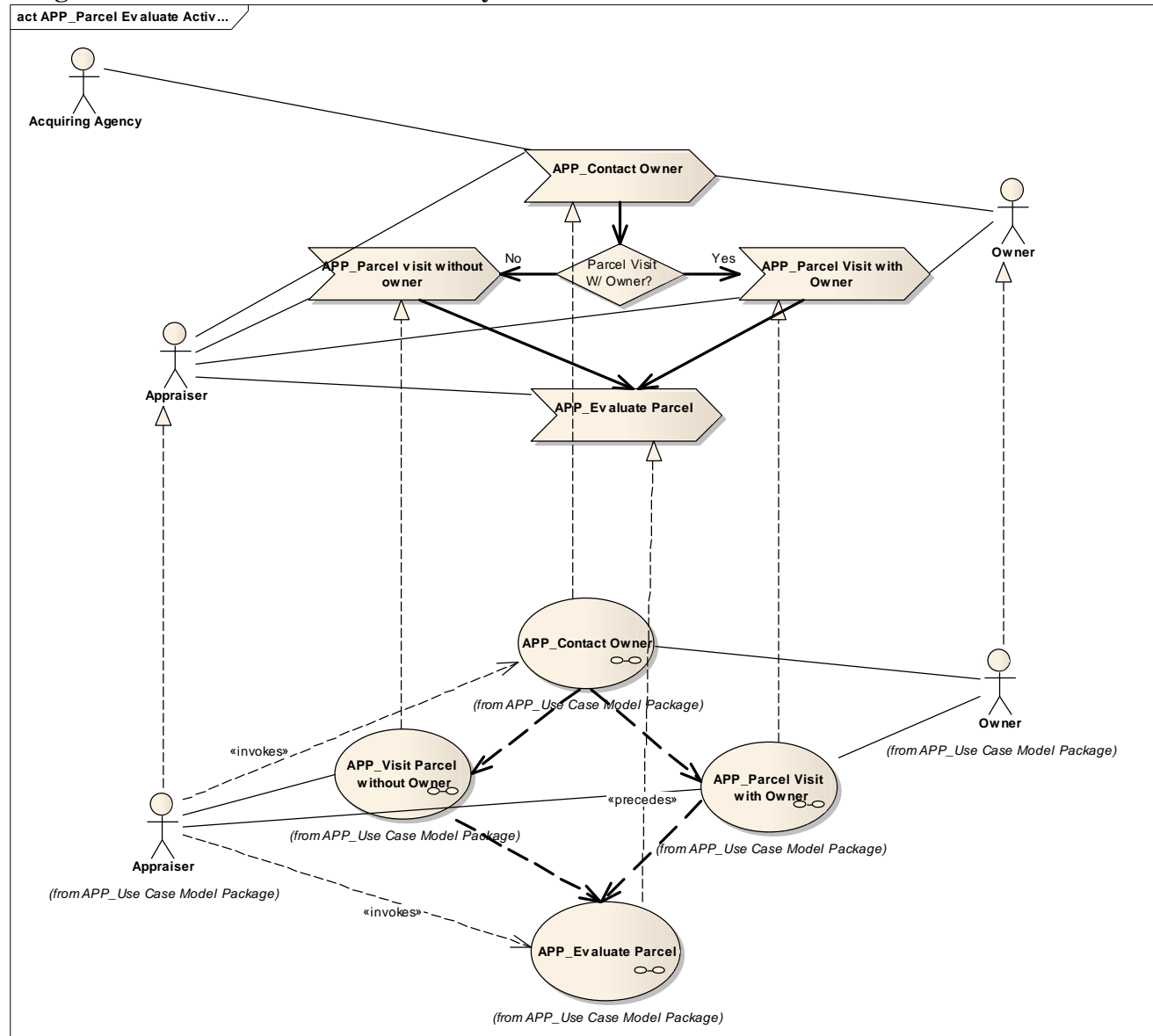
Diagram: APP_Parcel Evaluate Activity

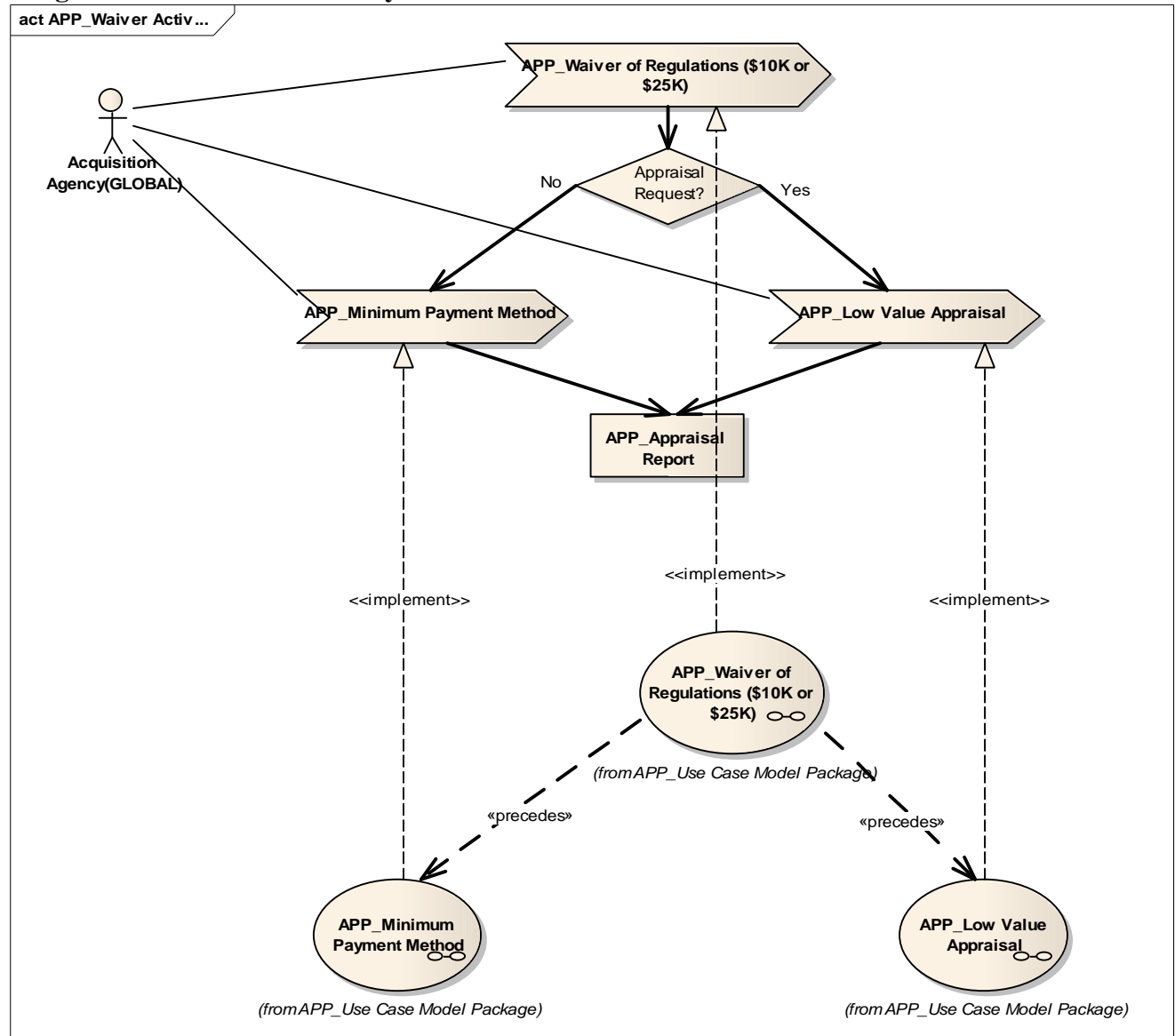
Diagram: APP_Waiver Activity

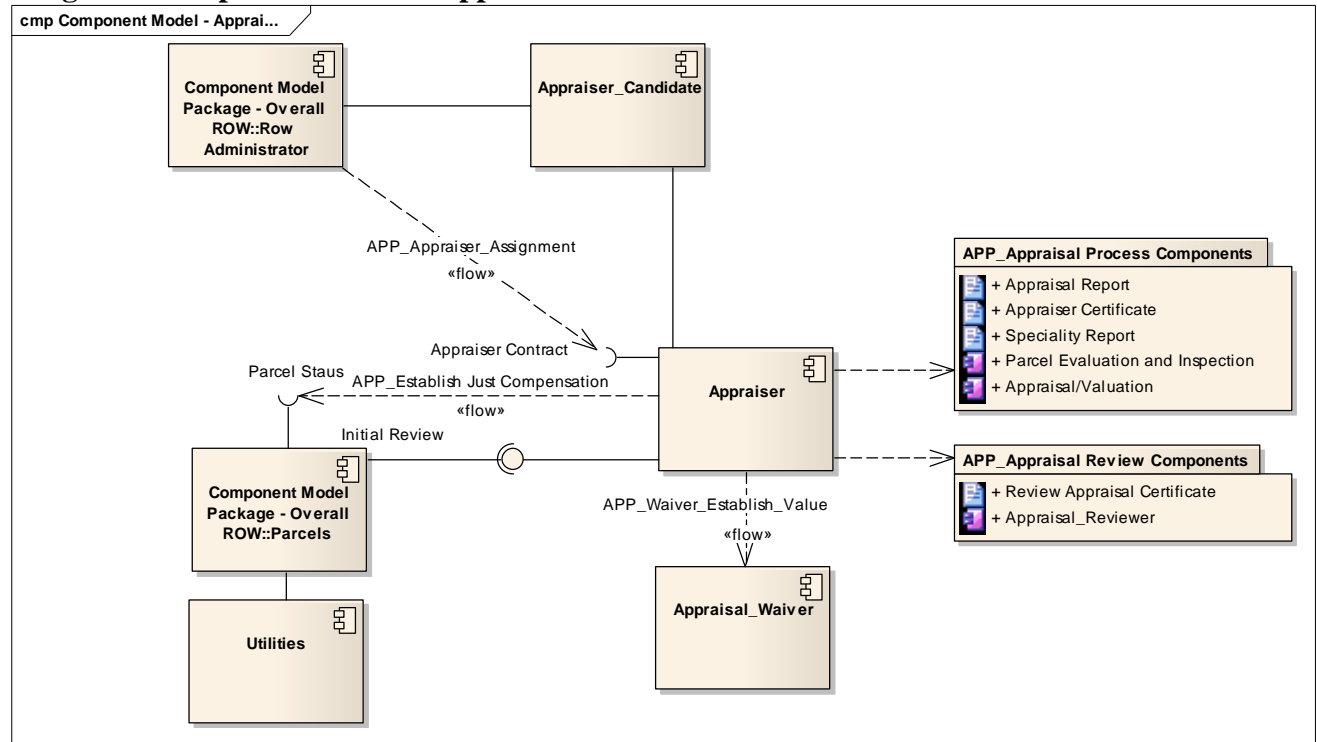
Diagram: Component Model - Appraisal

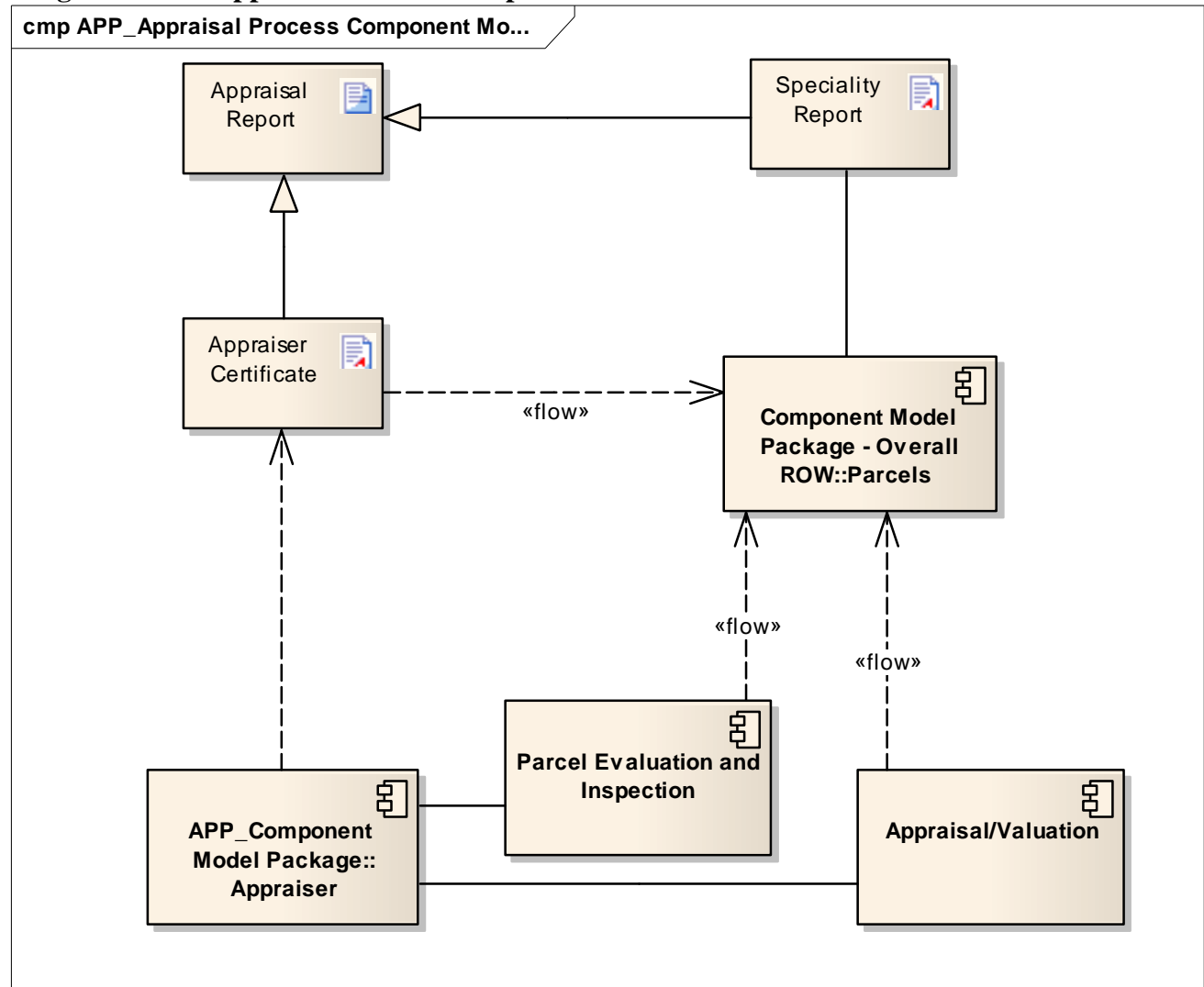
Diagram: APP_Appraisal Process Component Model

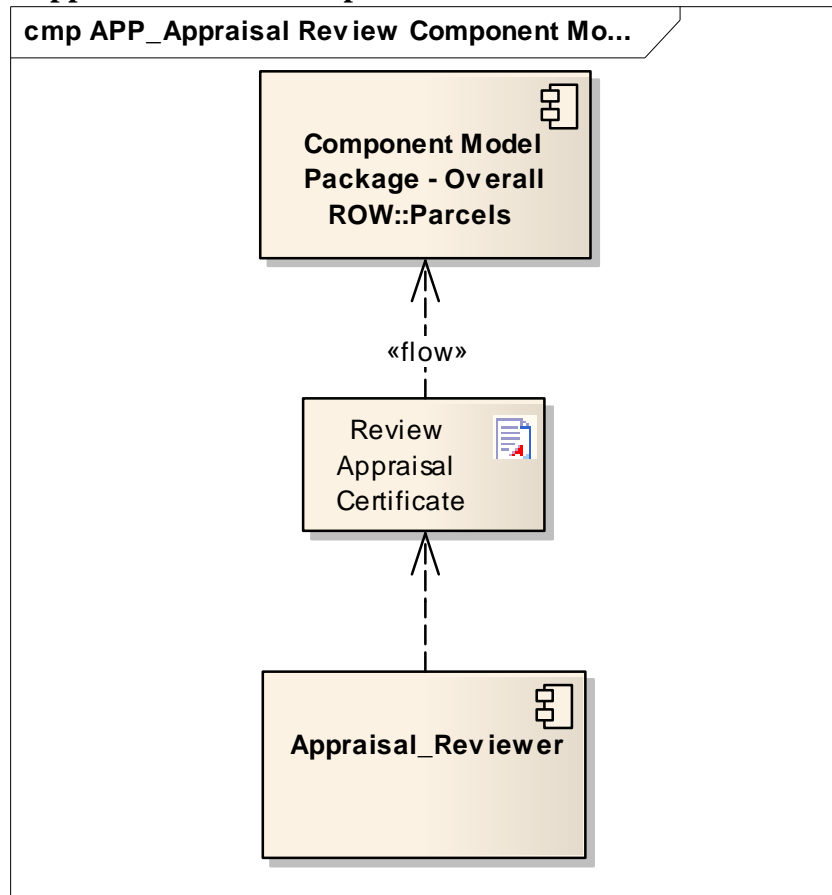
Diagram: APP_Appraisal Review Component Model

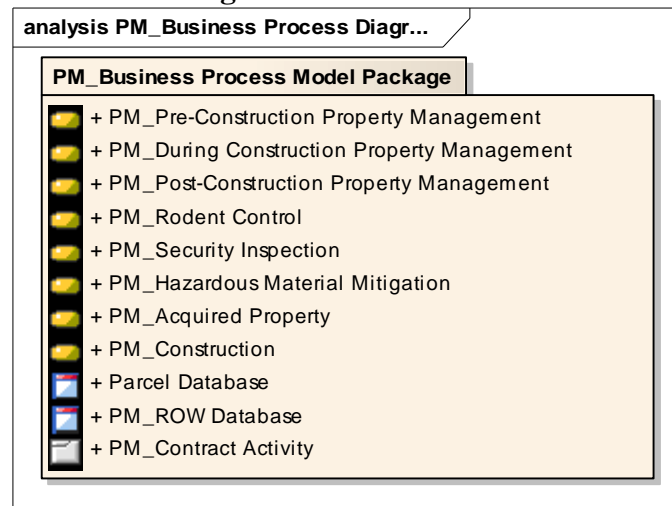
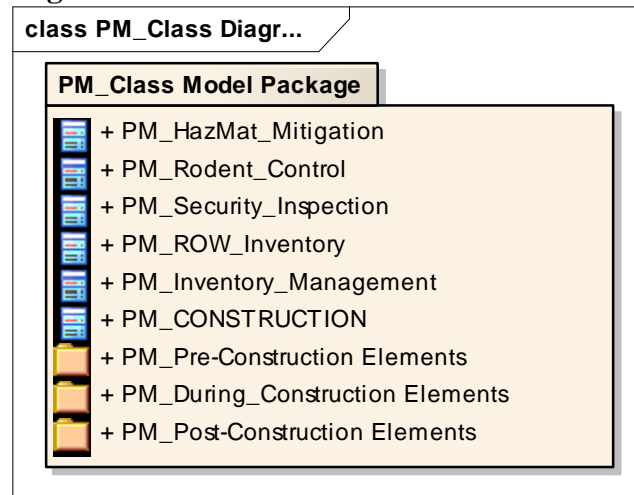
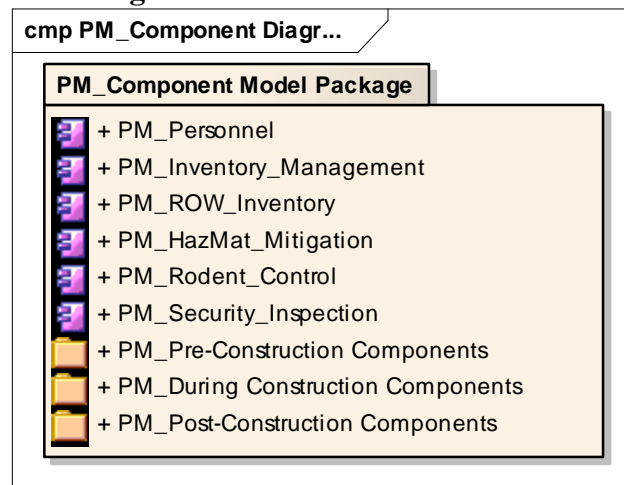
Diagram: PM_Business Process Diagram**Diagram: PM_Class Diagram****Diagram: PM_Component Diagram**

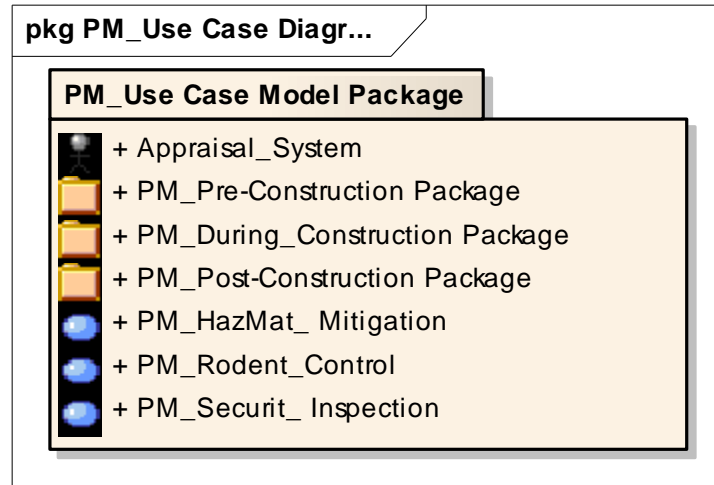
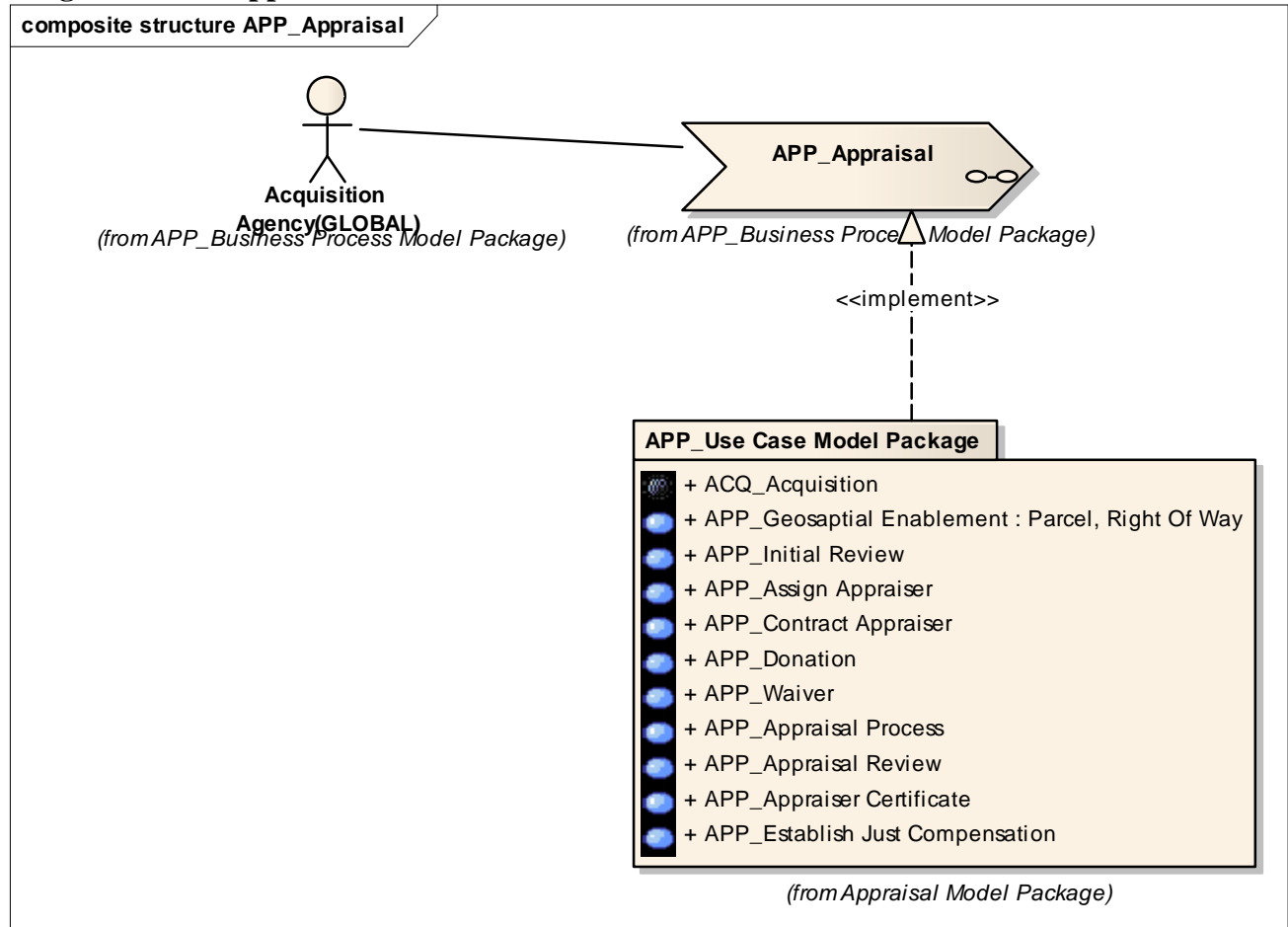
Diagram: PM_Use Case Diagram**Diagram: APP_Appraisal**

Diagram: PM_Business Process Model

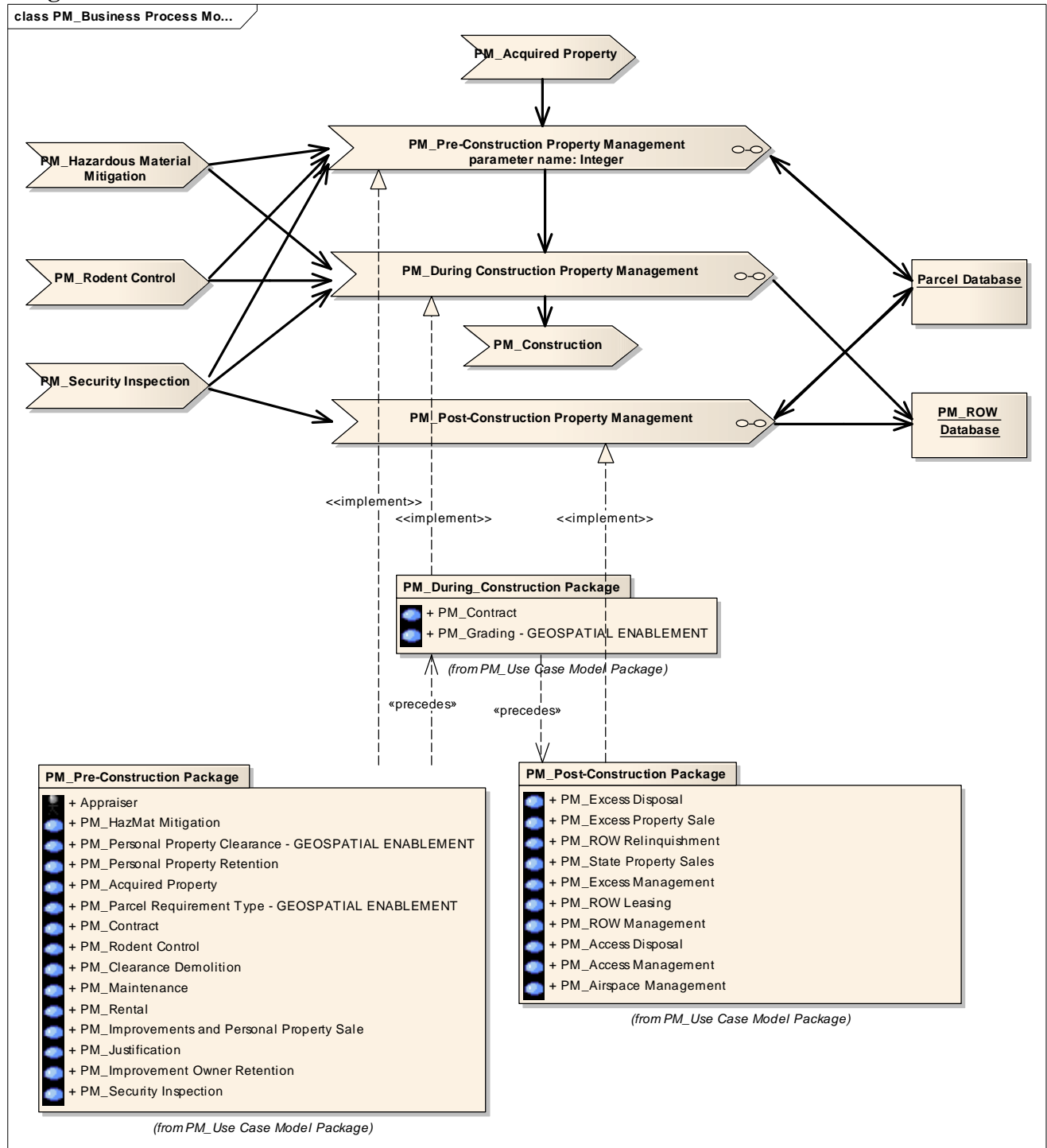


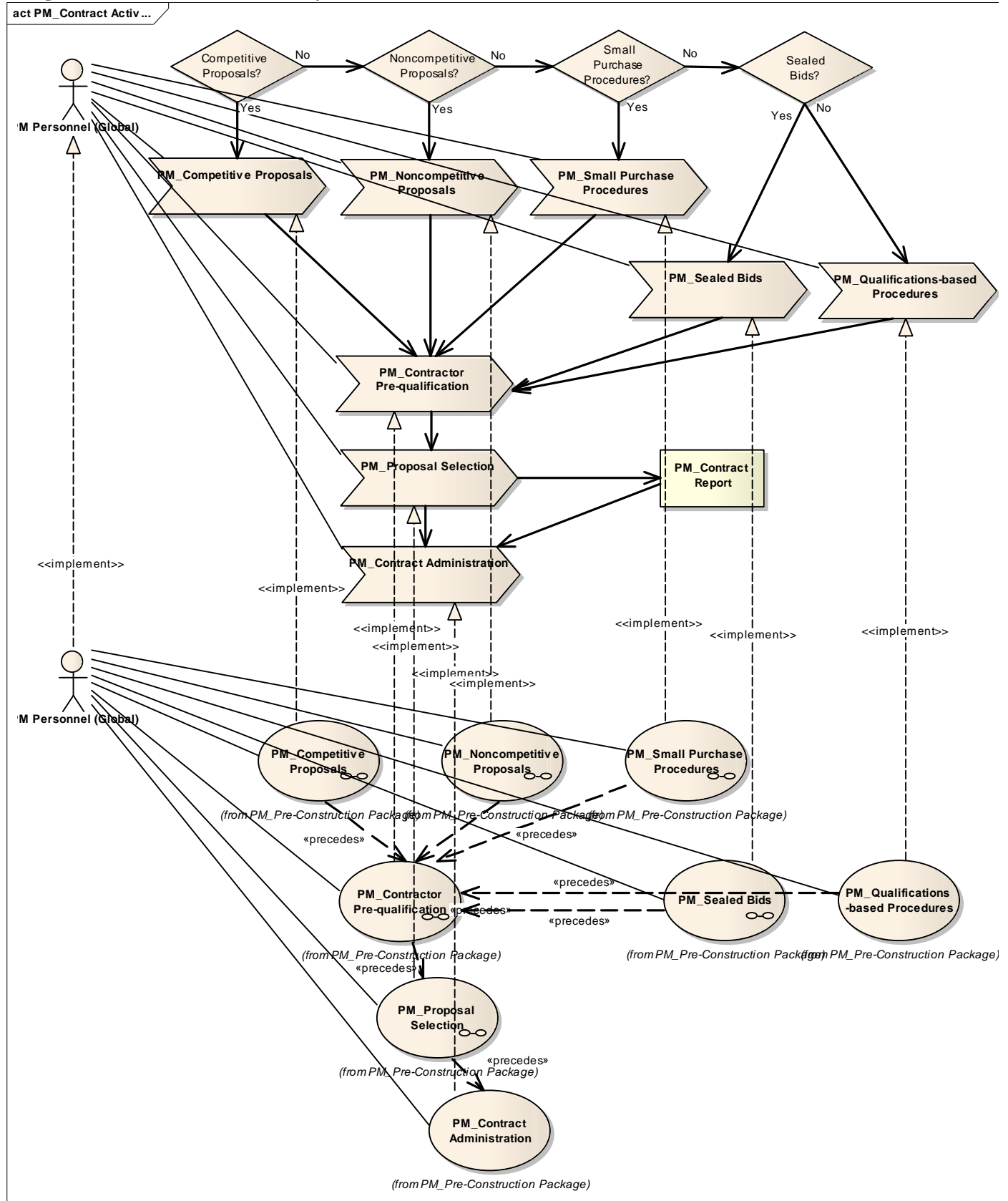
Diagram: PM_Contract Activity

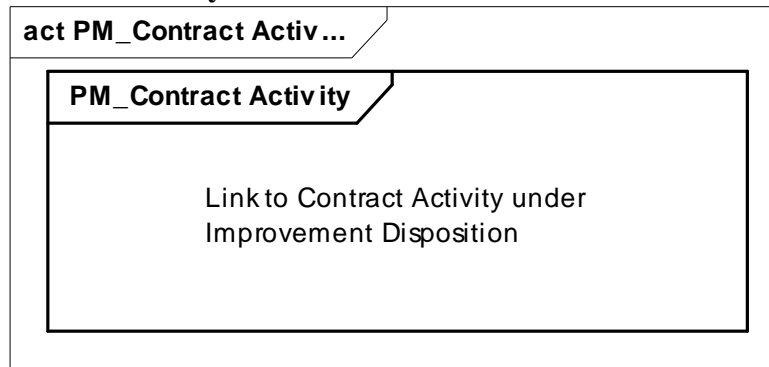
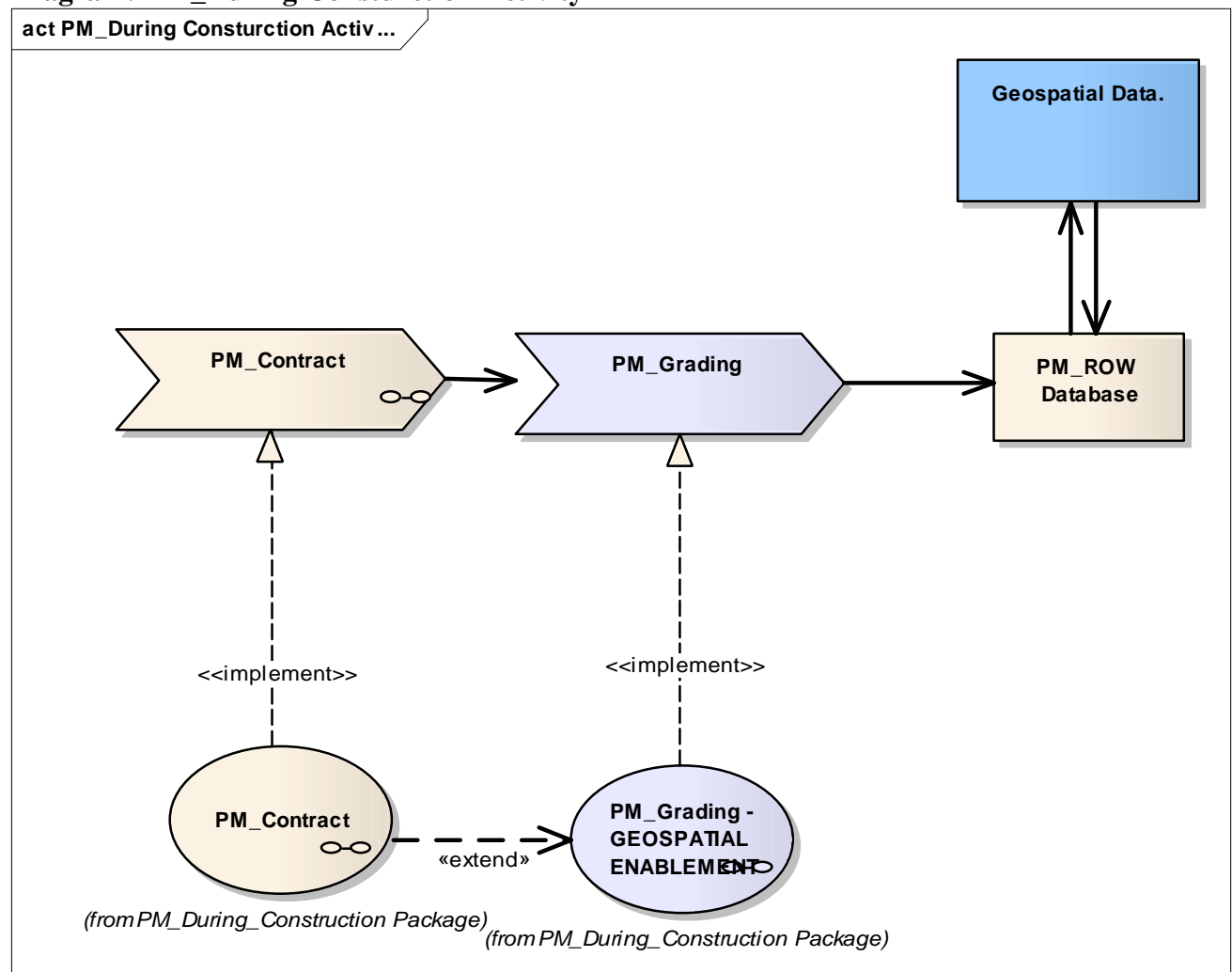
Diagram: PM_Contract Activity**Diagram: PM_During Consturction Activity**

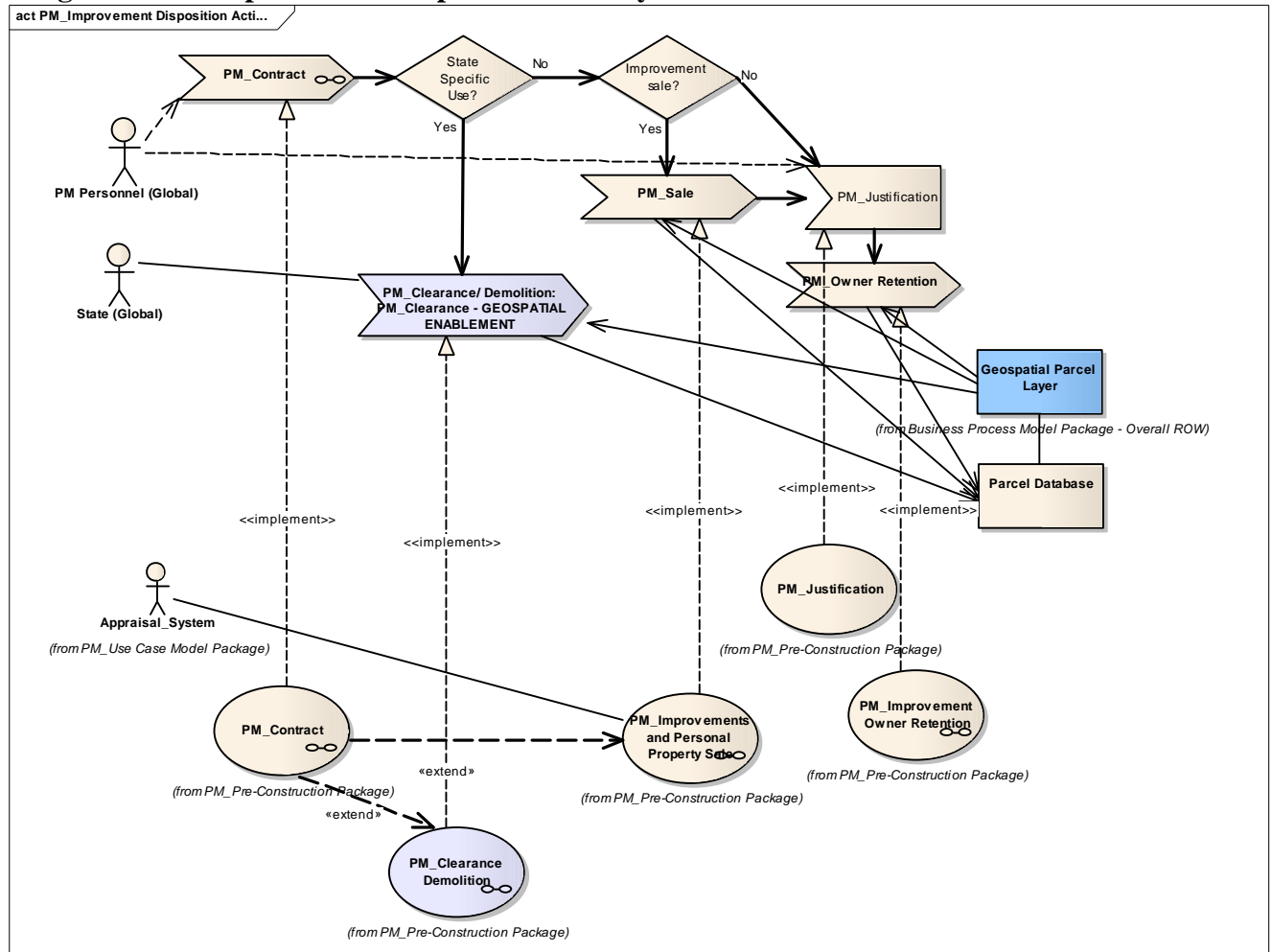
Diagram: PM Improvement Disposition Activity

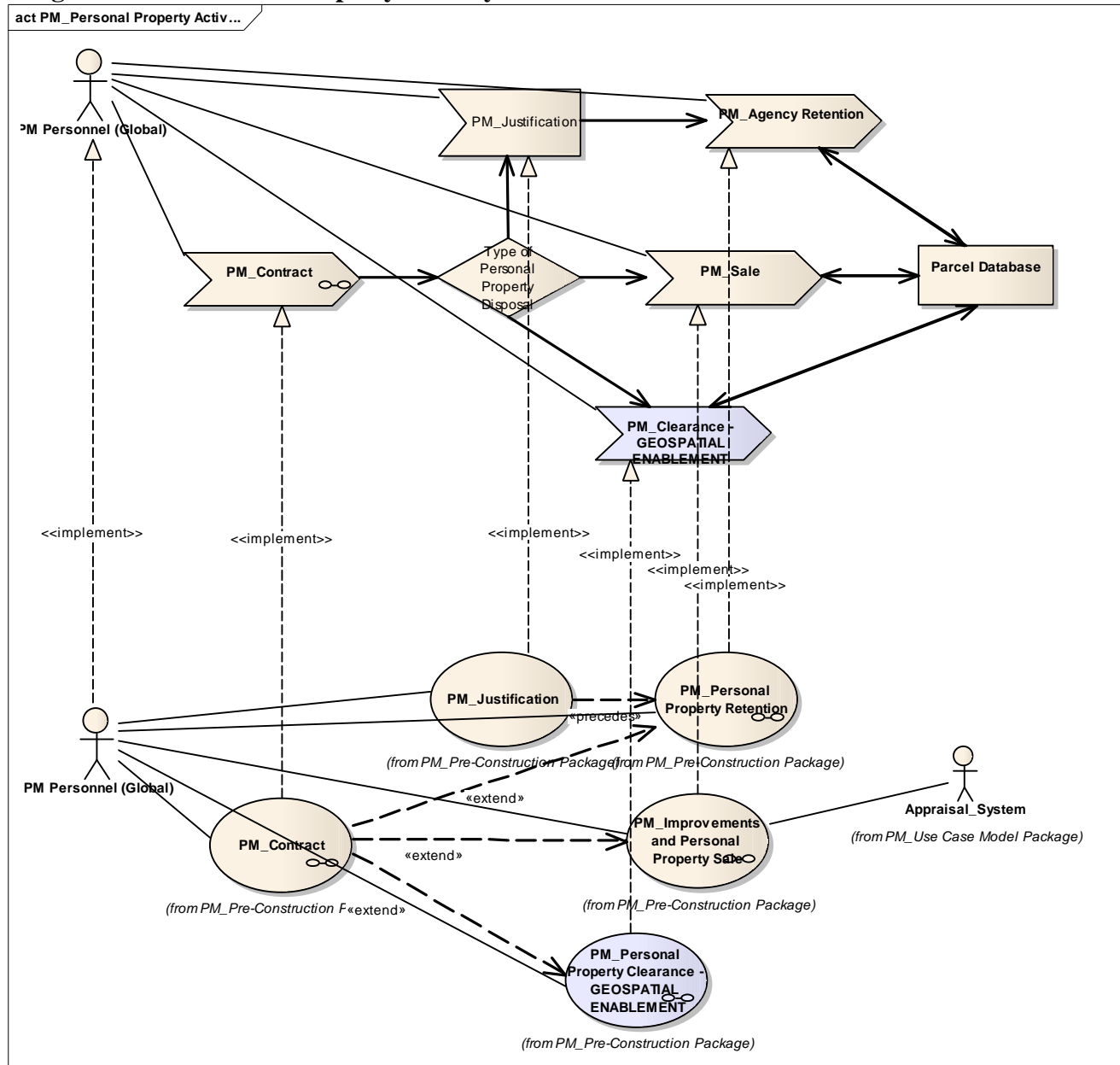
Diagram: PM_Personal Property Activity

Diagram: PM_Post-Construction Activity

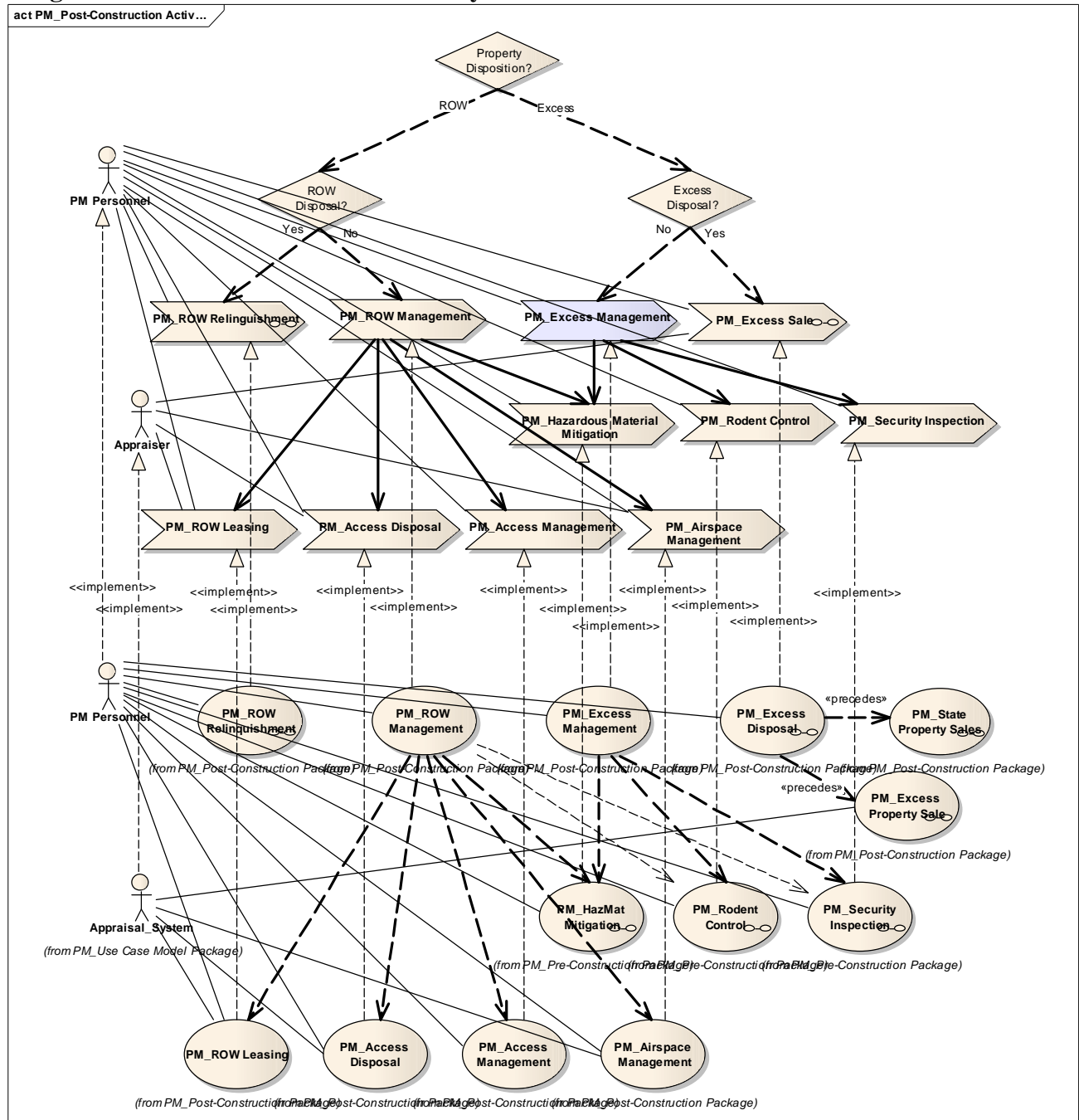


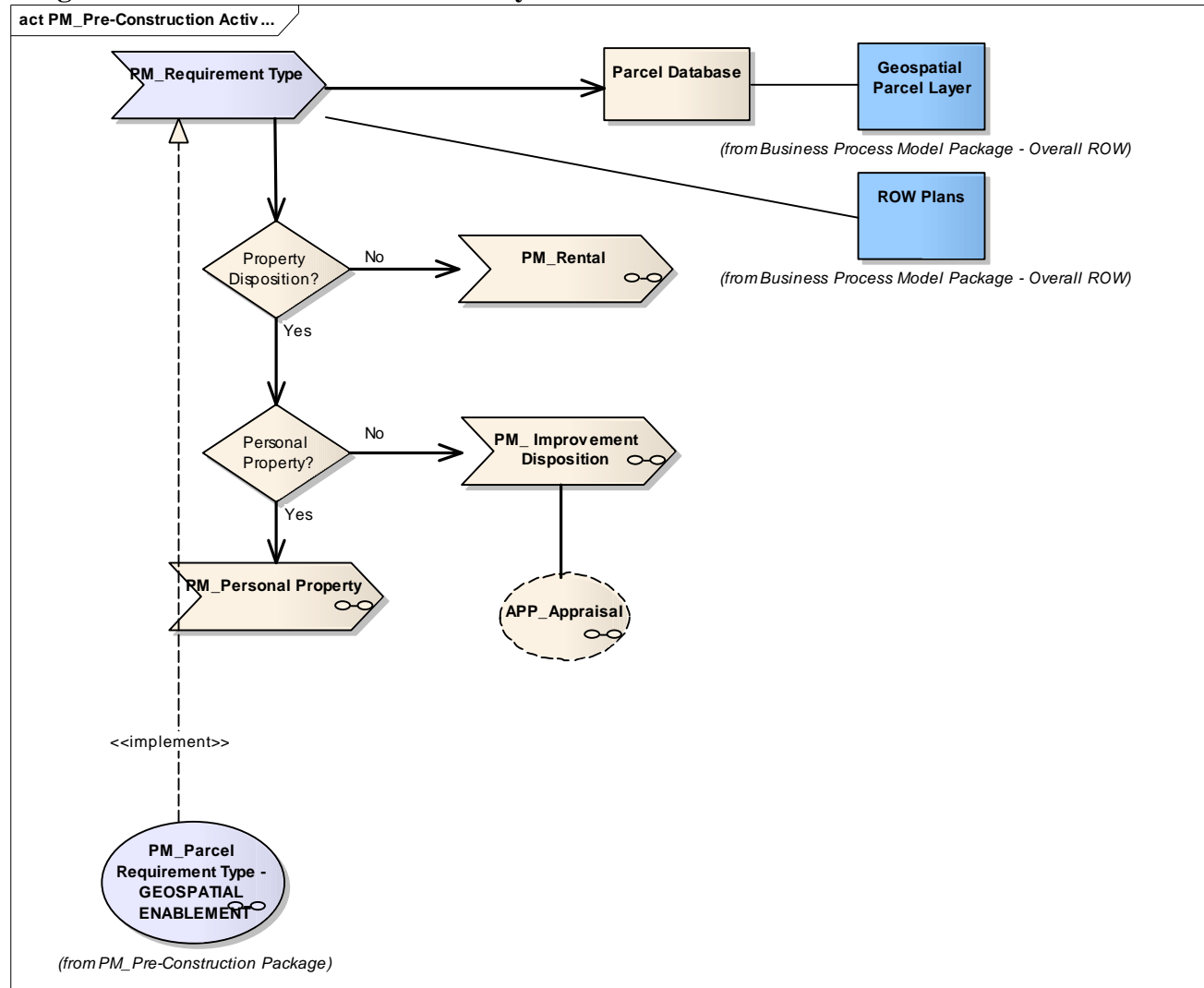
Diagram: PM_Pre-Construction Activity

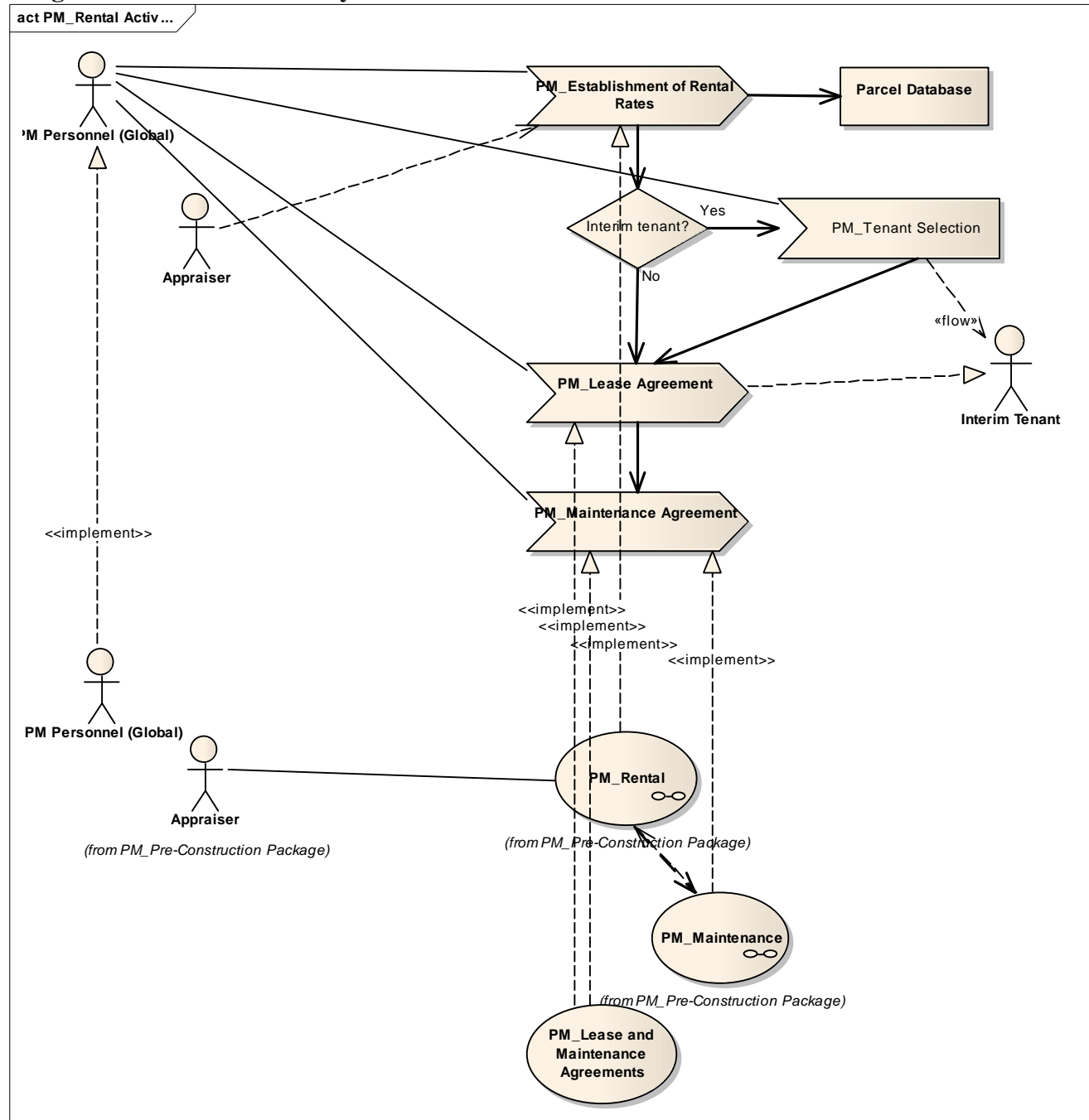
Diagram: PM_Rental Activity

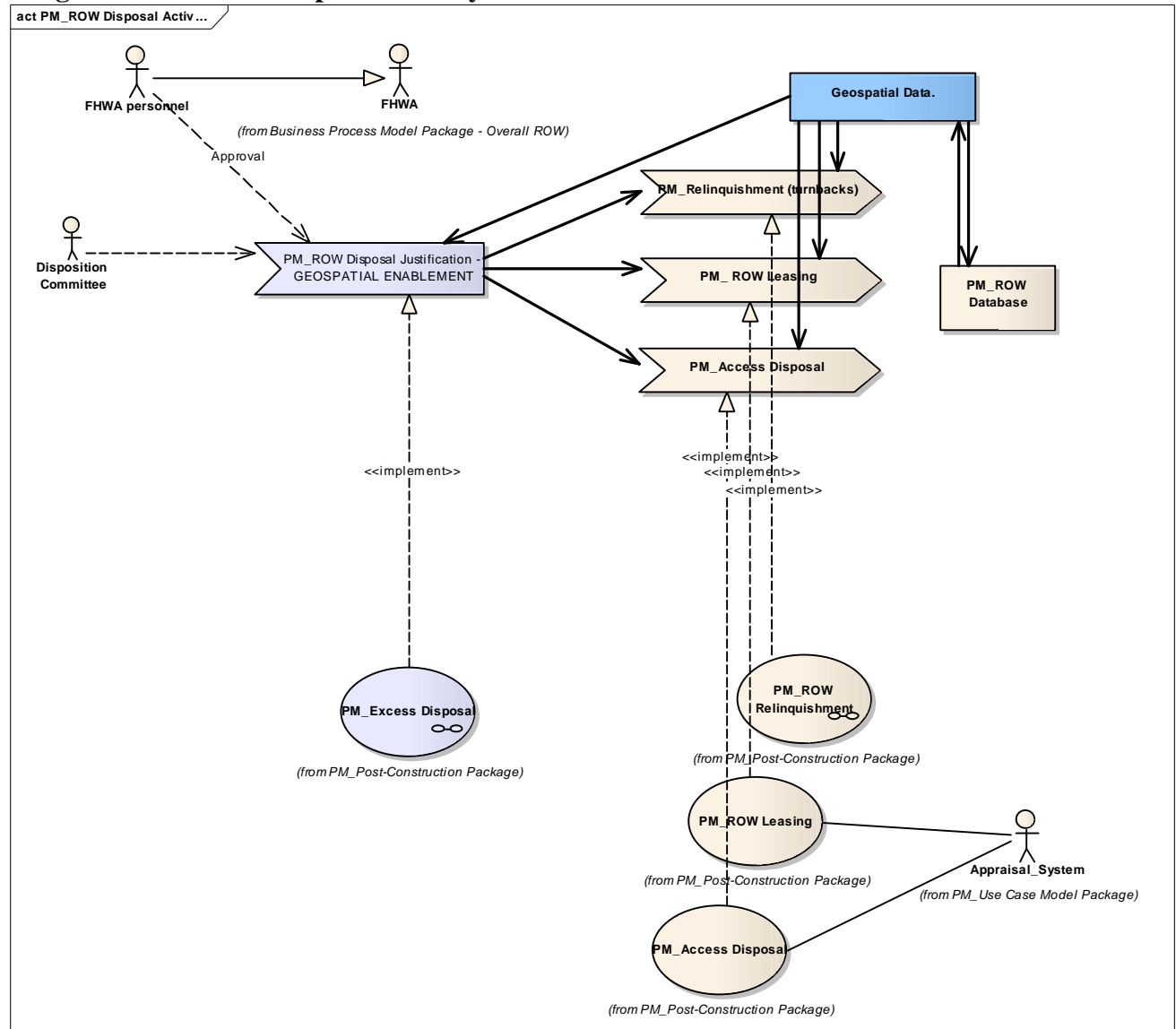
Diagram: PM_ROW Disposal Activity

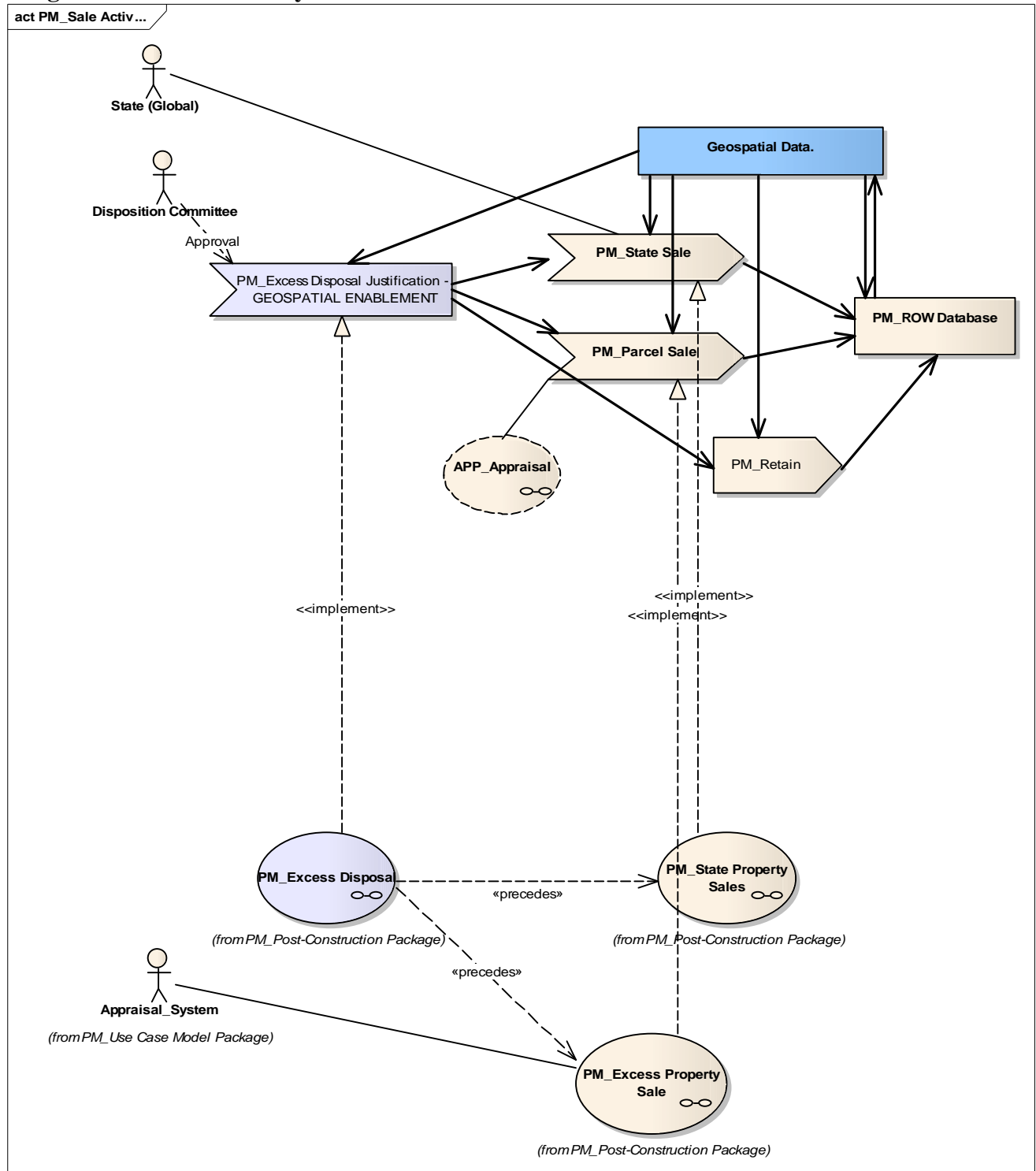
Diagram: PM_Sale Activity

Diagram: PM_Class Model

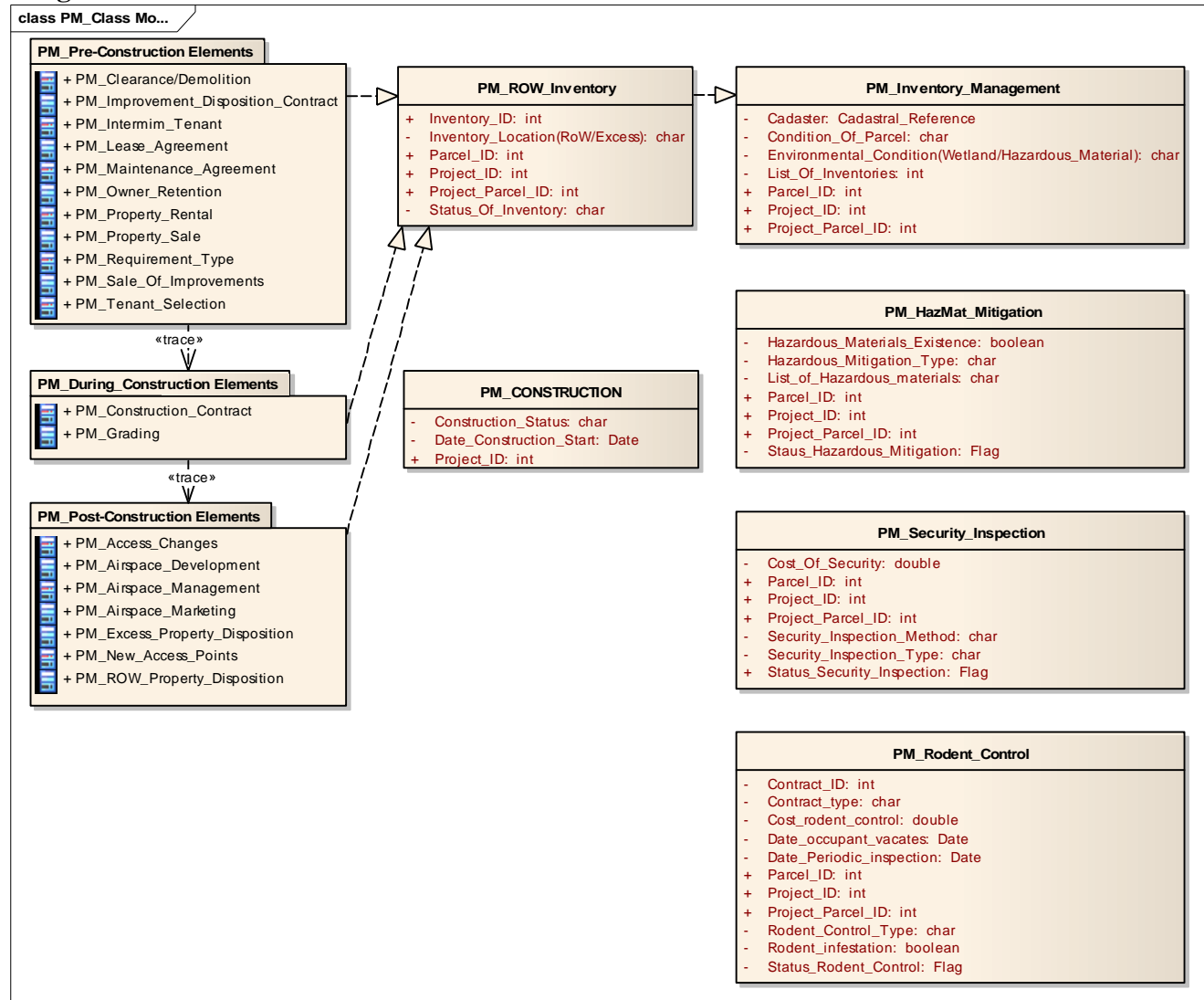


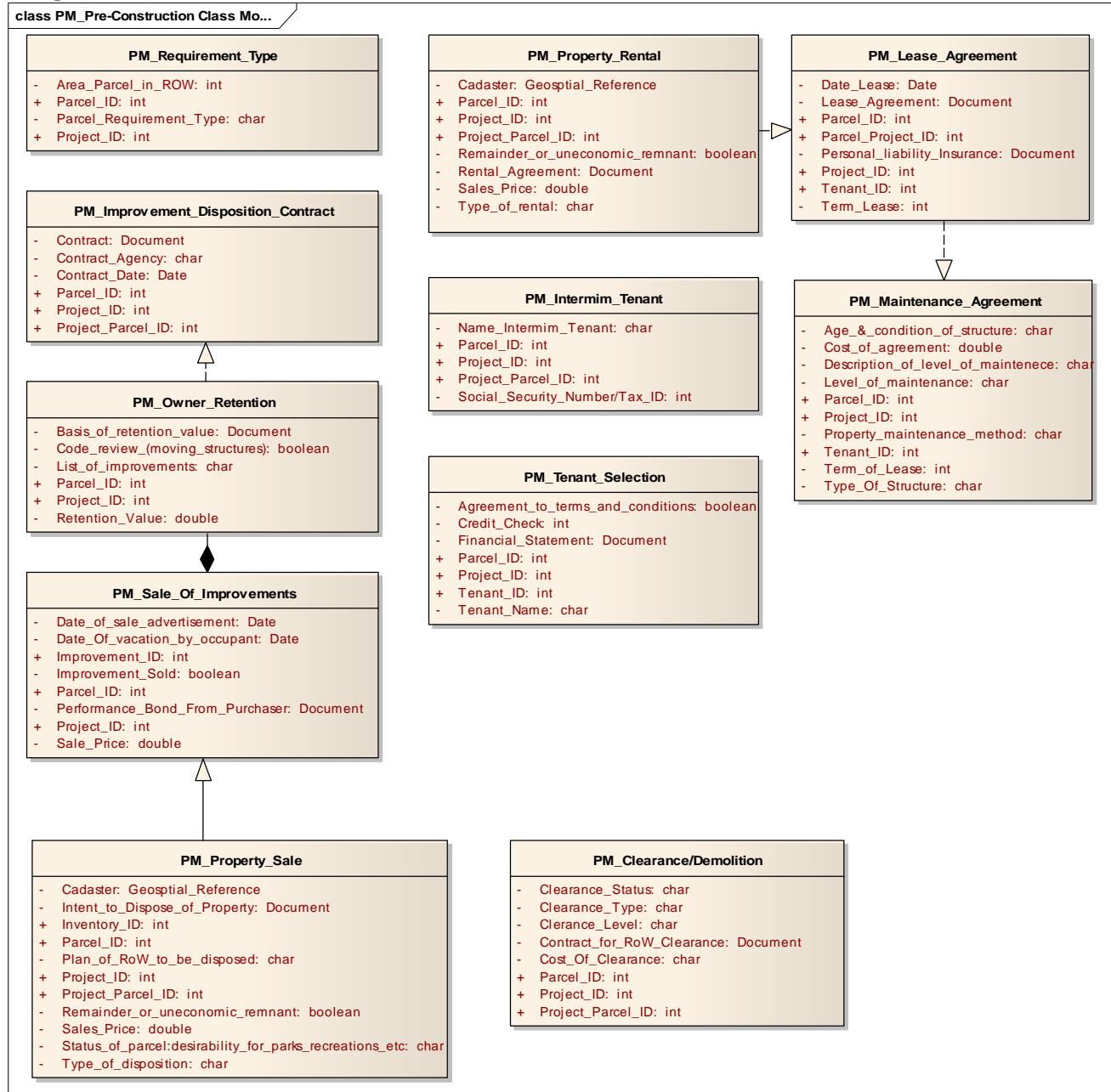
Diagram: PM_Pre-Construction Class Model

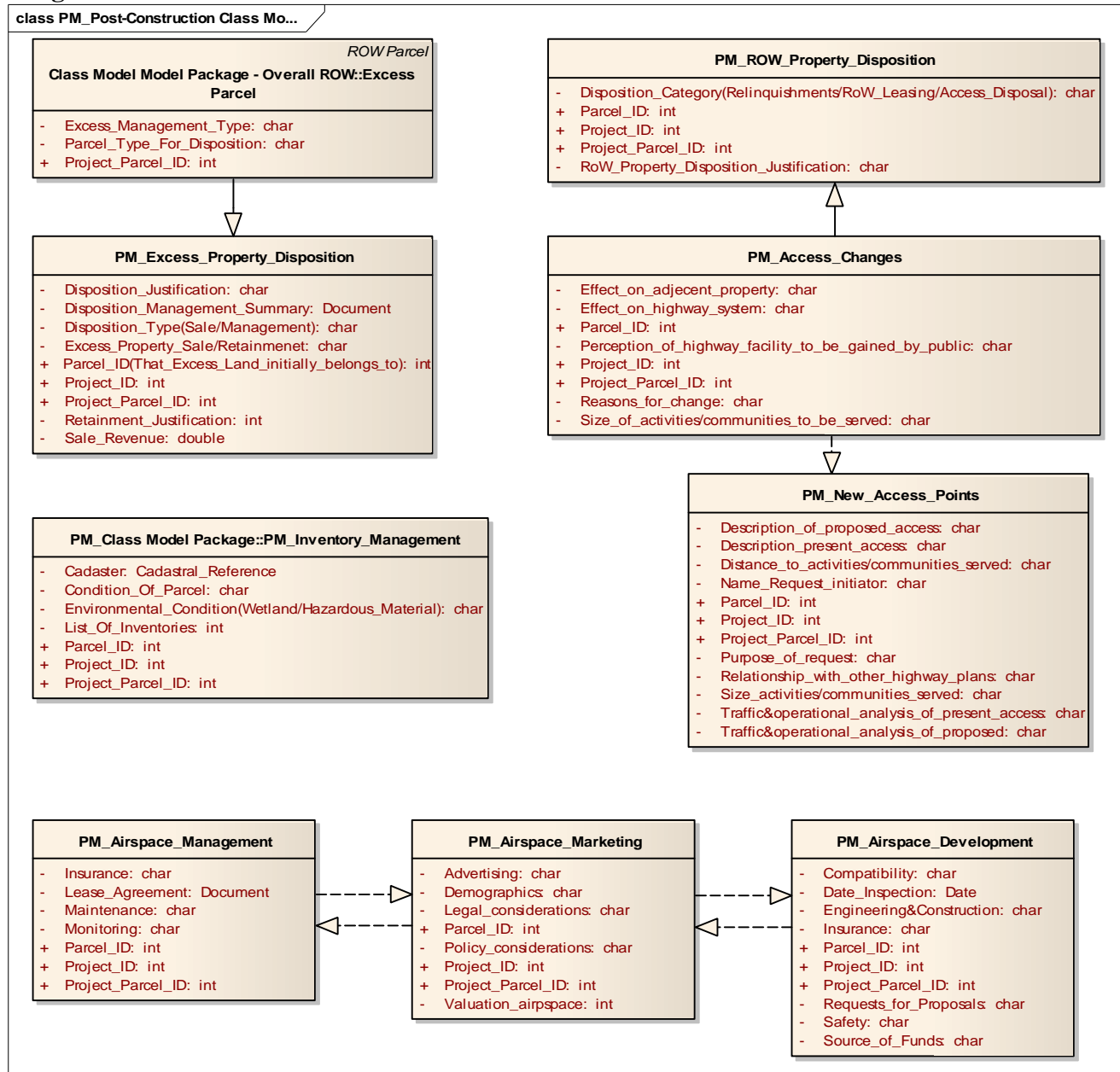
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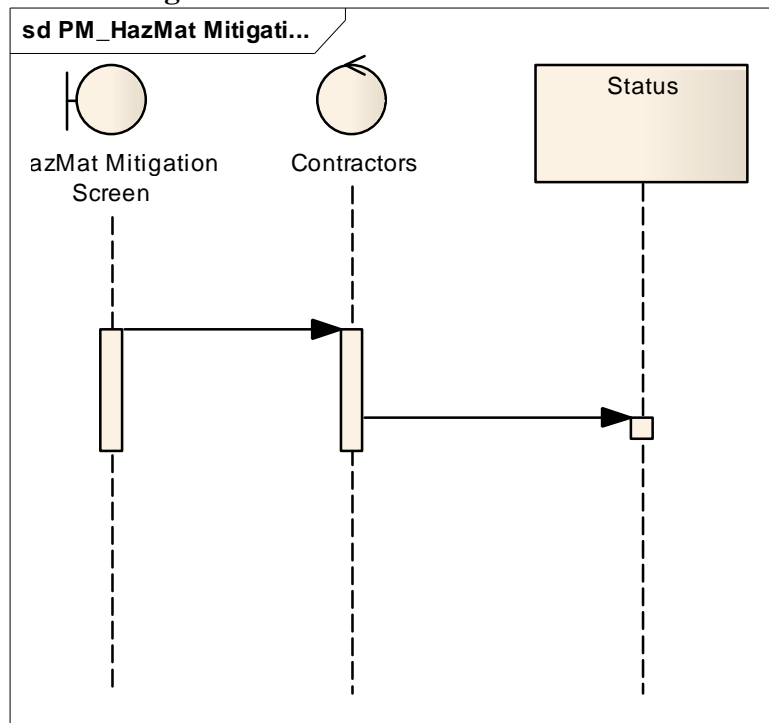
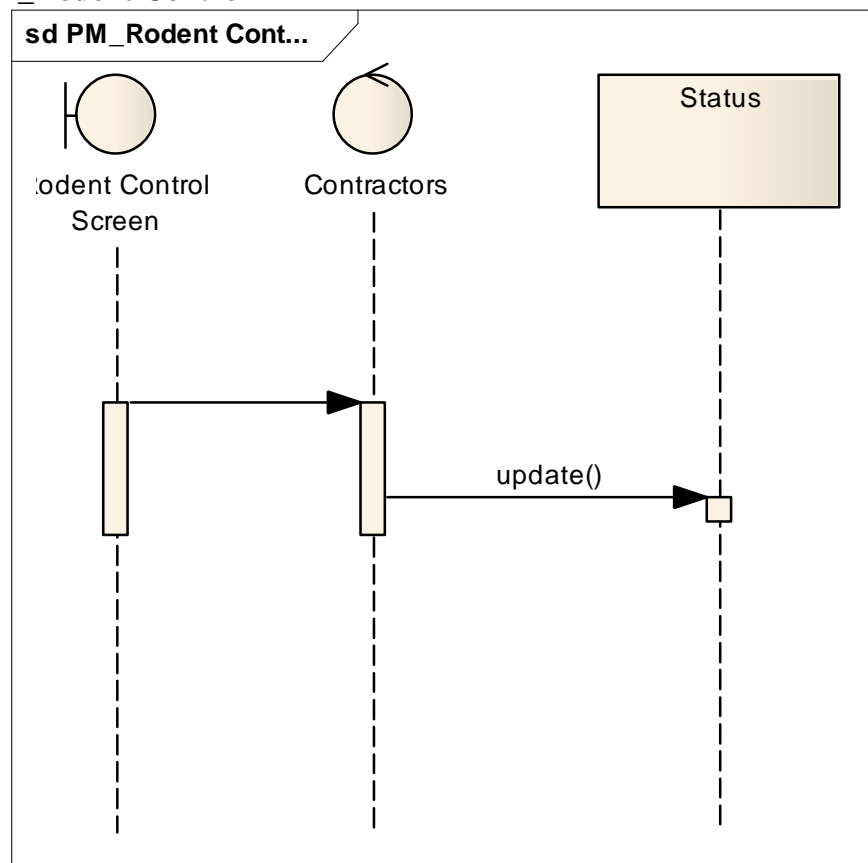
Diagram: PM_HazMat Mitigation**Diagram: PM_Rodent Control**

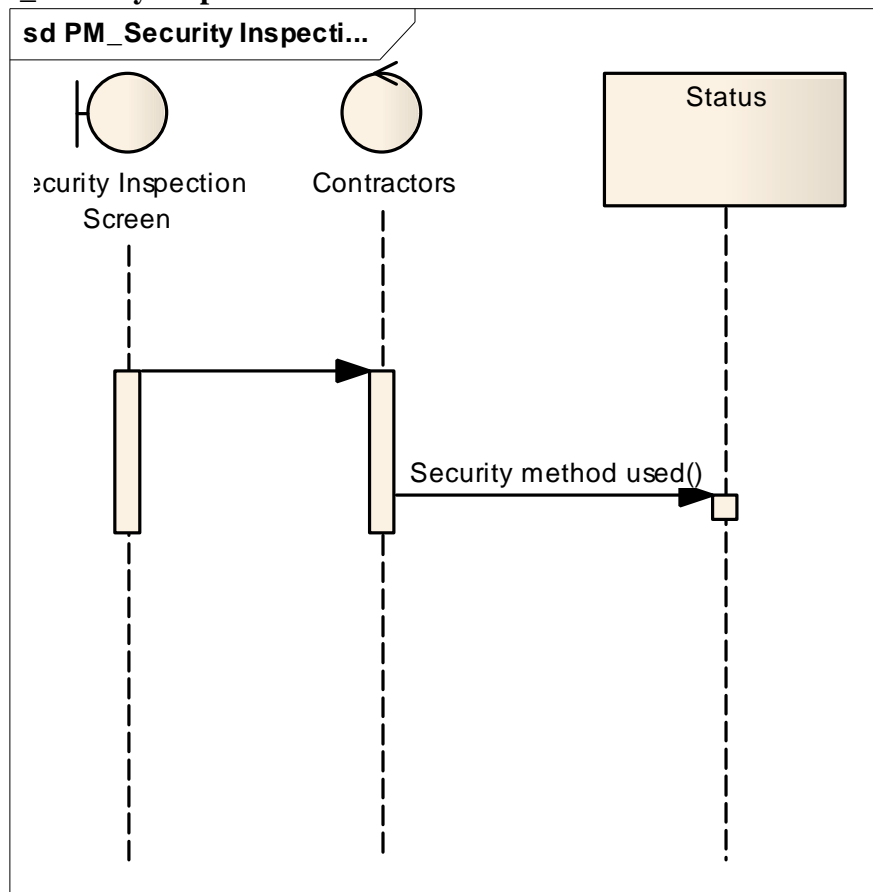
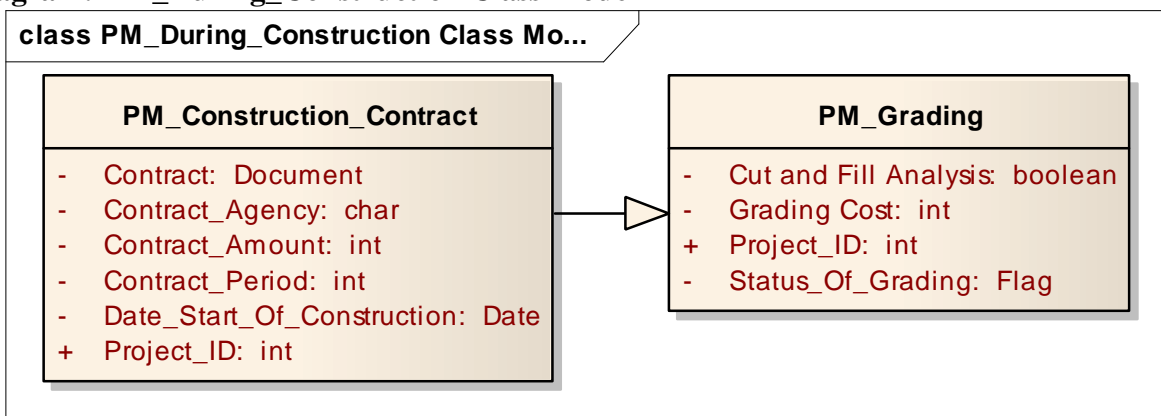
Diagram: PM_Security Inspection**Diagram: PM_During_Construction Class Model**

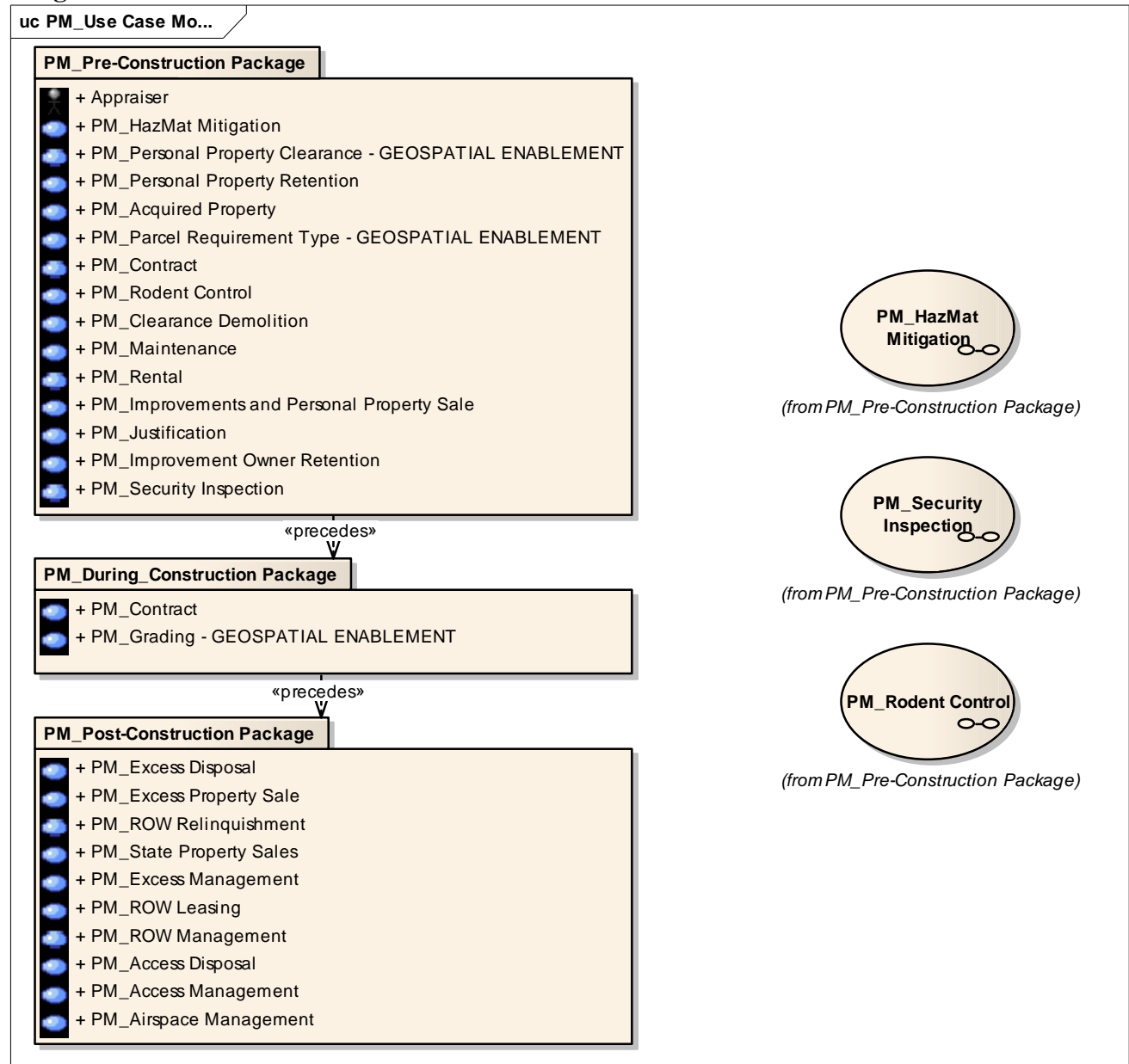
Diagram: PM_Use Case Model

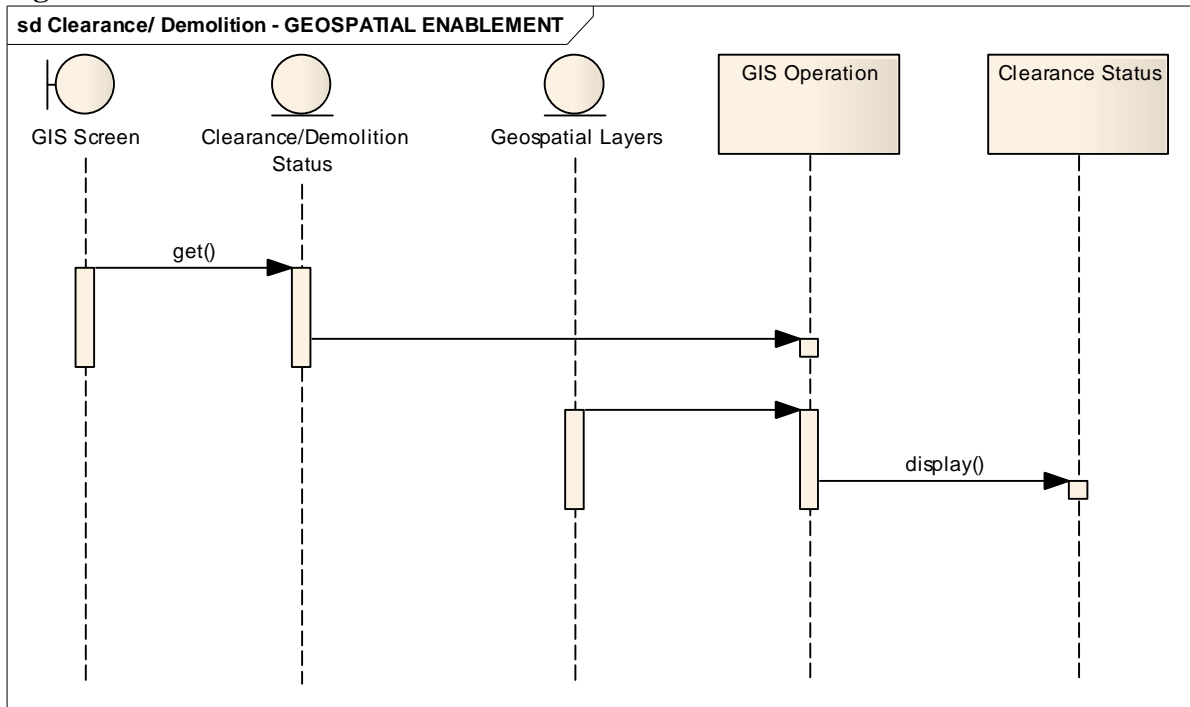
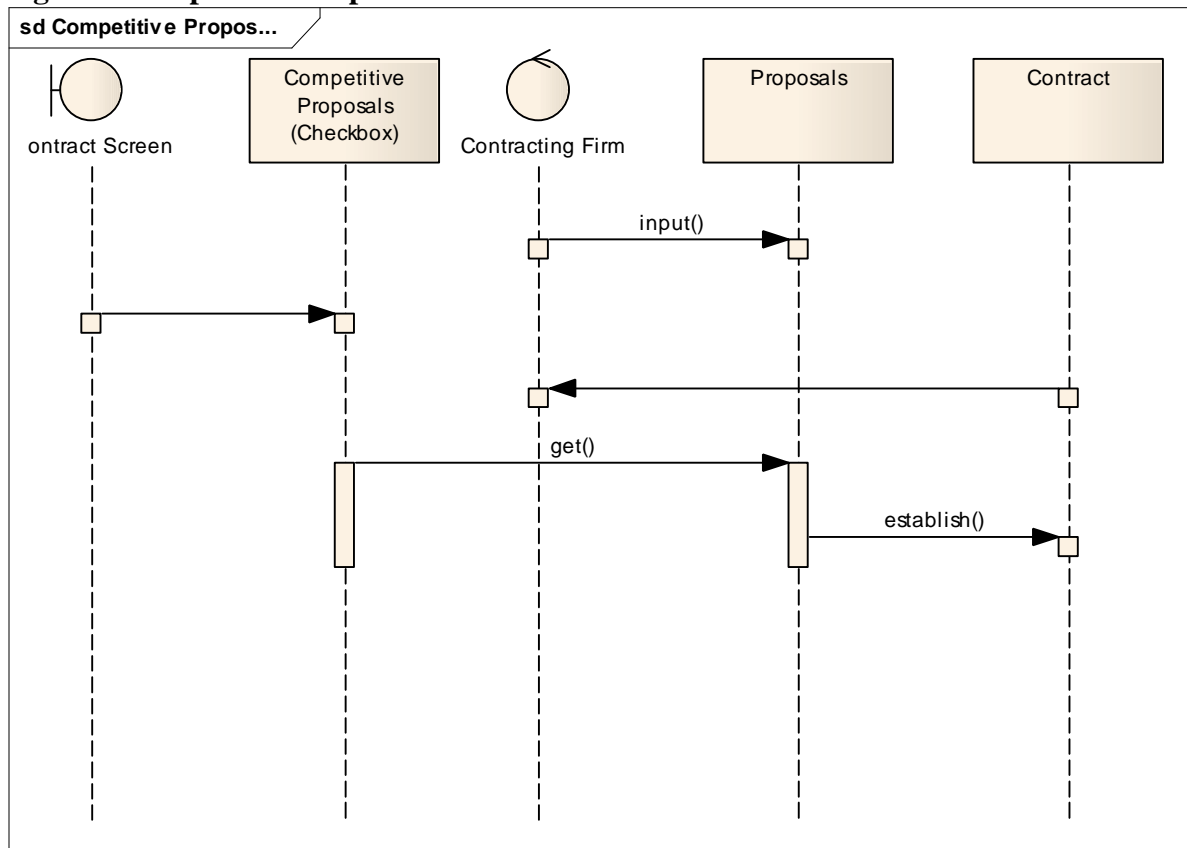
Diagram: Clearance/ Demolition - GEOSPATIAL ENABLEMENT**Diagram: Competitive Proposals**

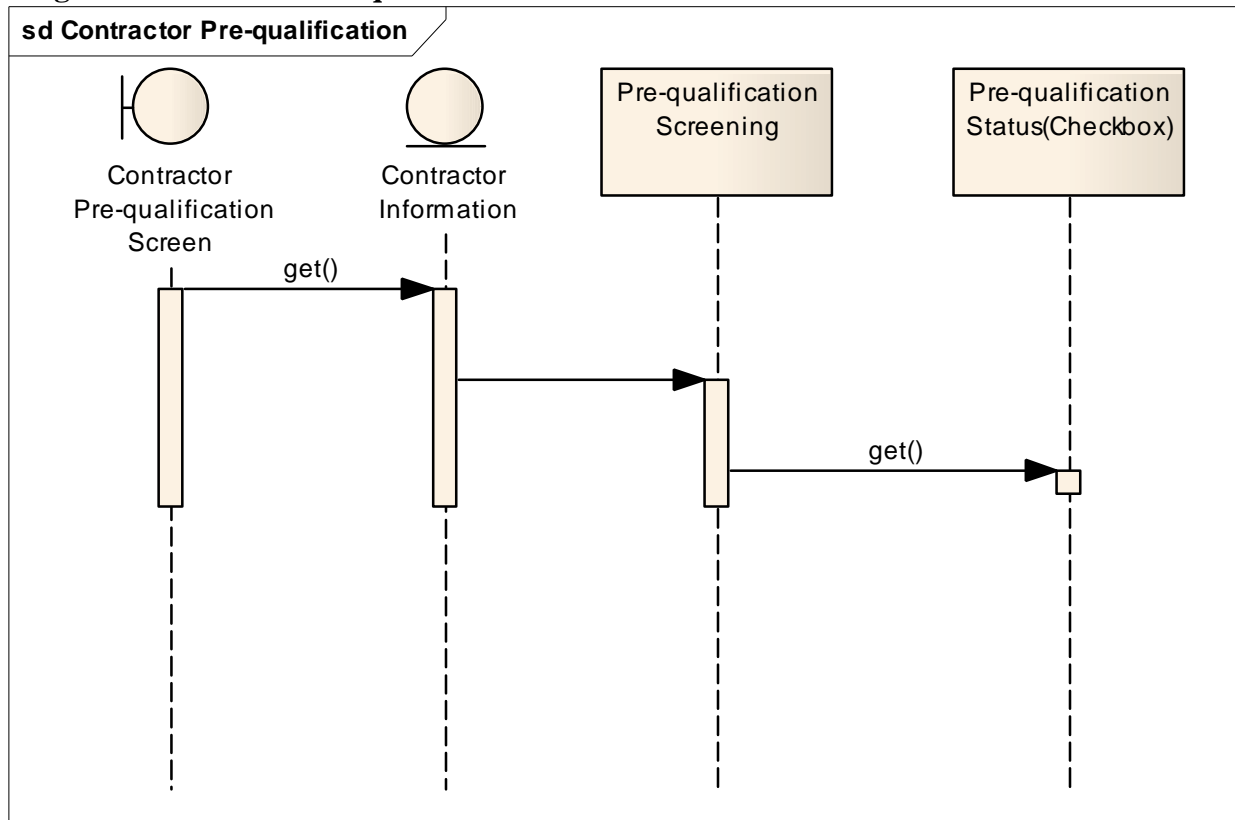
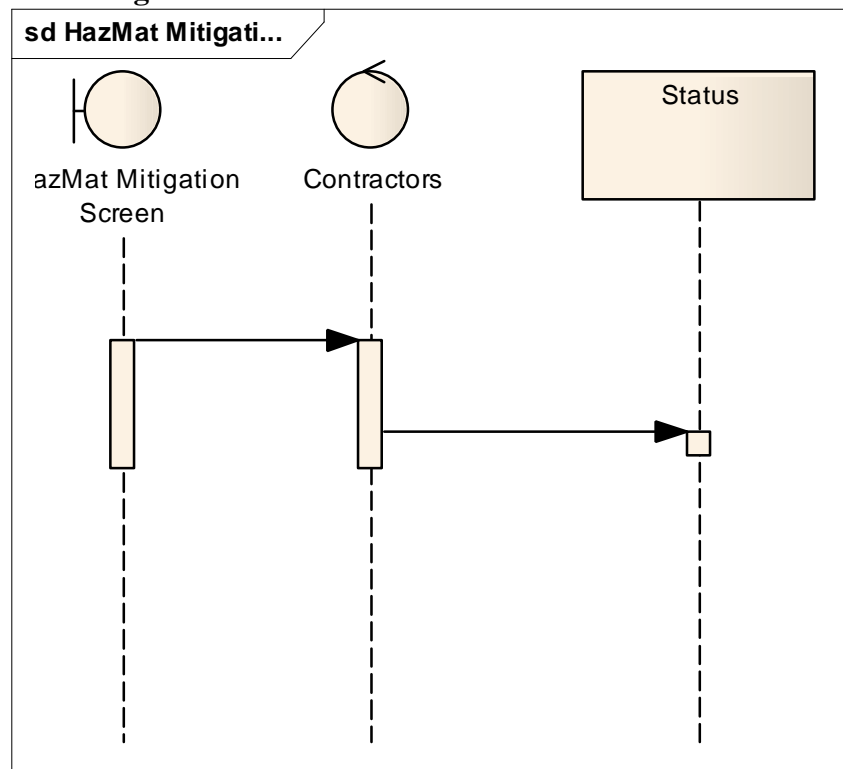
Diagram: Contractor Pre-qualification**Diagram: HazMat Mitigation**

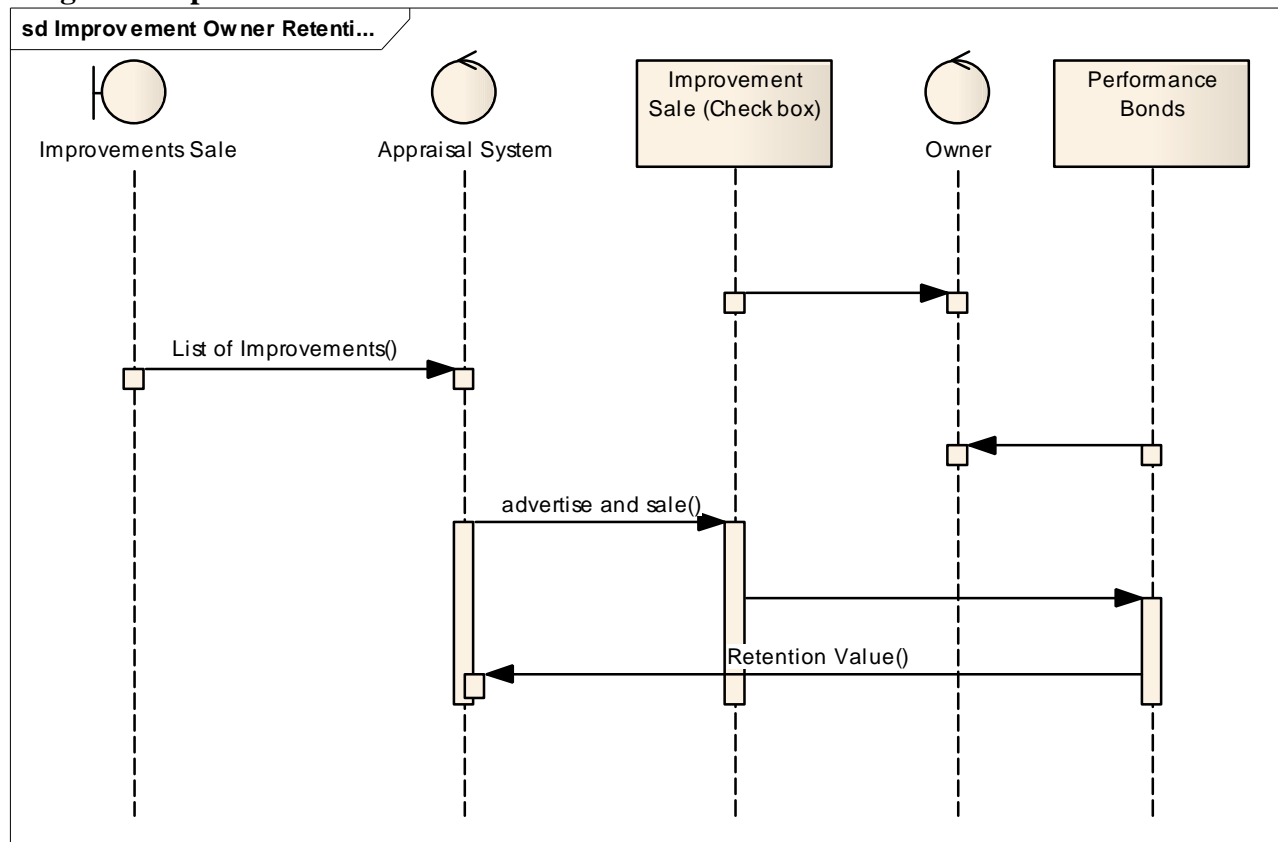
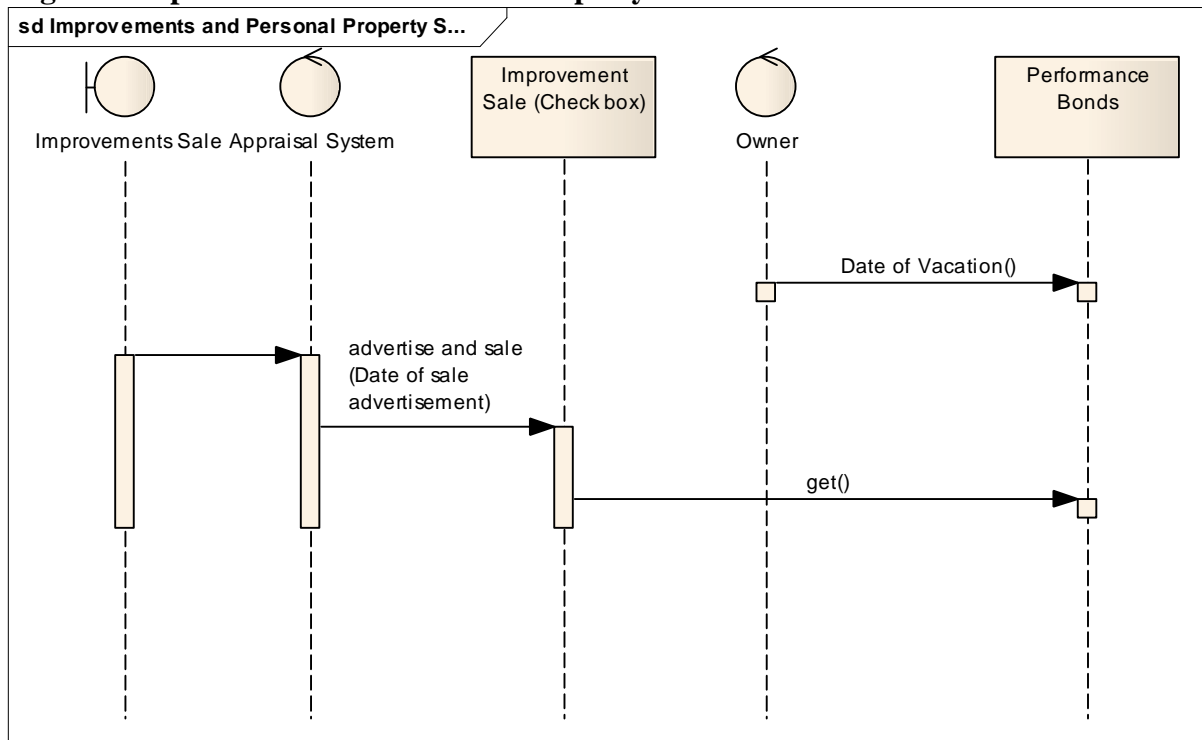
Diagram: Improvement Owner Retention**Diagram: Improvements and Personal Property Sale**

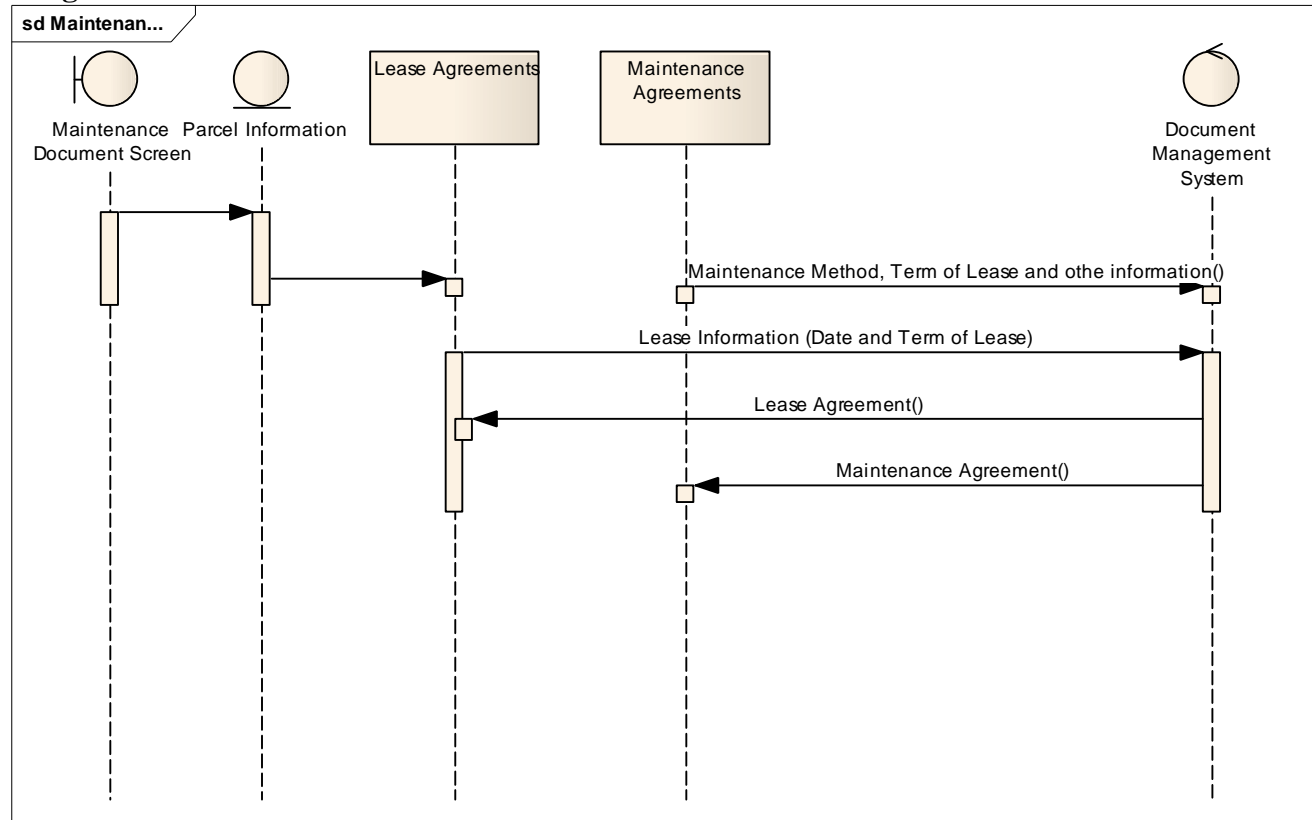
Diagram: Maintenance

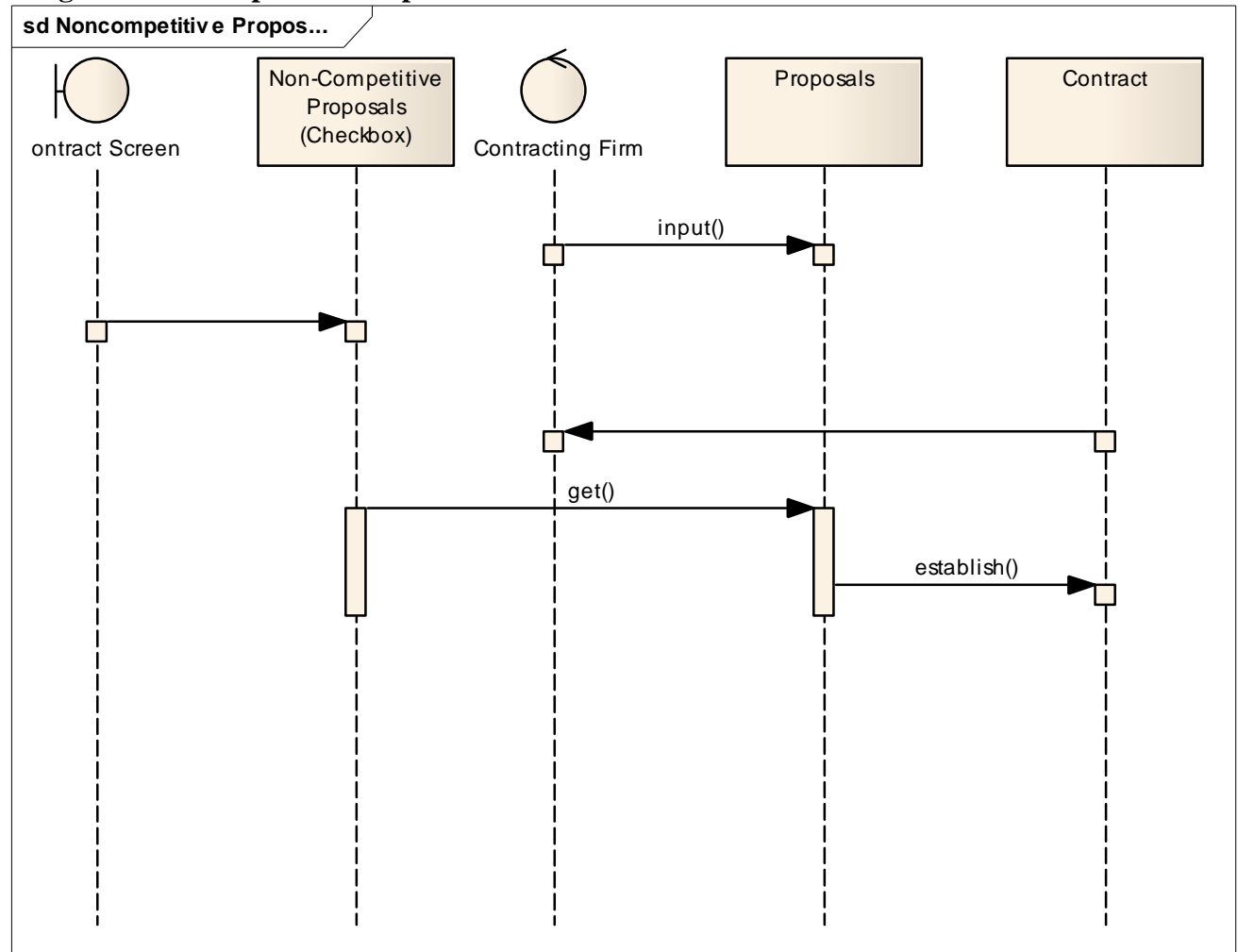
Diagram: Noncompetitive Proposals

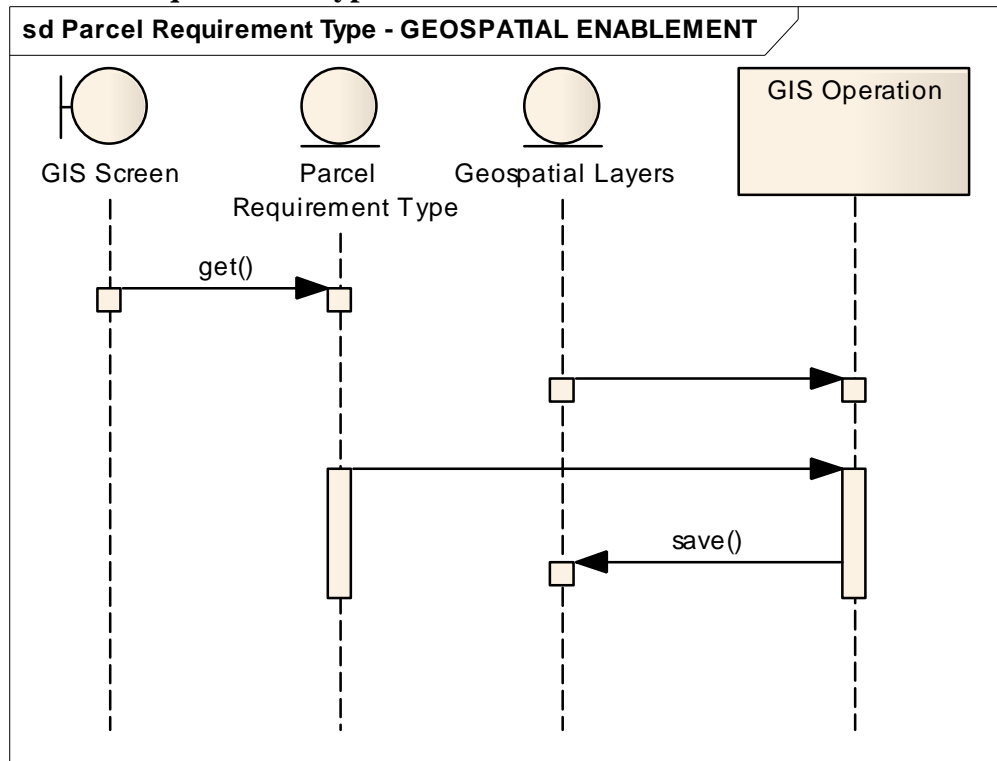
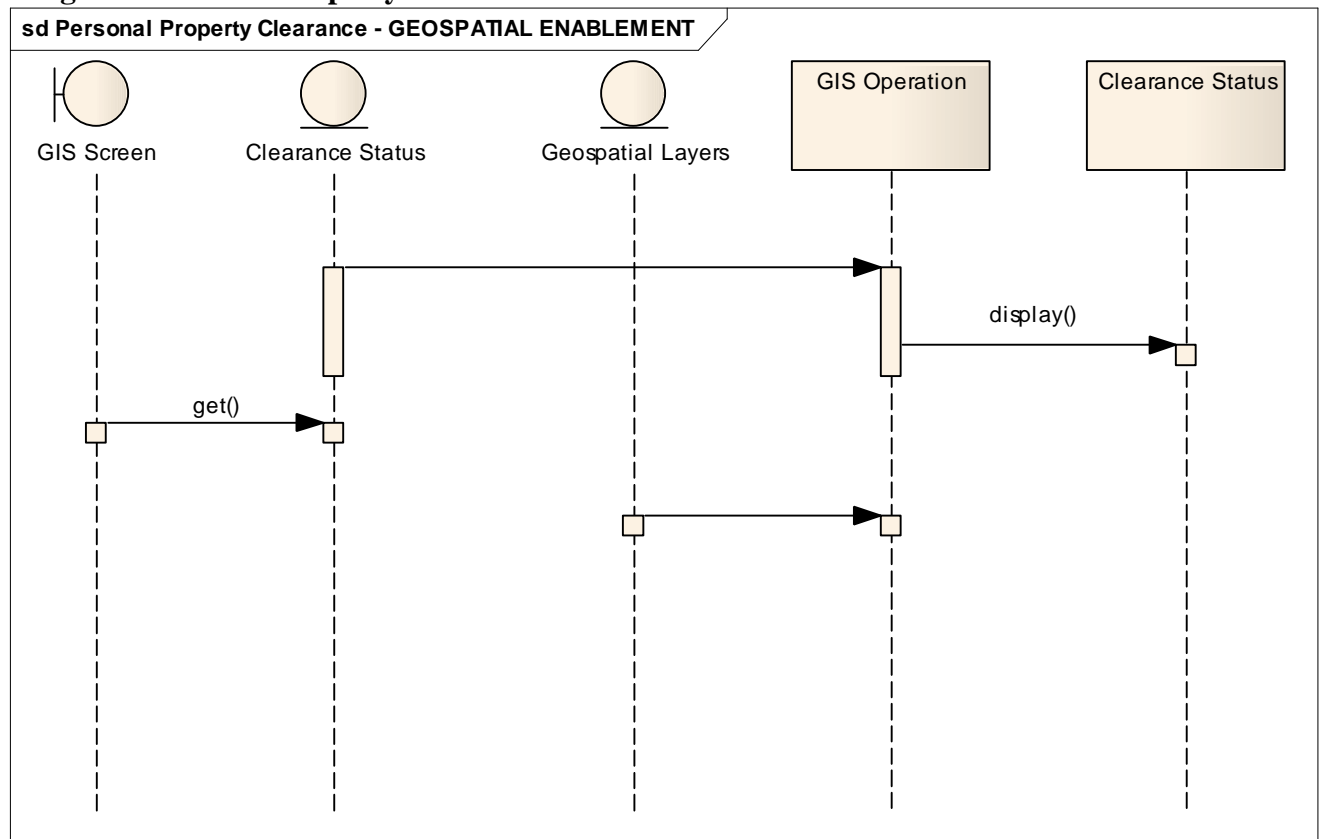
Diagram: Parcel Requirement Type - GEOSPATIAL ENABLEMENT**Diagram: Personal Property Clearance - GEOSPATIAL ENABLEMENT**

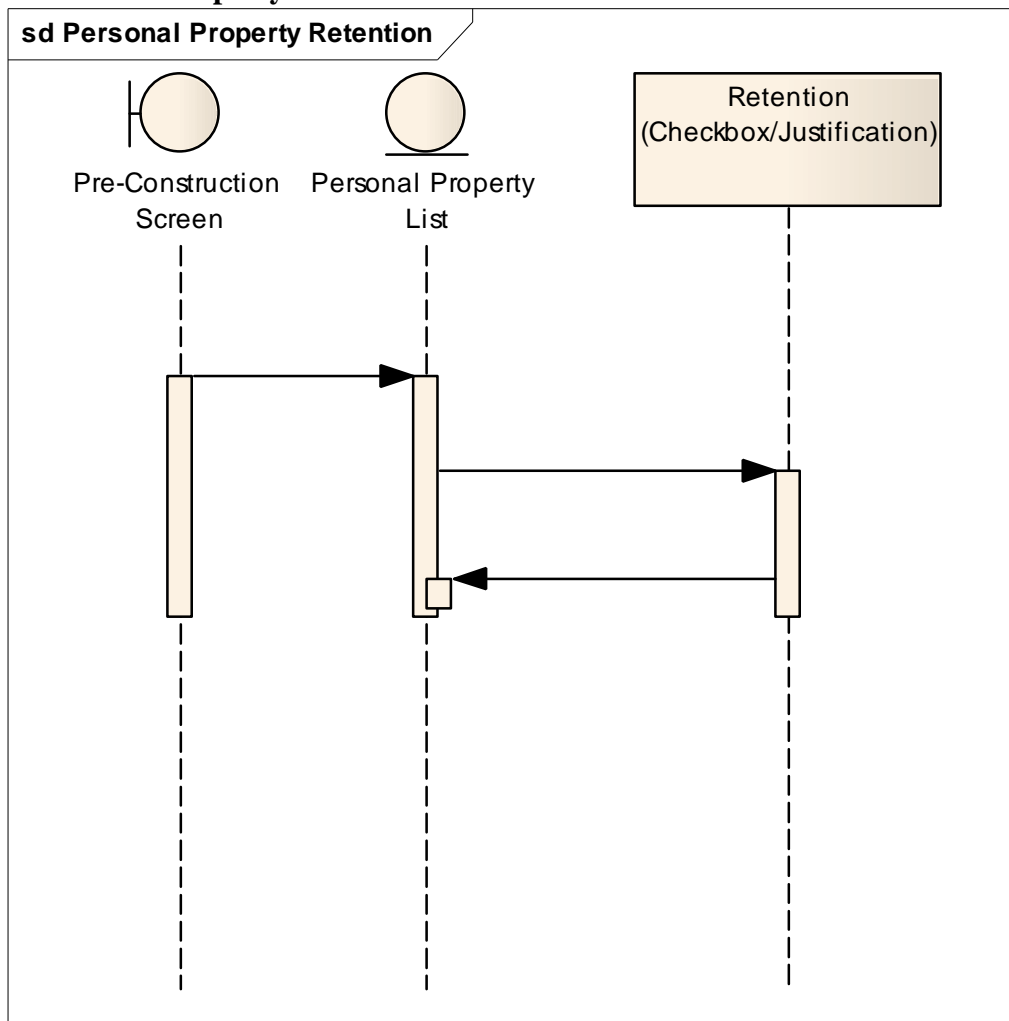
Diagram: Personal Property Retention

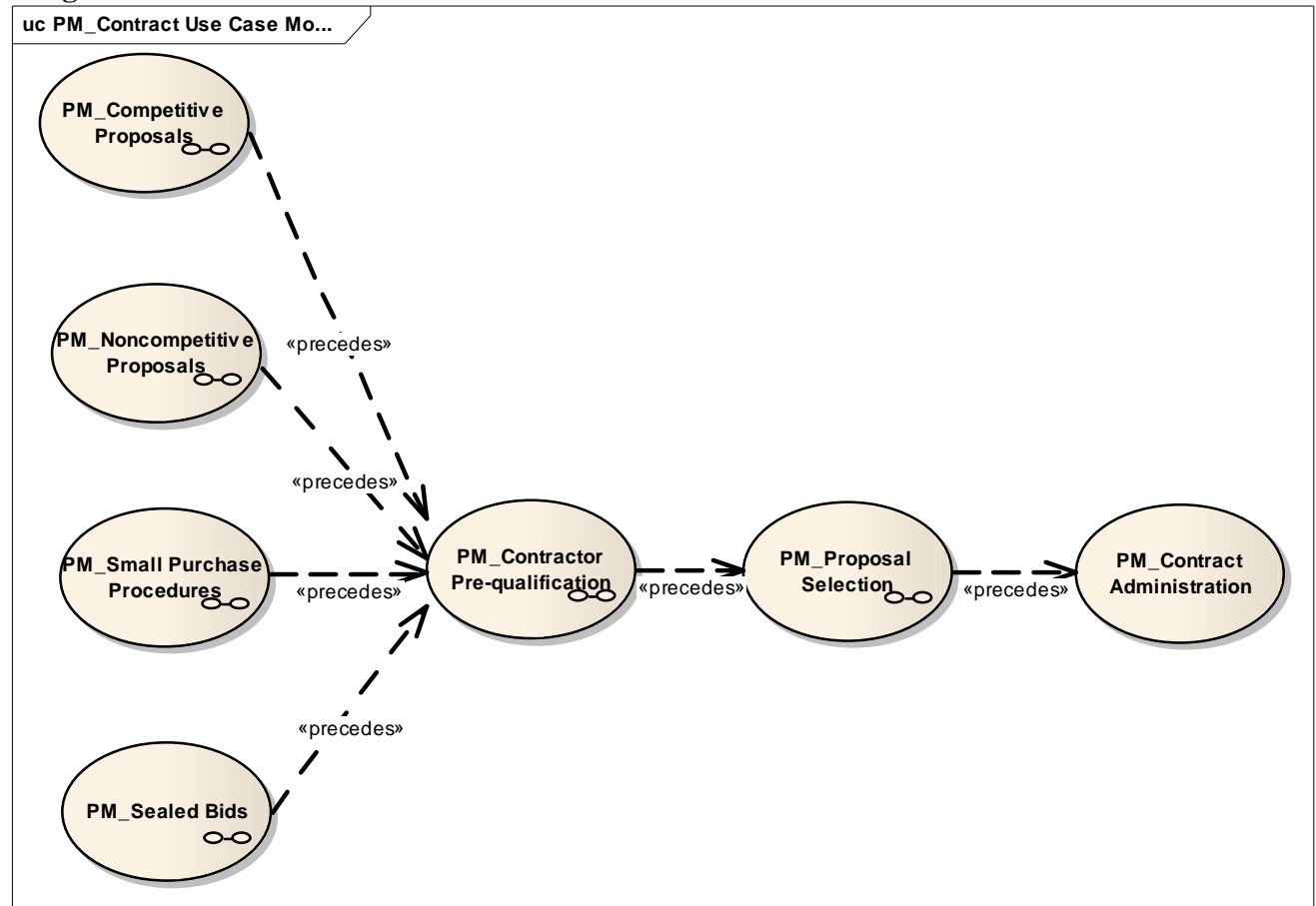
Diagram: PM_Contract Use Case Model

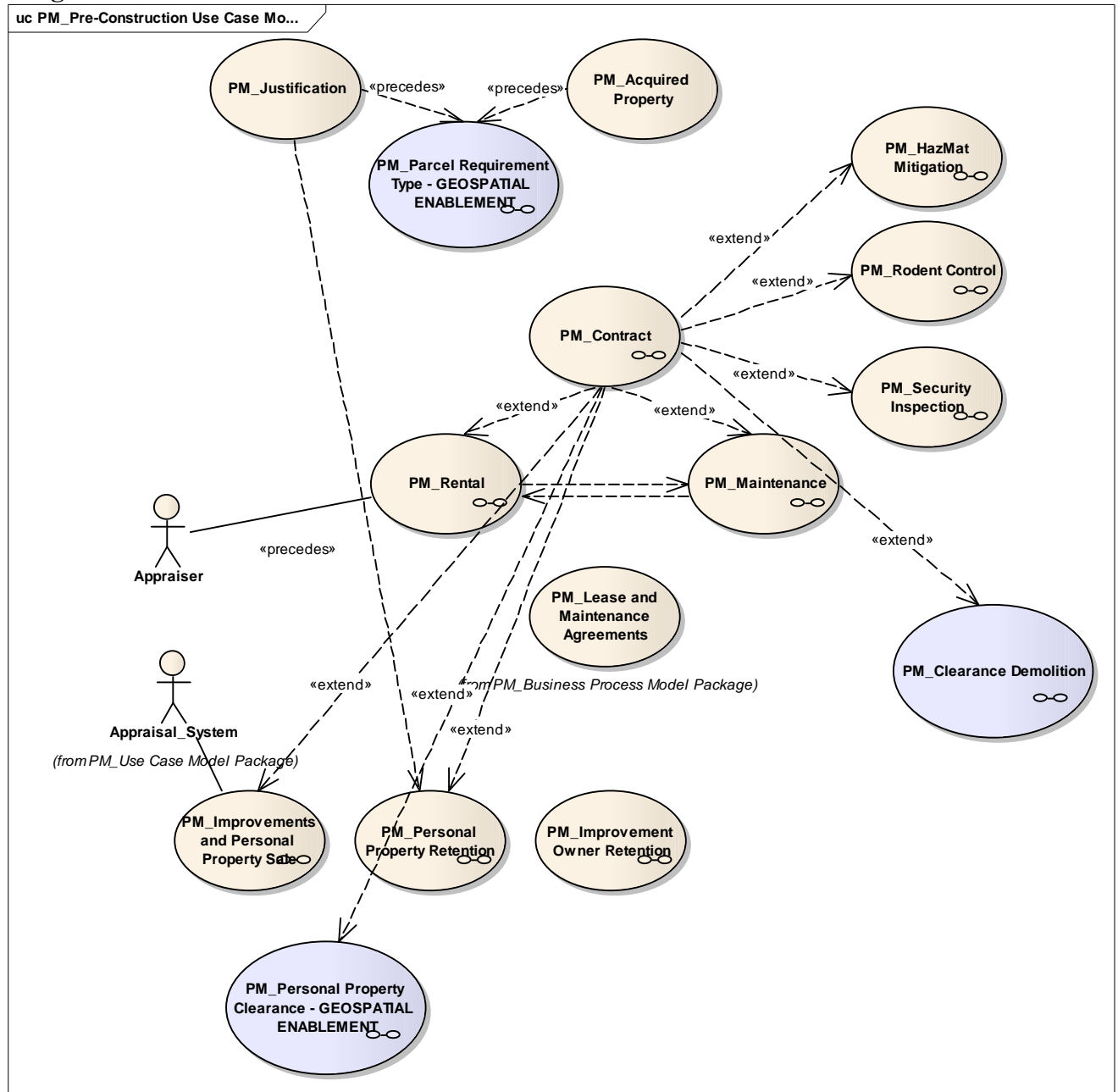
Diagram: PM_Pre-Construction Use Case Model

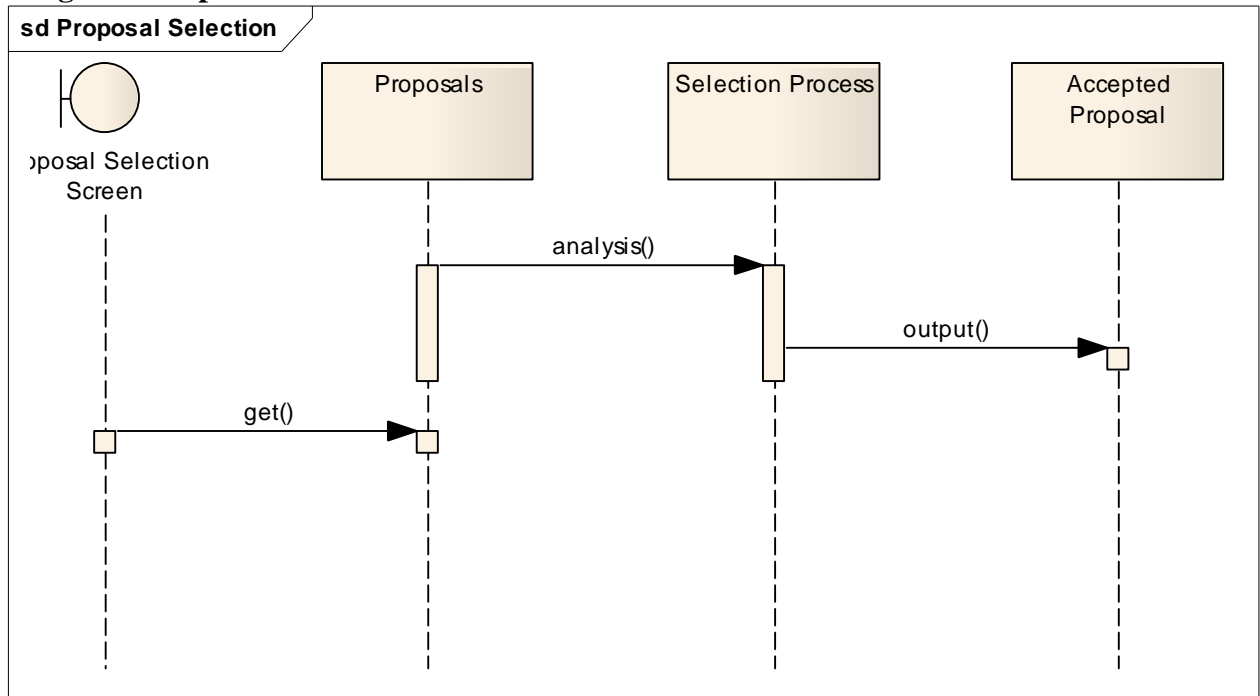
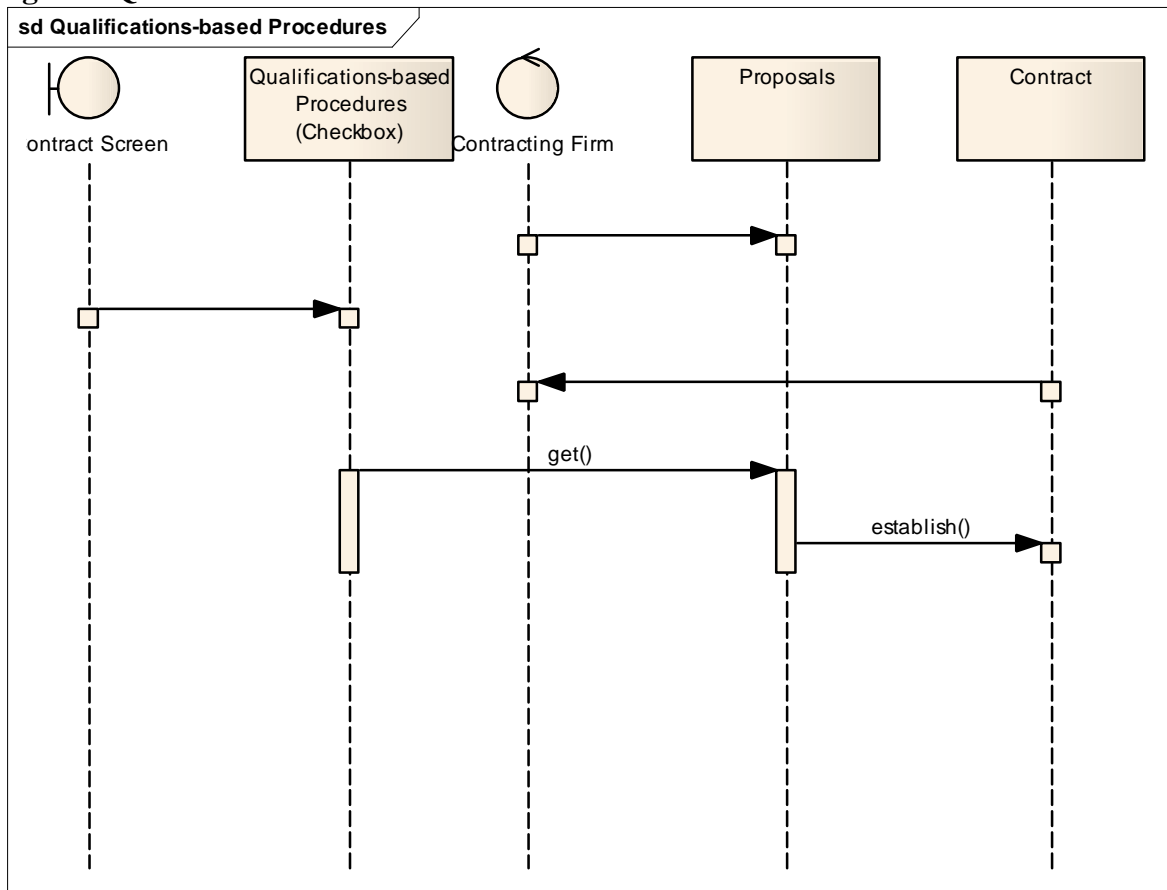
Diagram: Proposal Selection**Diagram: Qualifications-based Procedures**

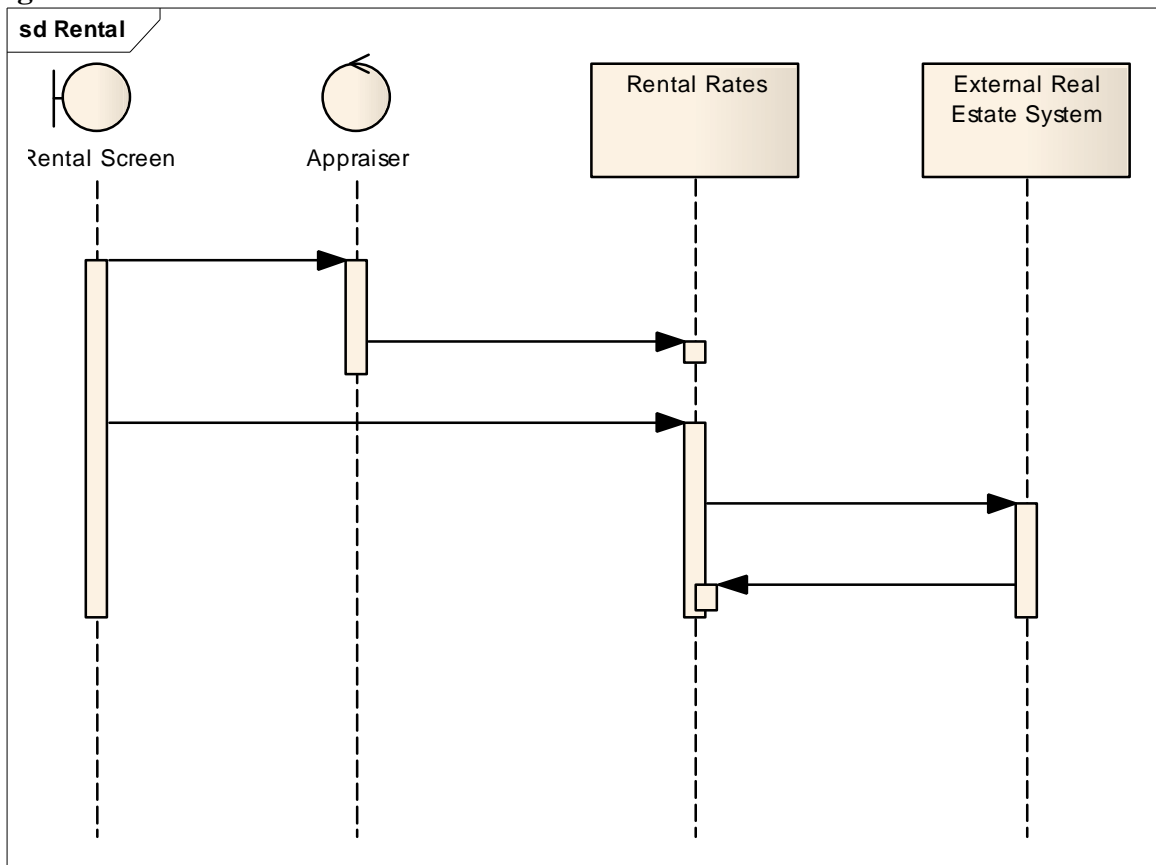
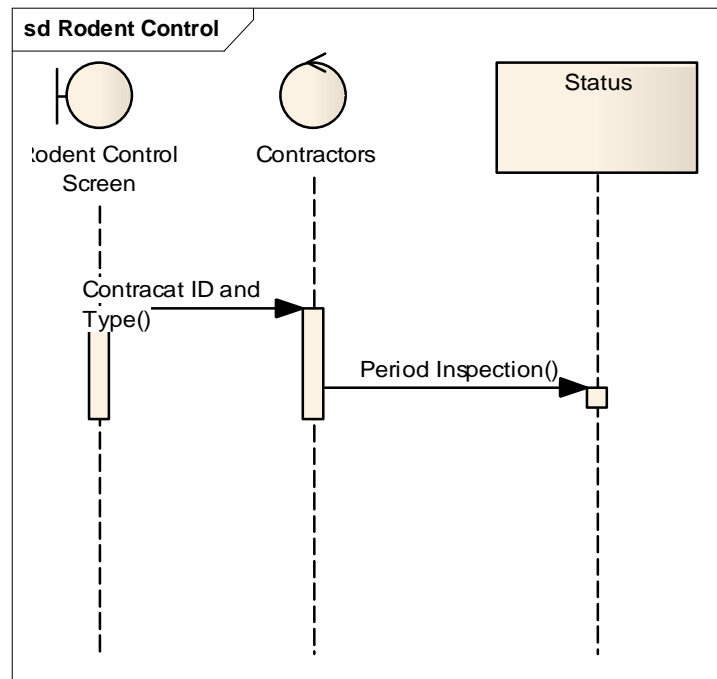
Diagram: Rental**Diagram: Rodent Control**

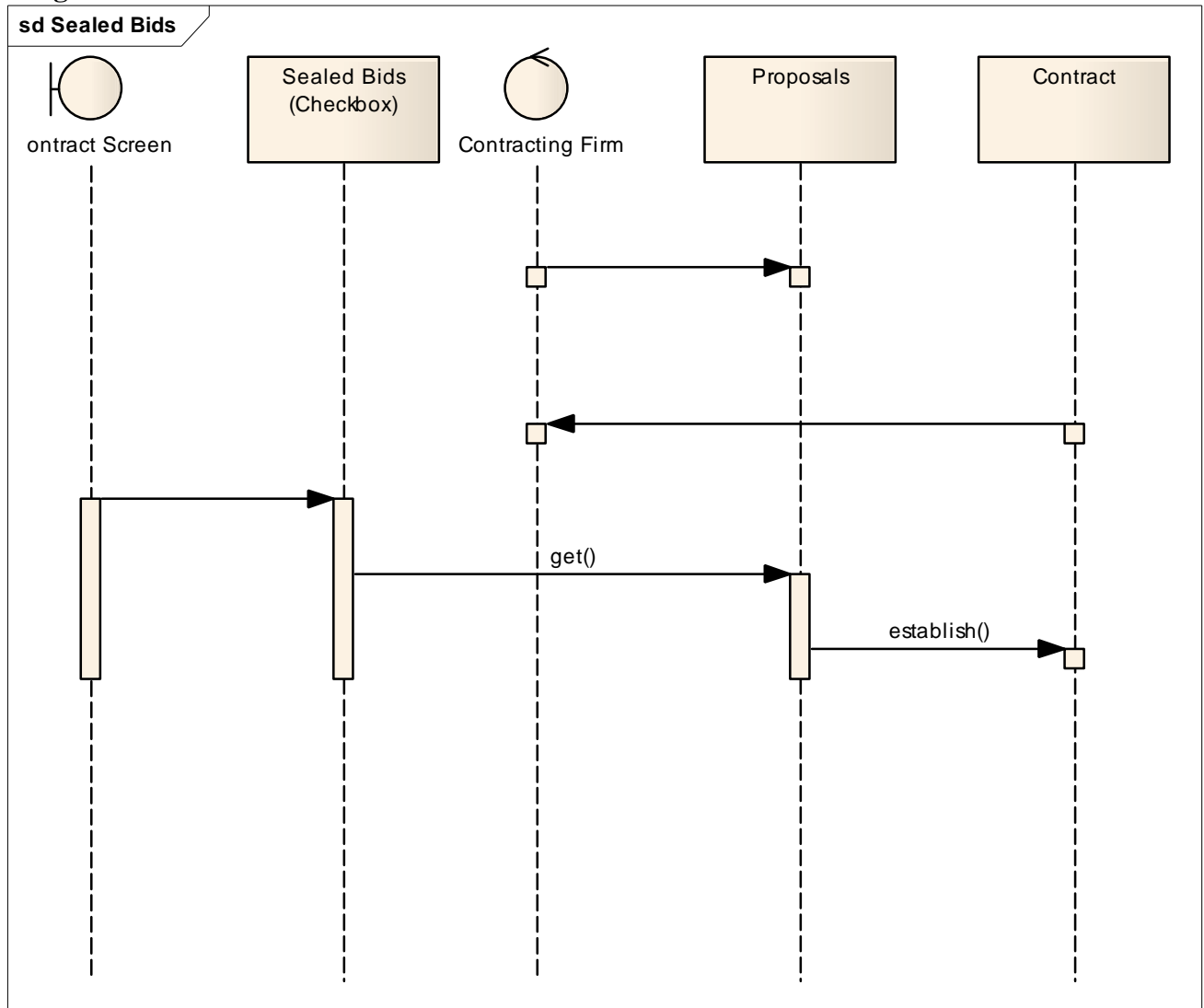
Diagram: Sealed Bids

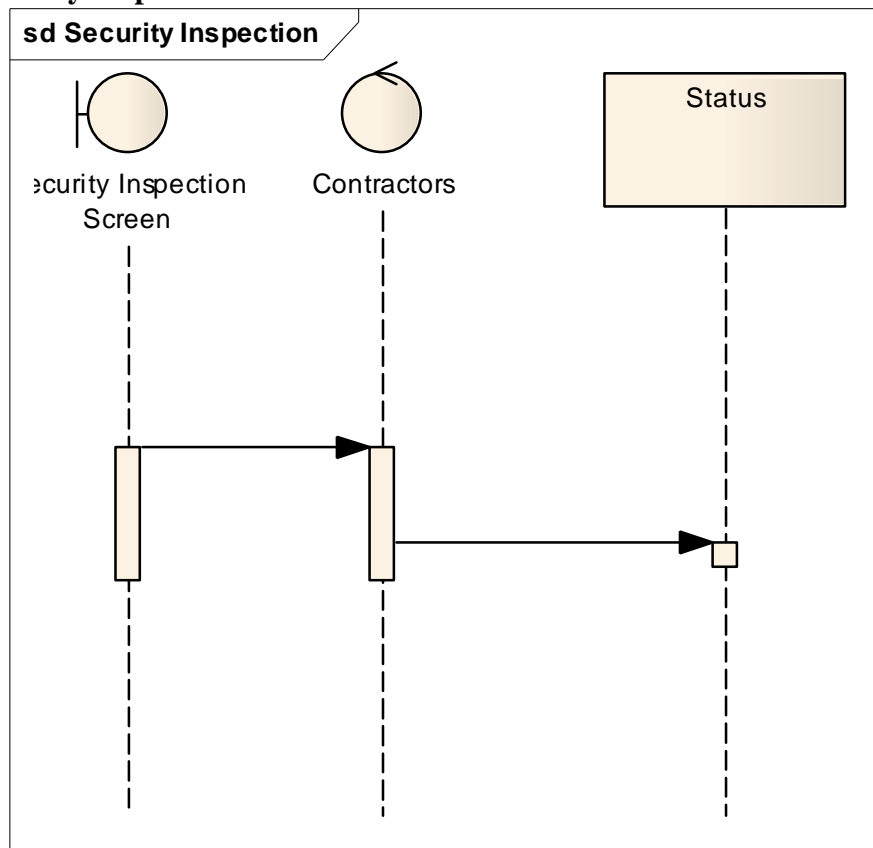
Diagram: Security Inspection

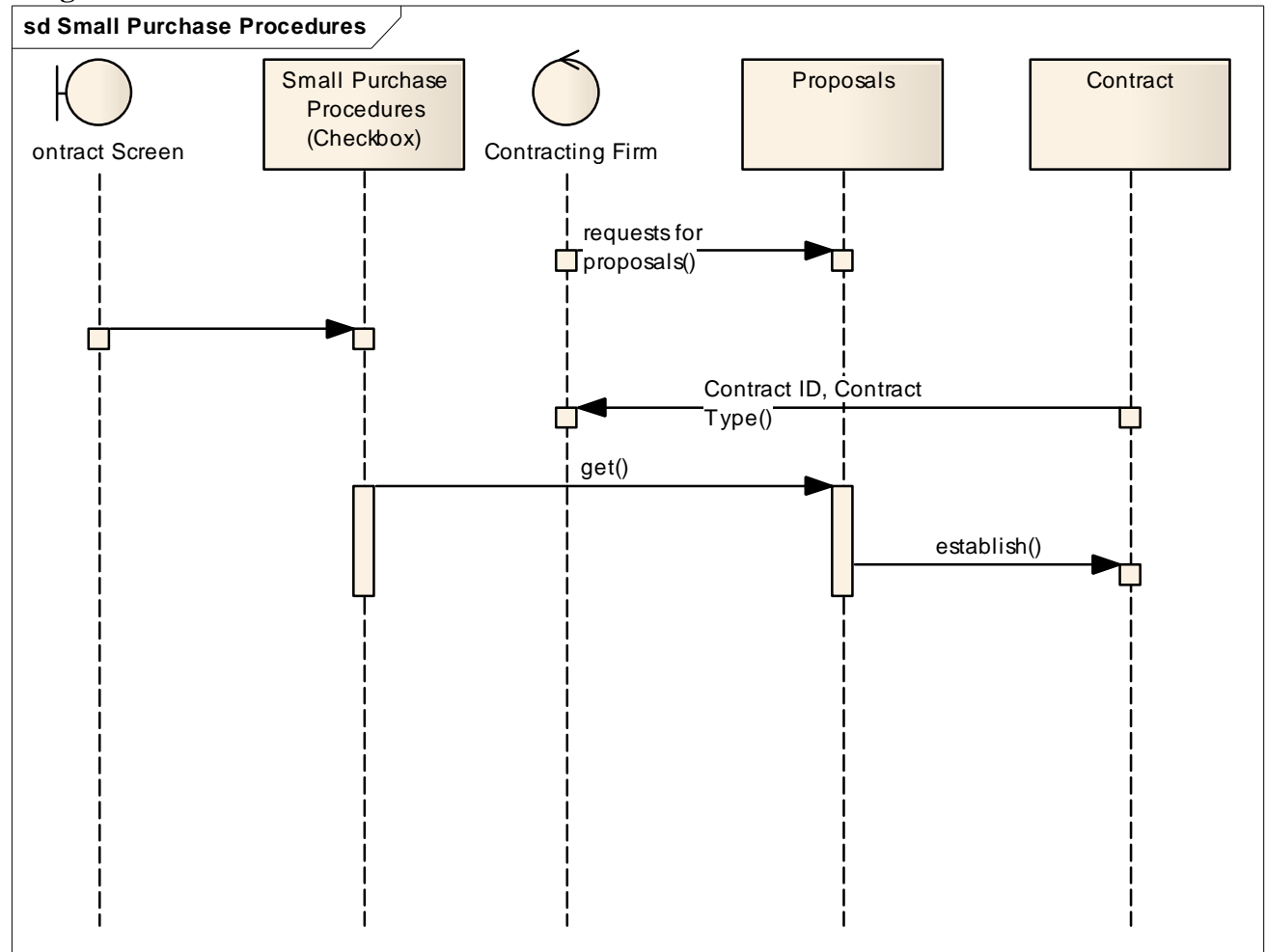
Diagram: Small Purchase Procedures

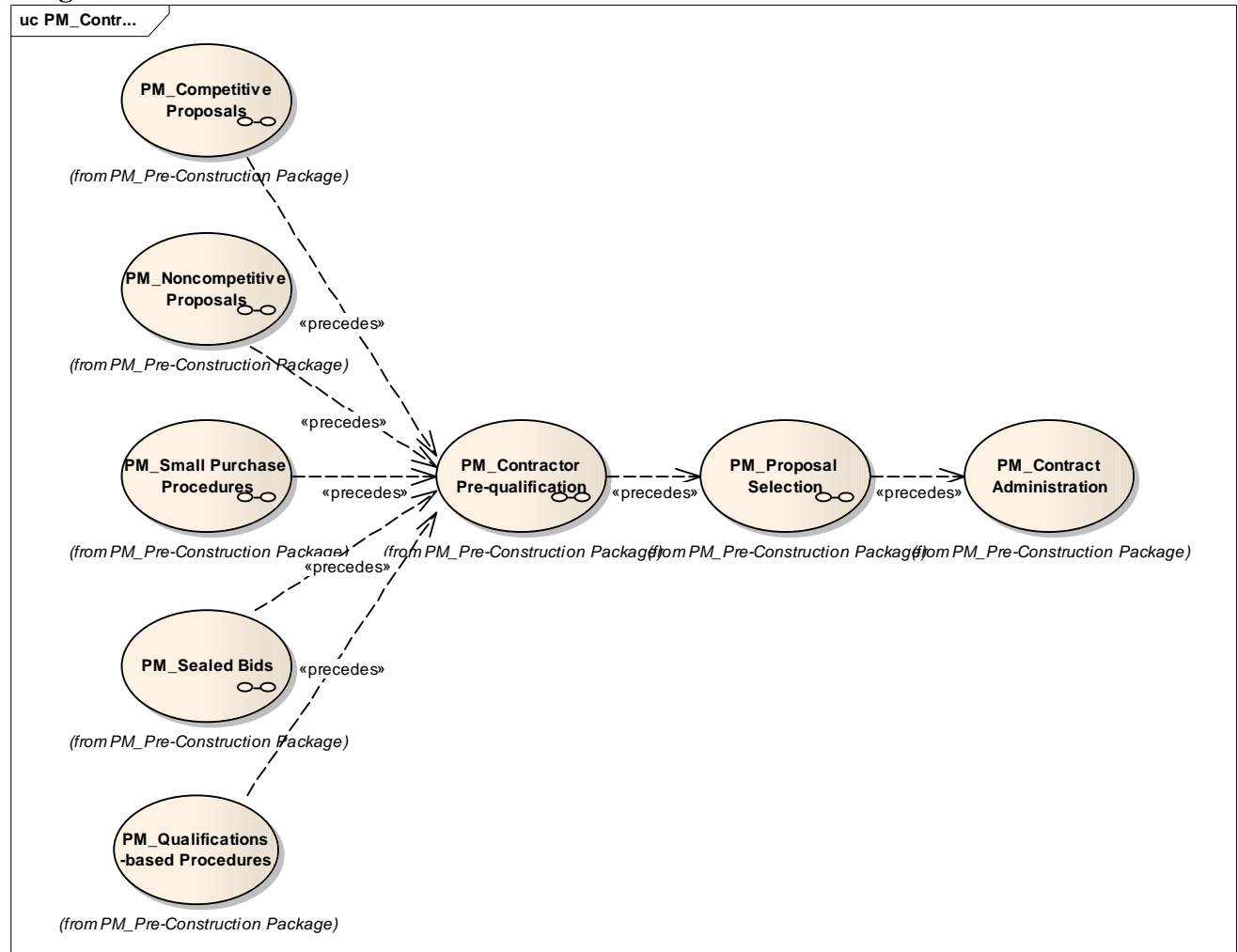
Diagram: PM_Contract

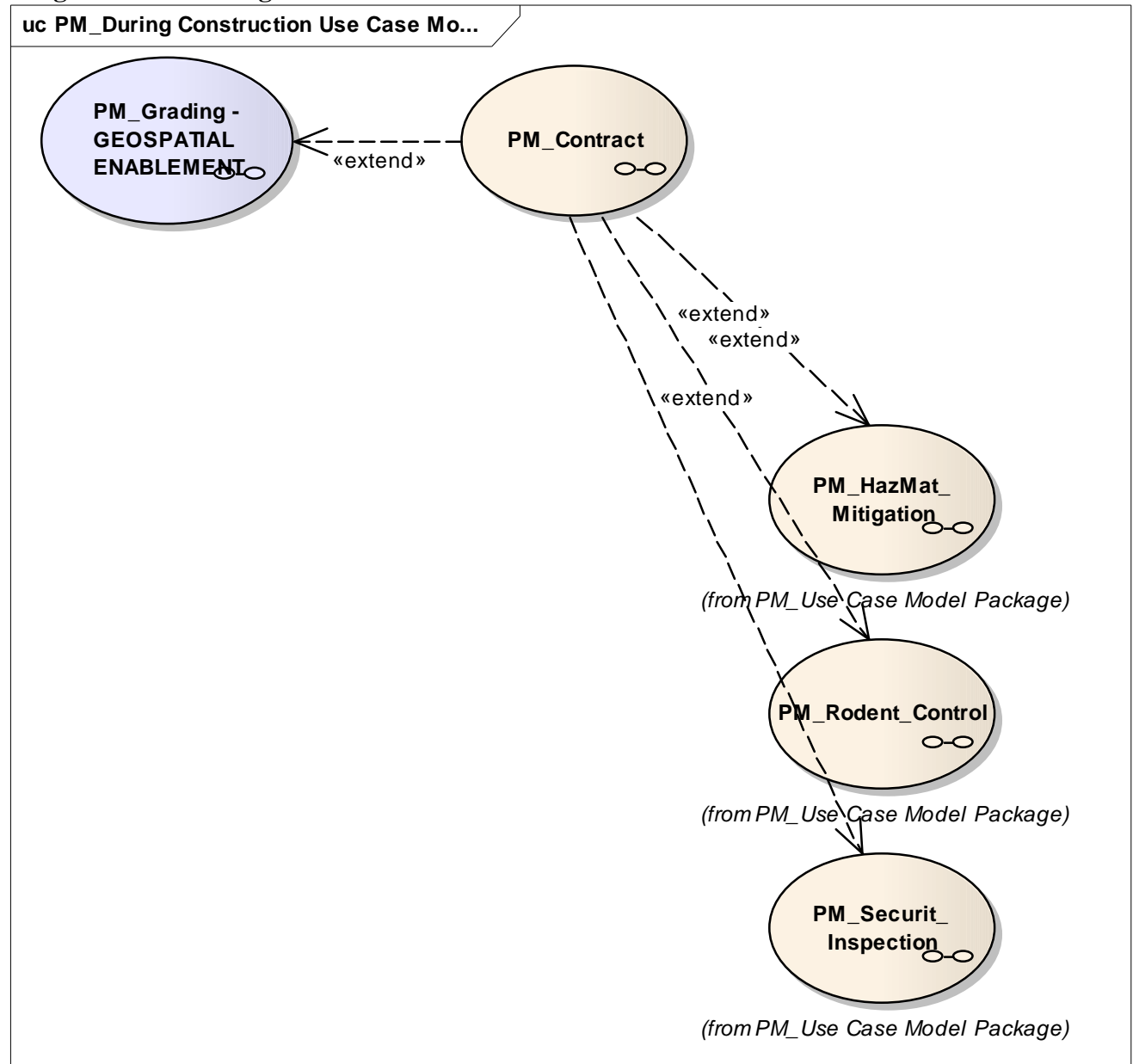
Diagram: PM_During Construction Use Case Model

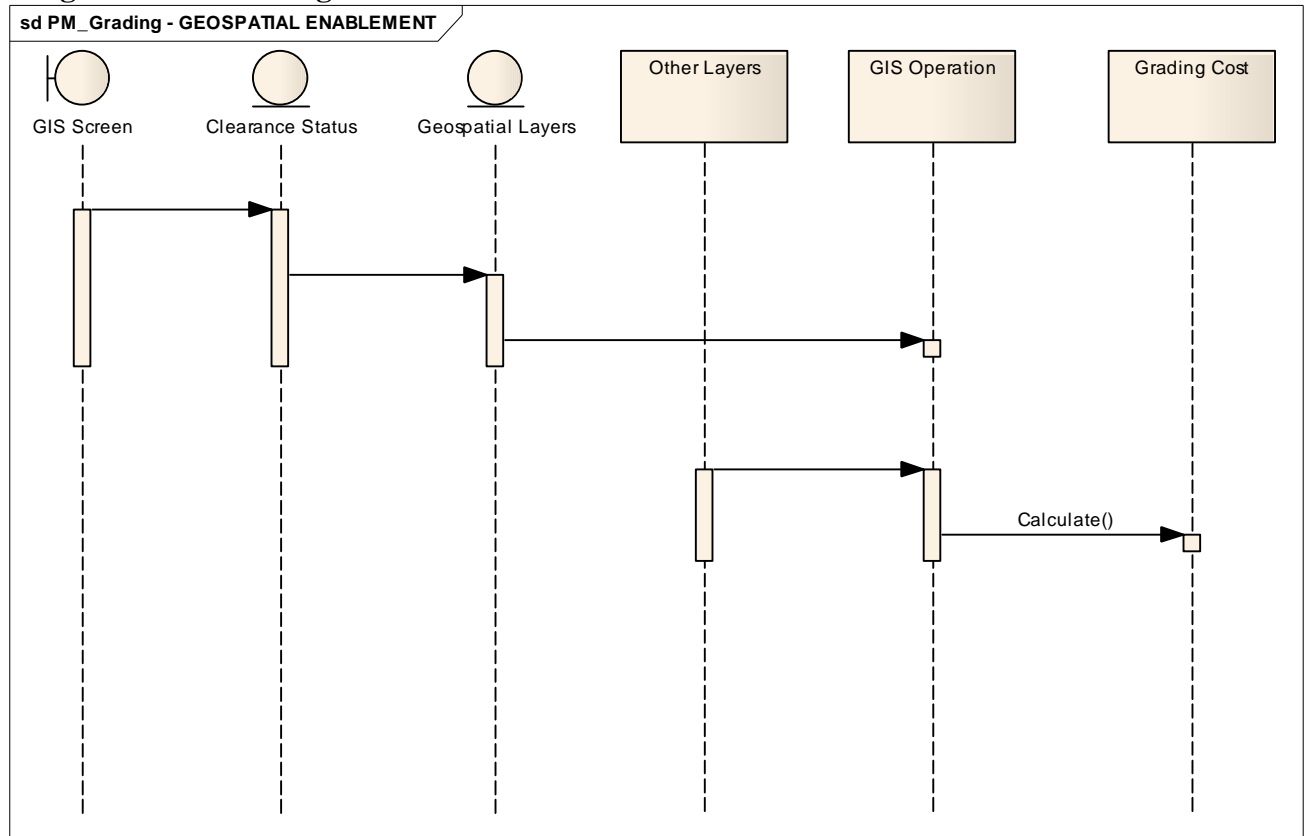
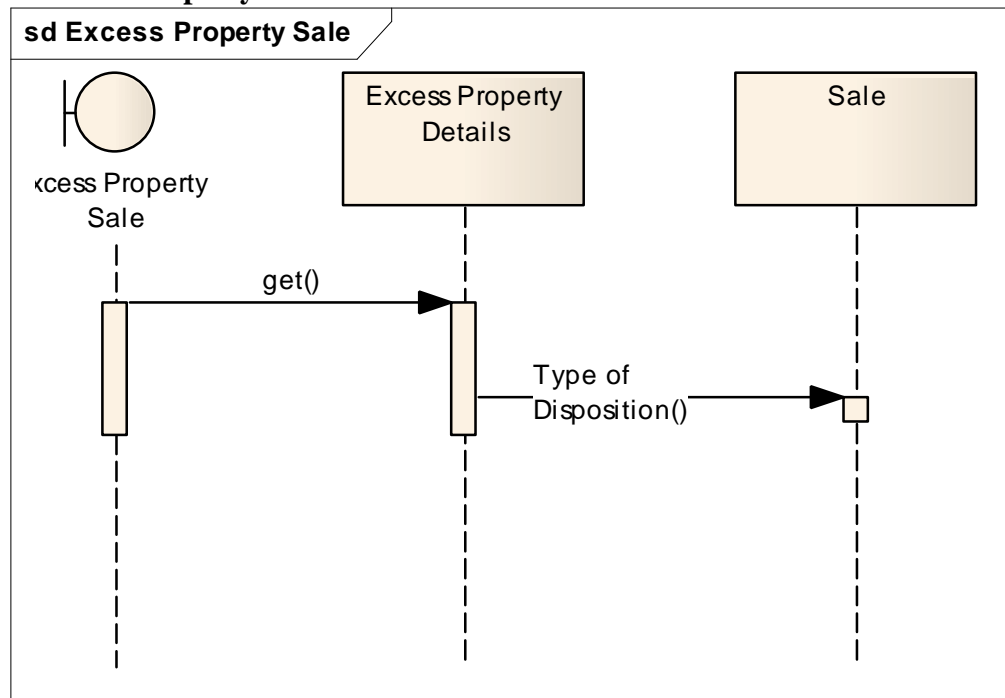
Diagram: PM_Grading - GEOSPATIAL ENABLEMENT**Diagram: Excess Property Sale**

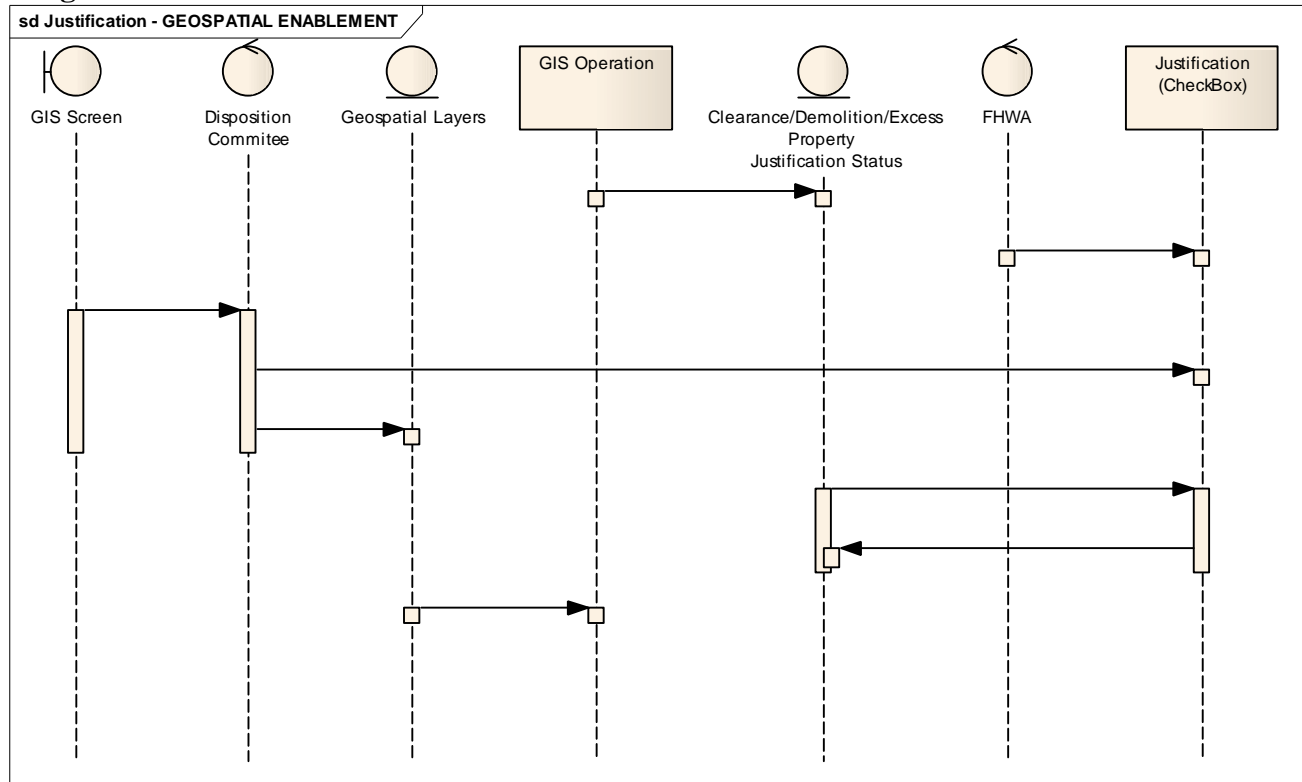
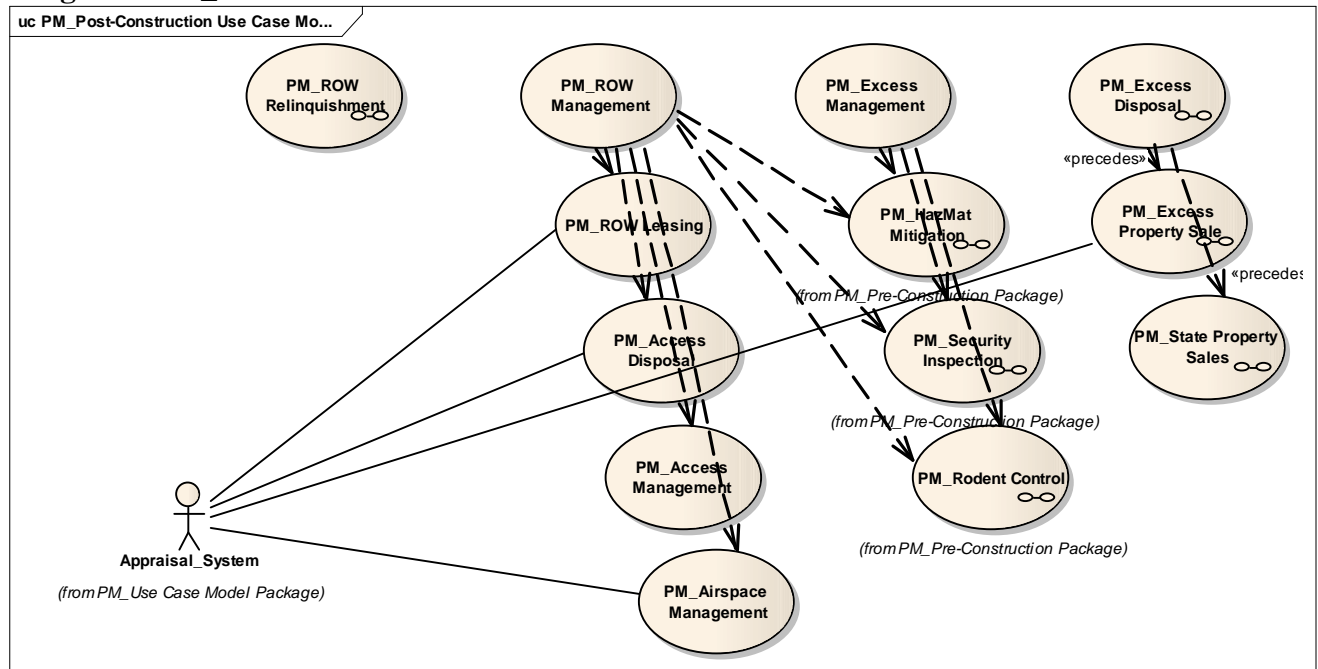
Diagram: Justification - GEOSPATIAL ENABLEMENT**Diagram: PM_Post-Construction Use Case Model**

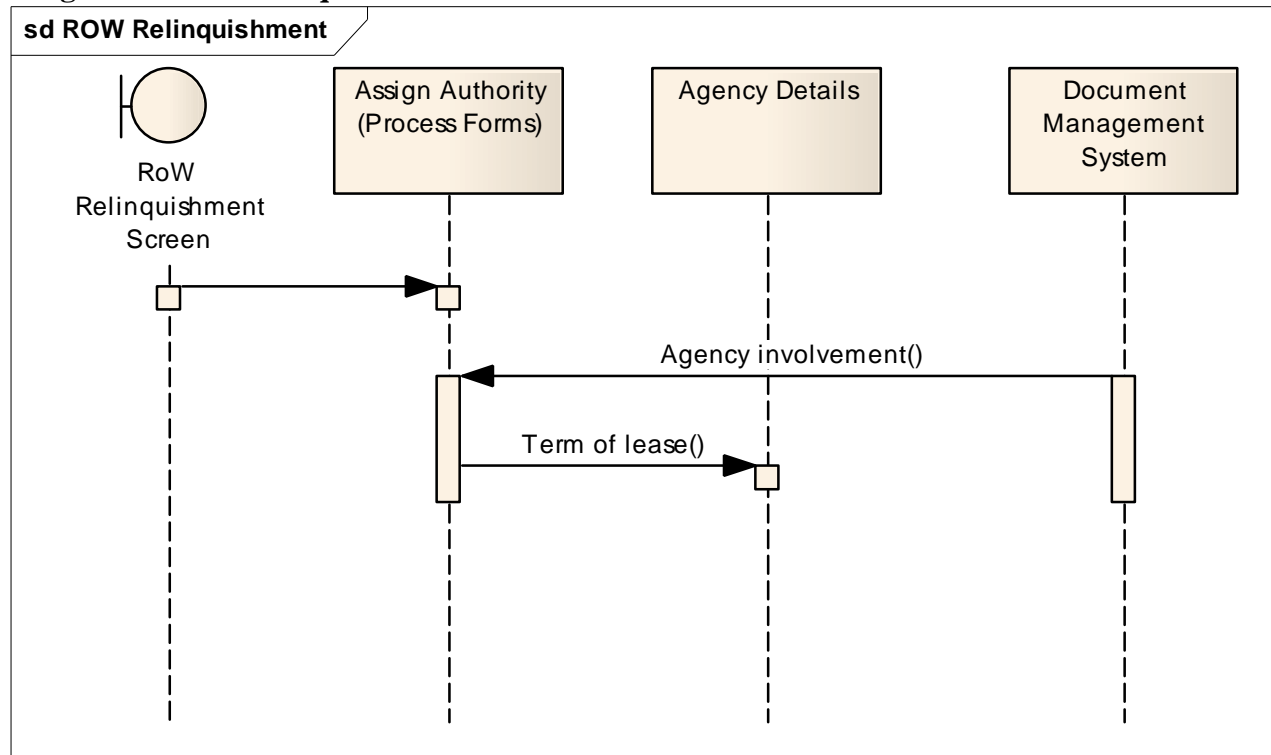
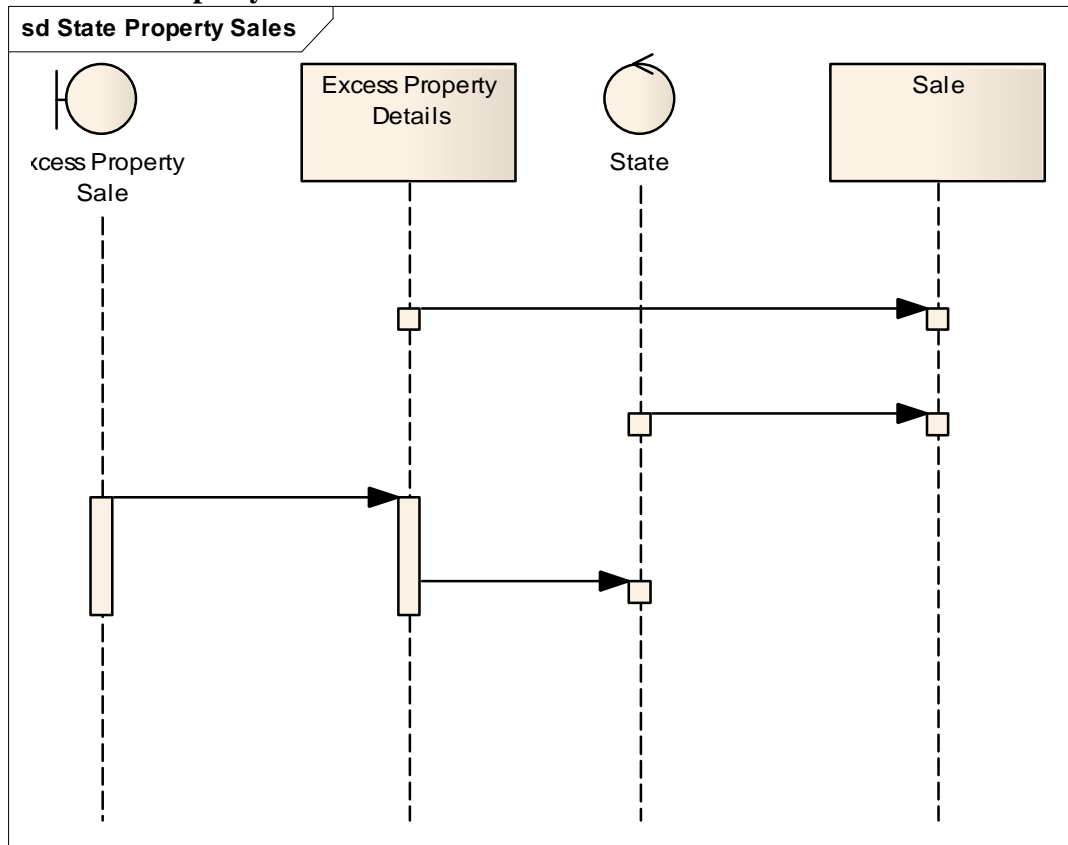
Diagram: ROW Relinquishment**Diagram: State Property Sales**

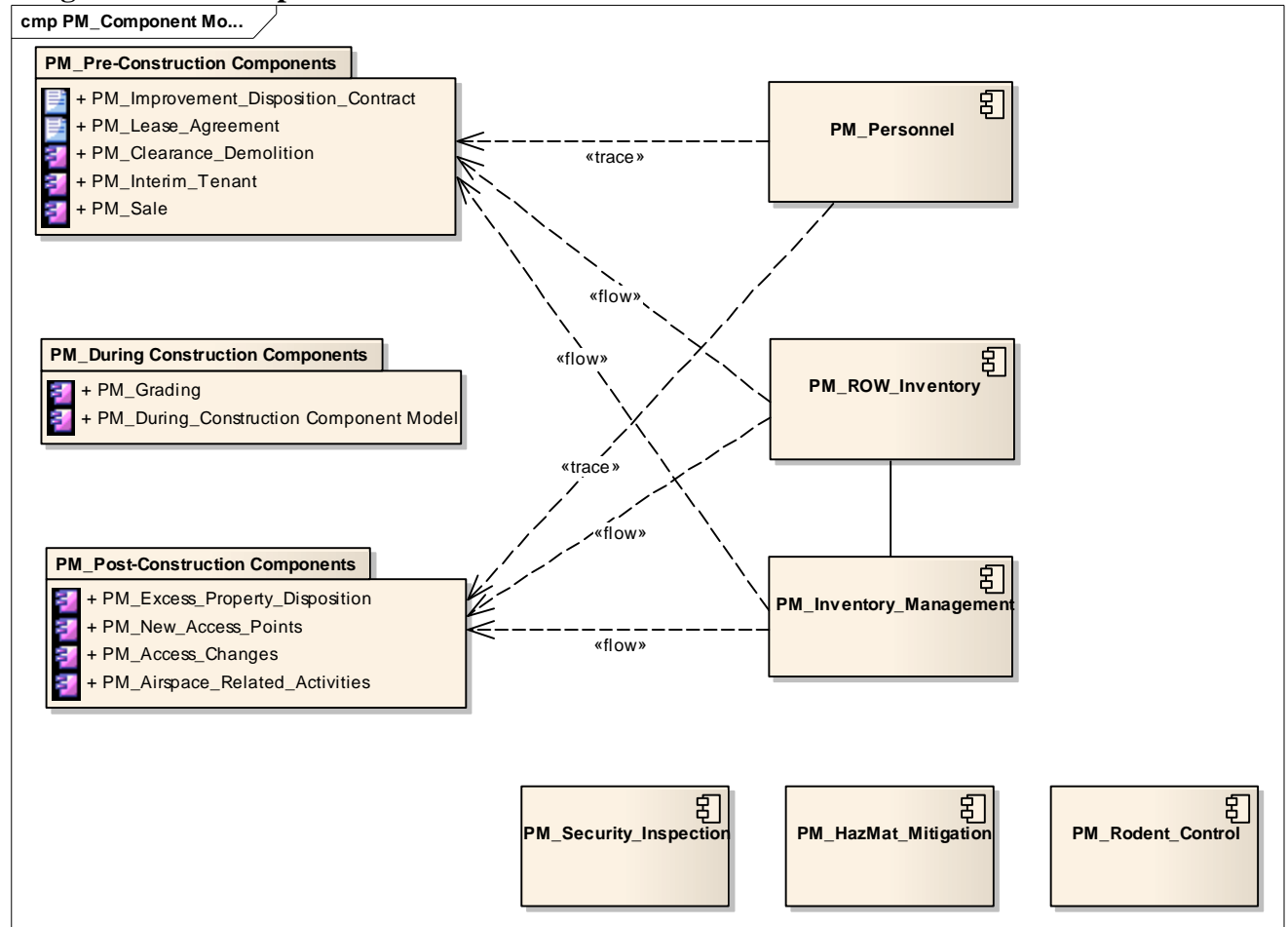
Diagram: PM_Component Model

Diagram: PM_Pre-Construction Component Model

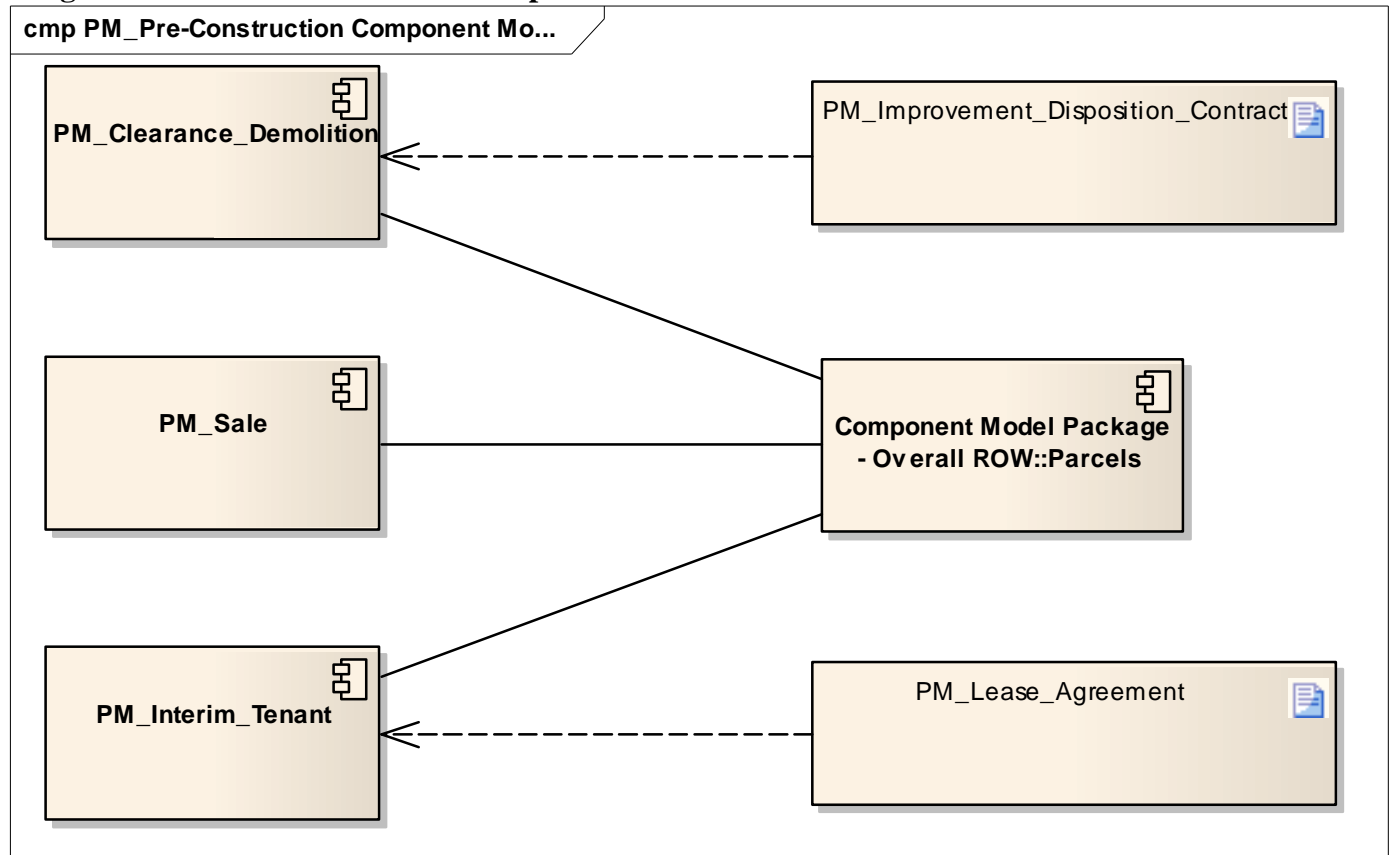


Diagram: PM_During_Construction Component Model

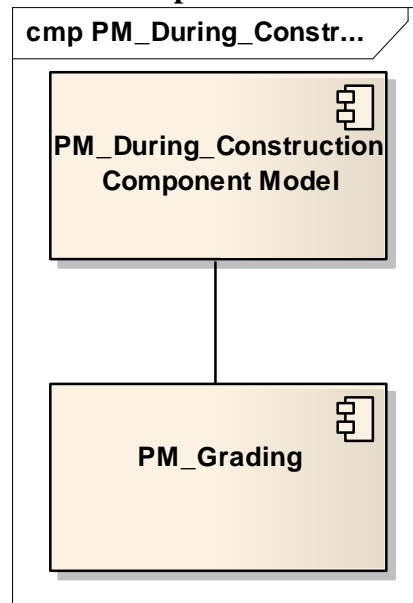


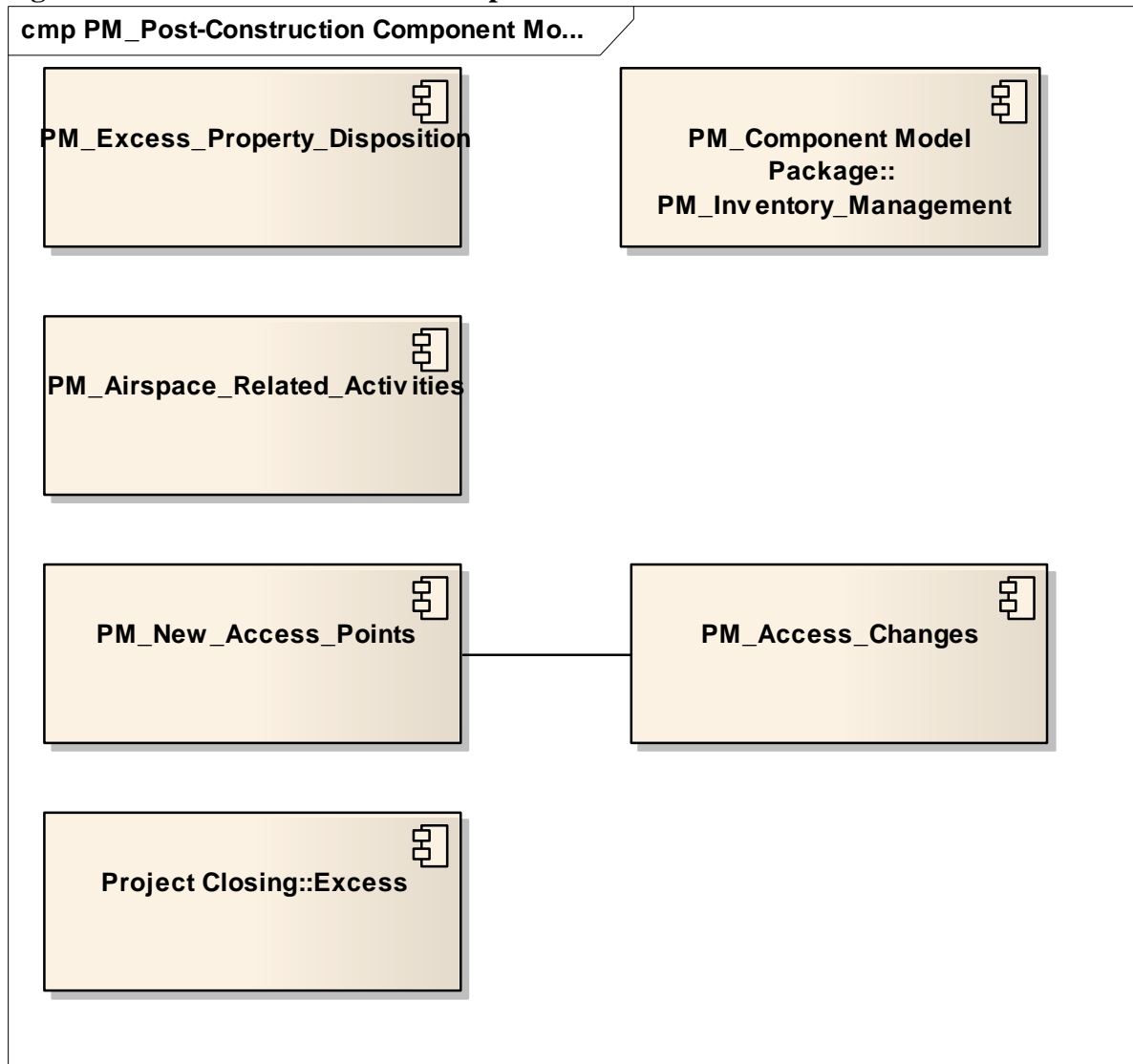
Diagram: PM_Post-Construction Component Model

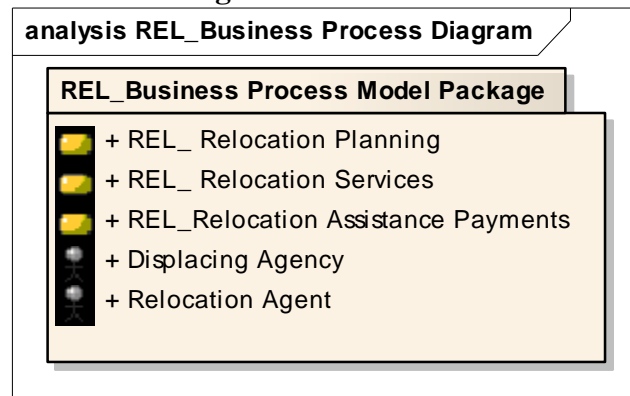
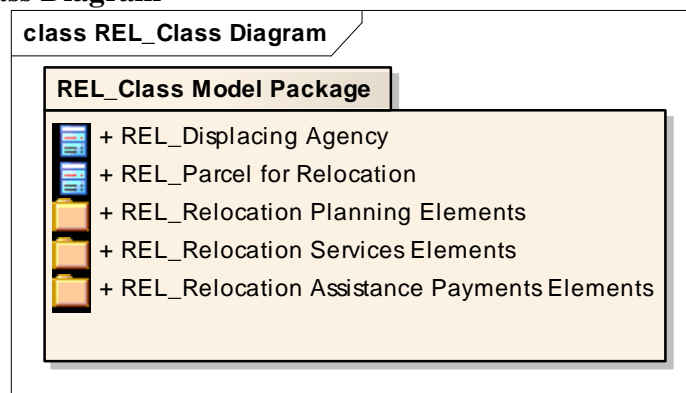
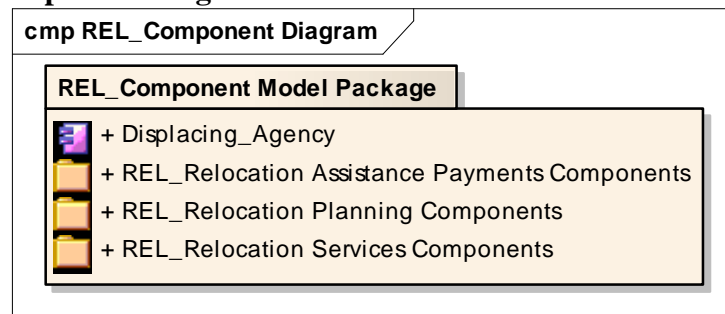
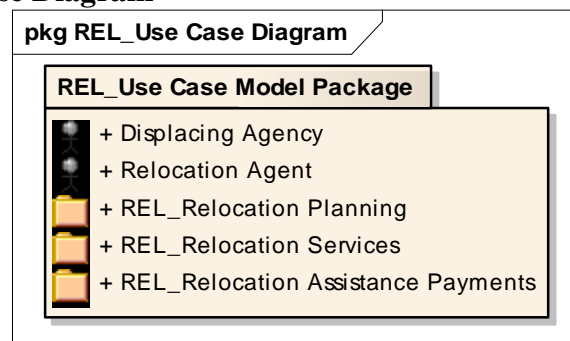
Diagram: REL_Business Process Diagram**Diagram: REL_Class Diagram****Diagram: REL_Component Diagram****Diagram: REL_Use Case Diagram**

Diagram: REL_Business Process Model

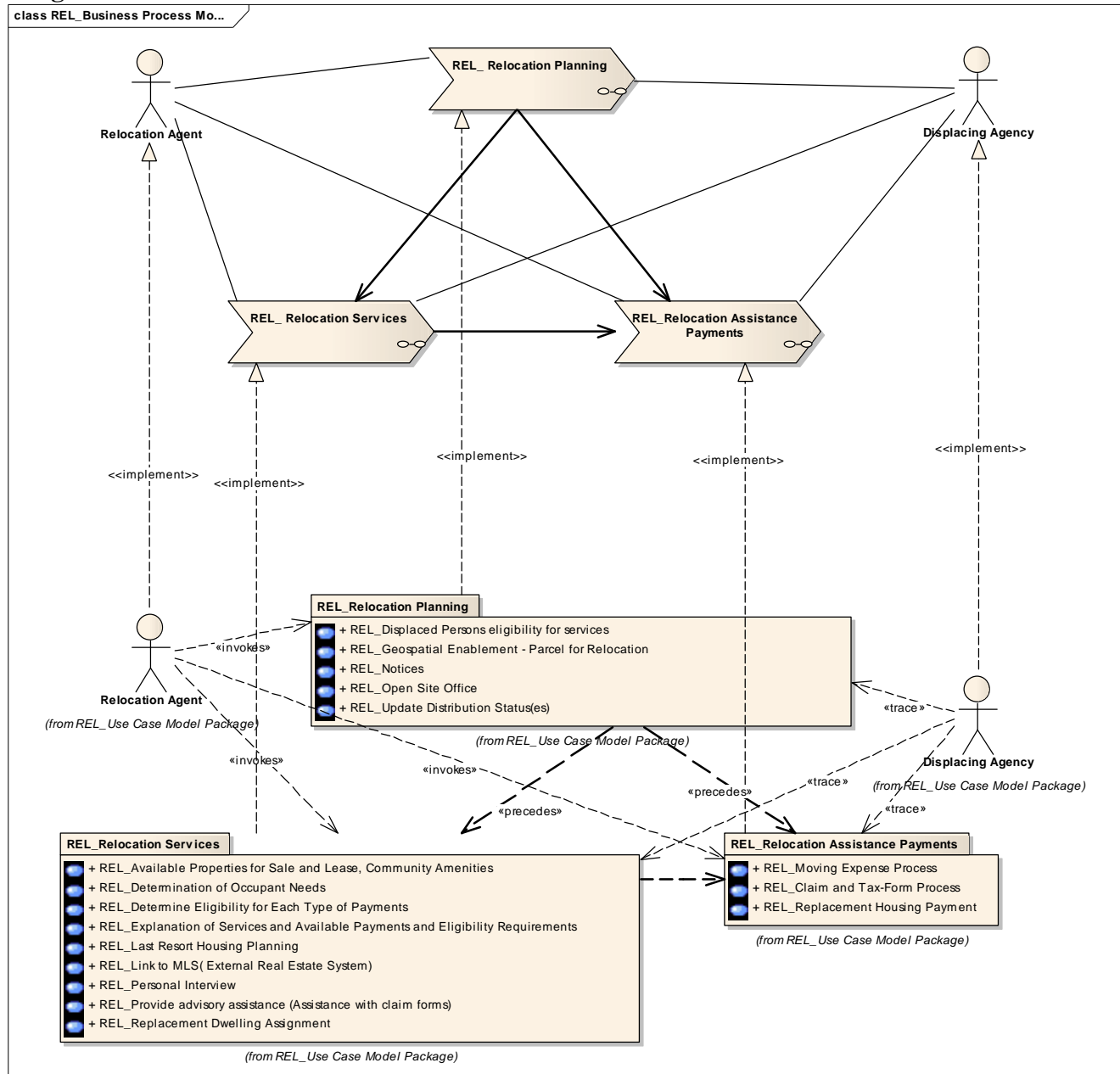


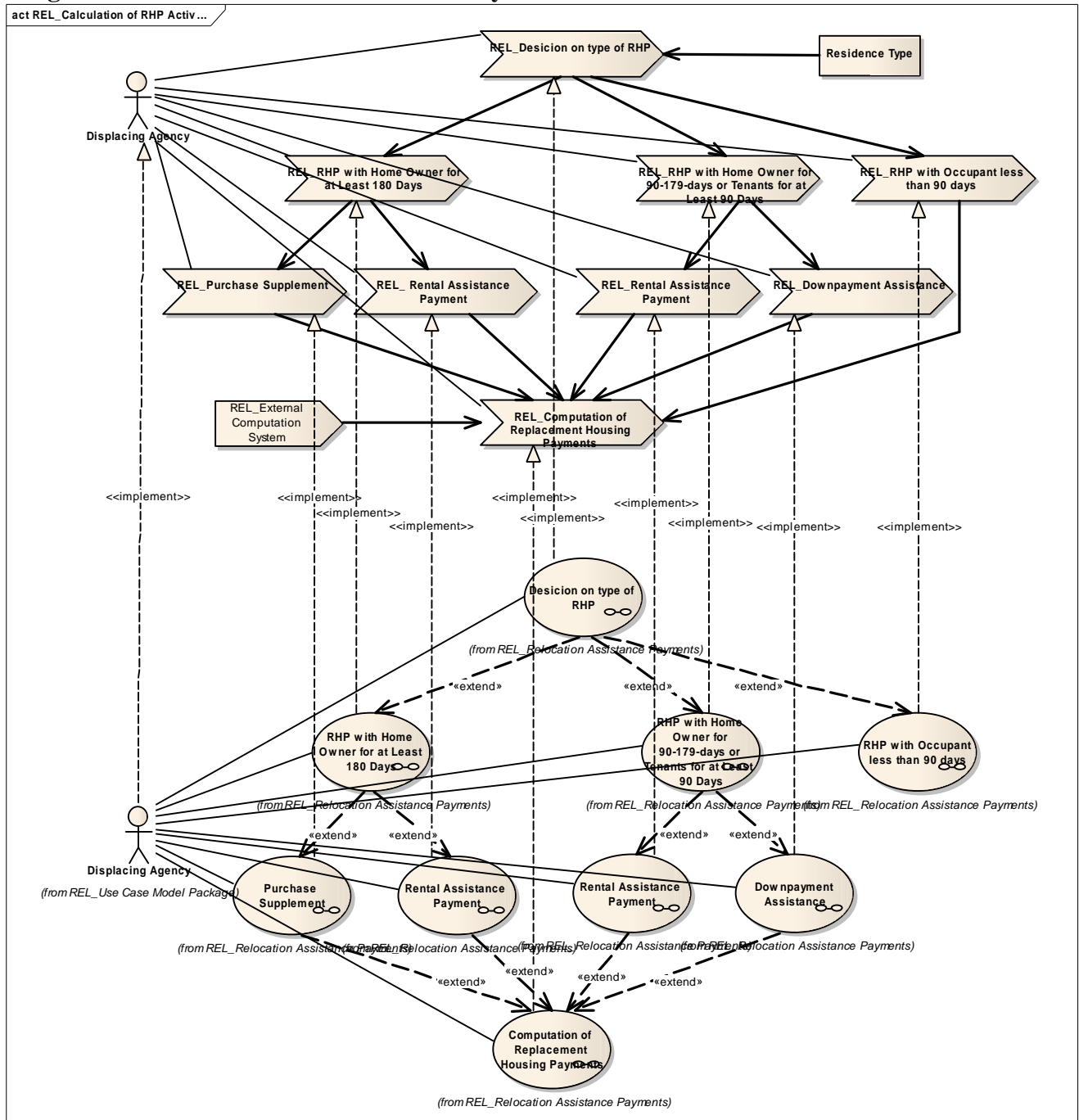
Diagram: REL Calculation of RHP Activity

Diagram: REL_Check for the eligibility for Replacement Housing Payment (RHP) Activity

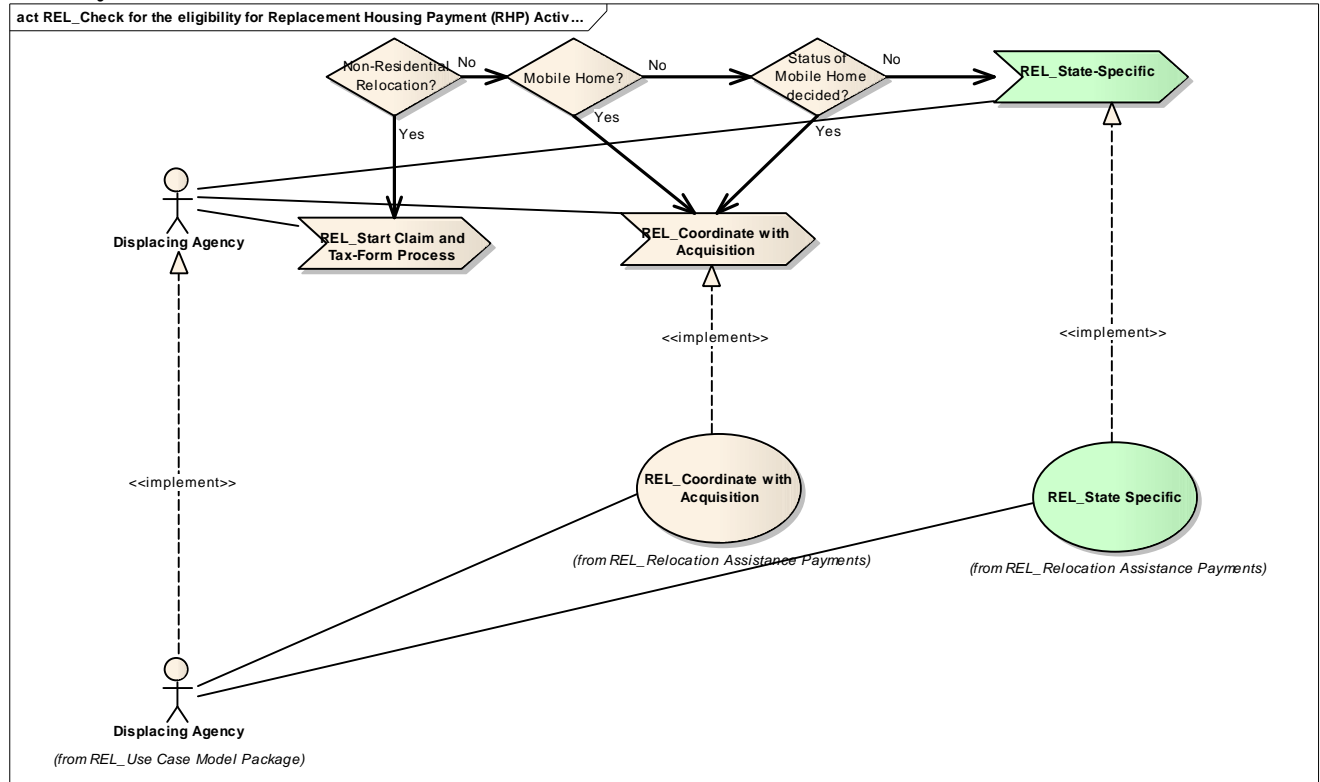


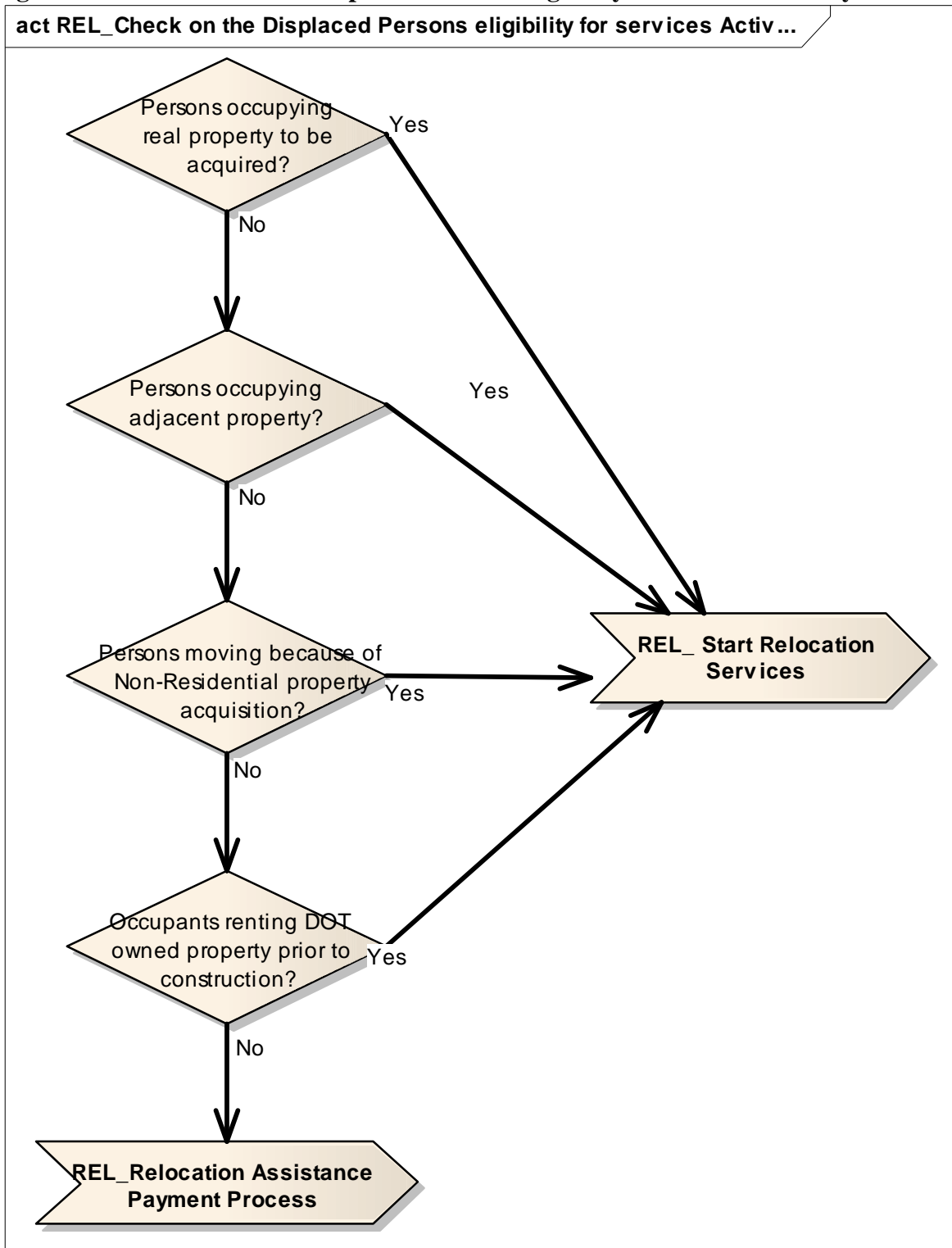
Diagram: REL_Check on the Displaced Persons eligibility for services Activity

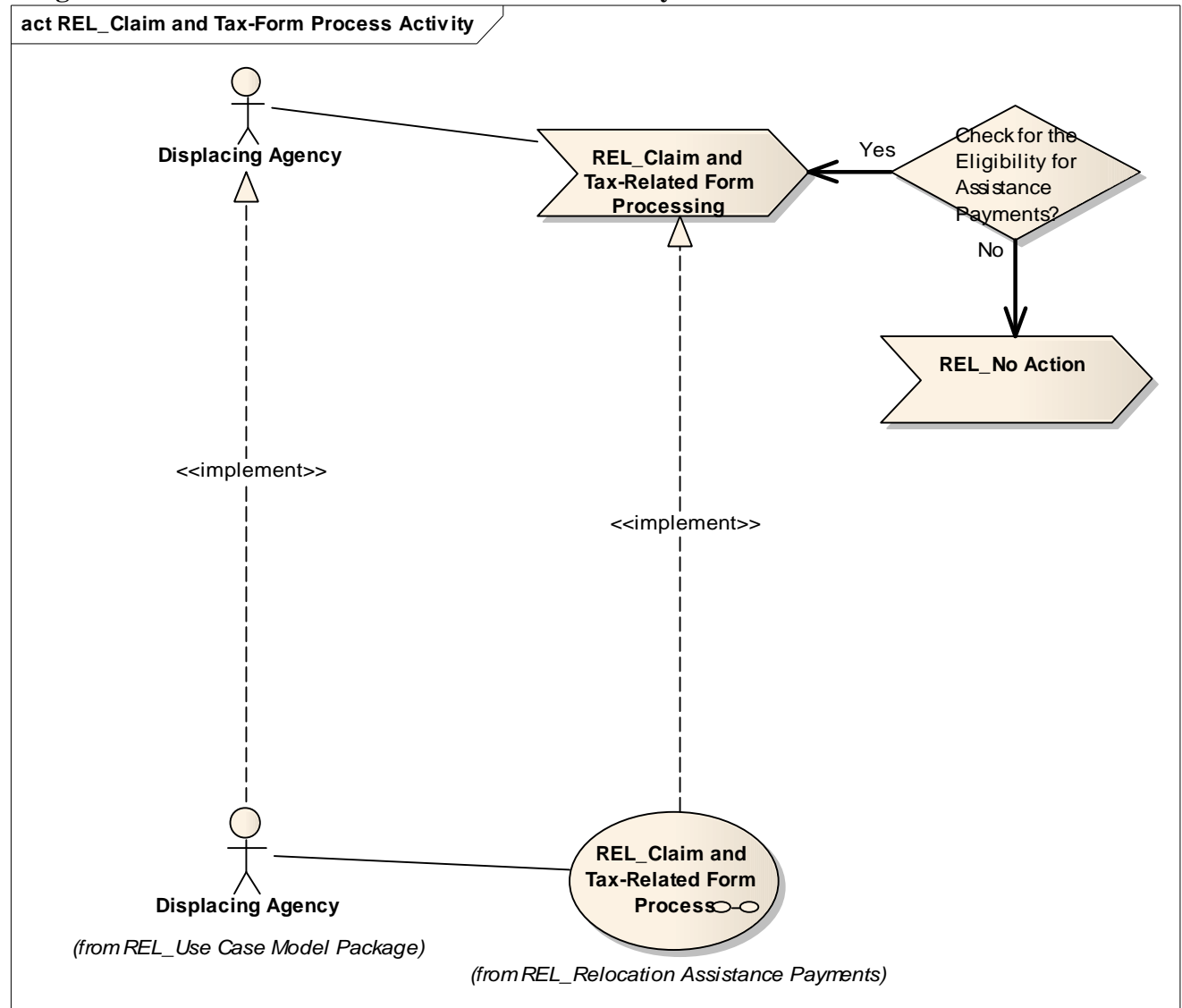
Diagram: REL_Claim and Tax-Form Process Activity

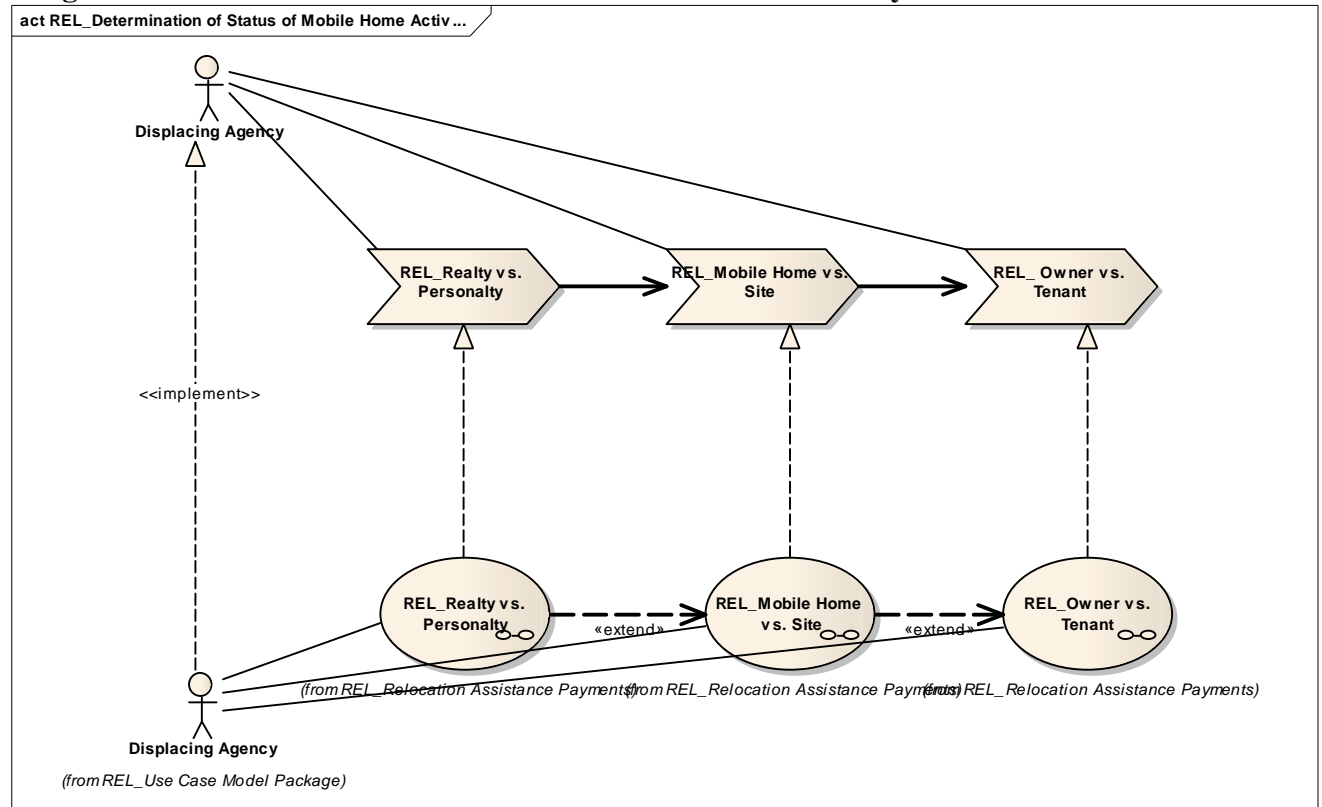
Diagram: REL Determination of Status of Mobile Home Activity

Diagram: REL_Mobile Home Relocation Payment Activity

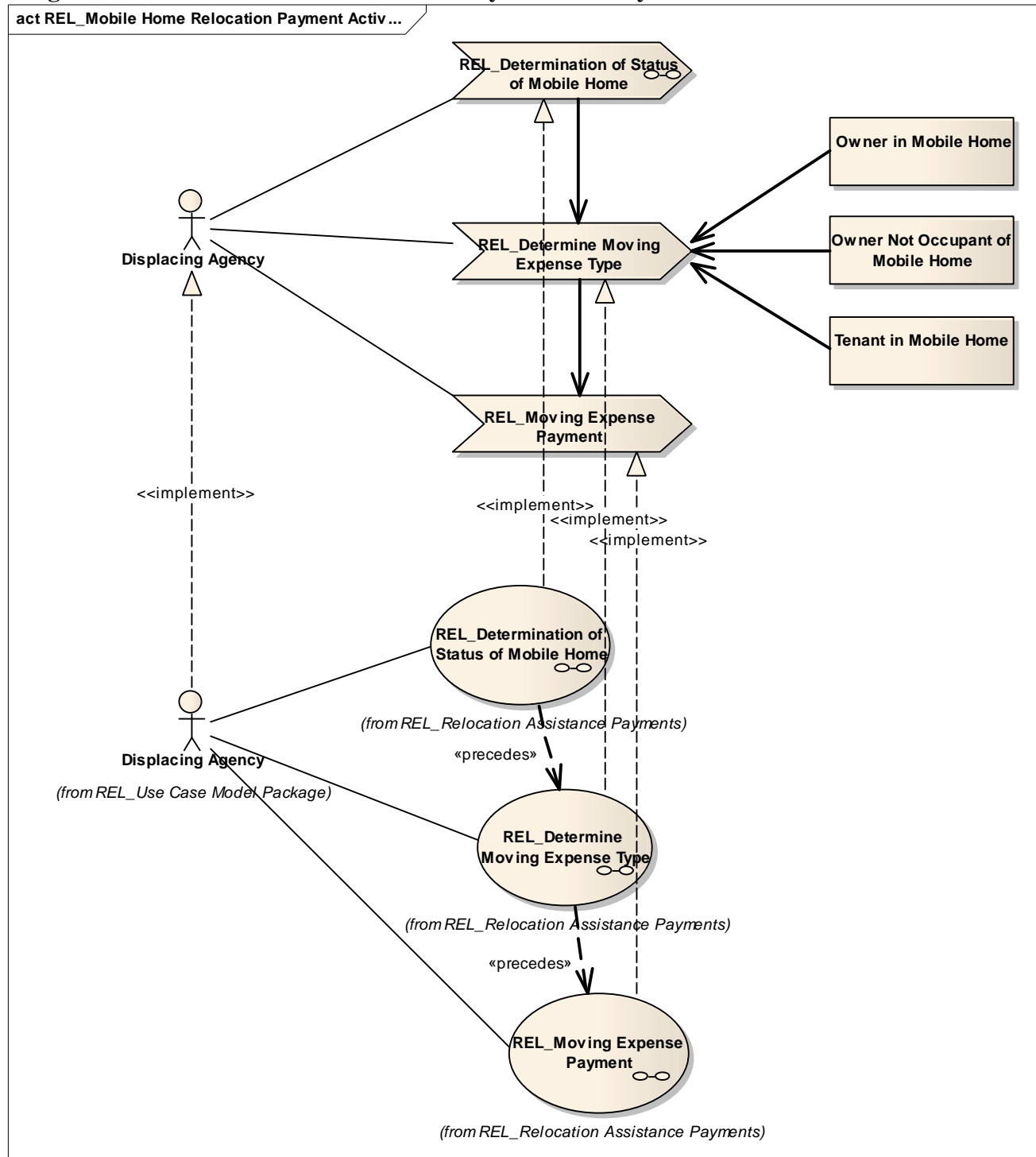


Diagram: REL_Moving Expense Payments for Residential (not mobile home) Relocation Activity

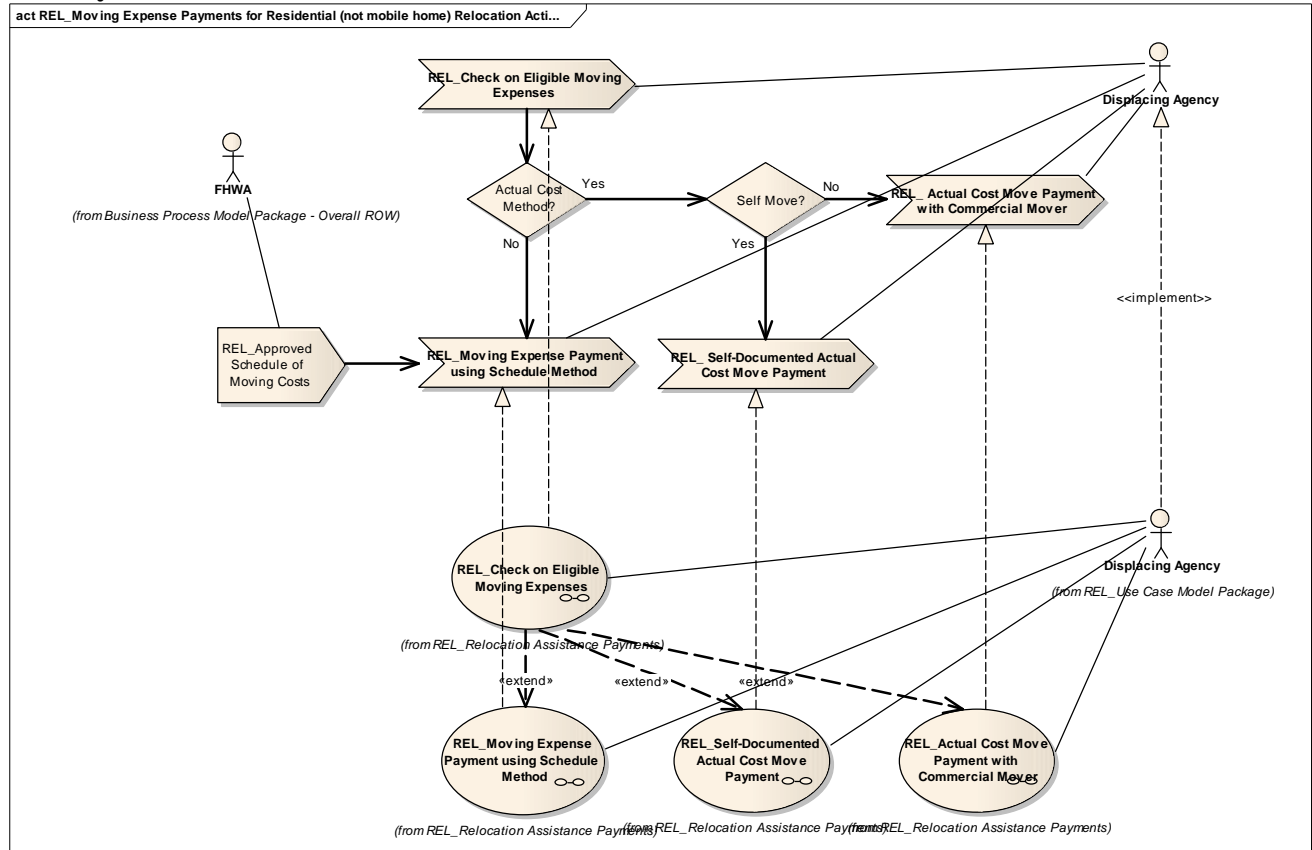


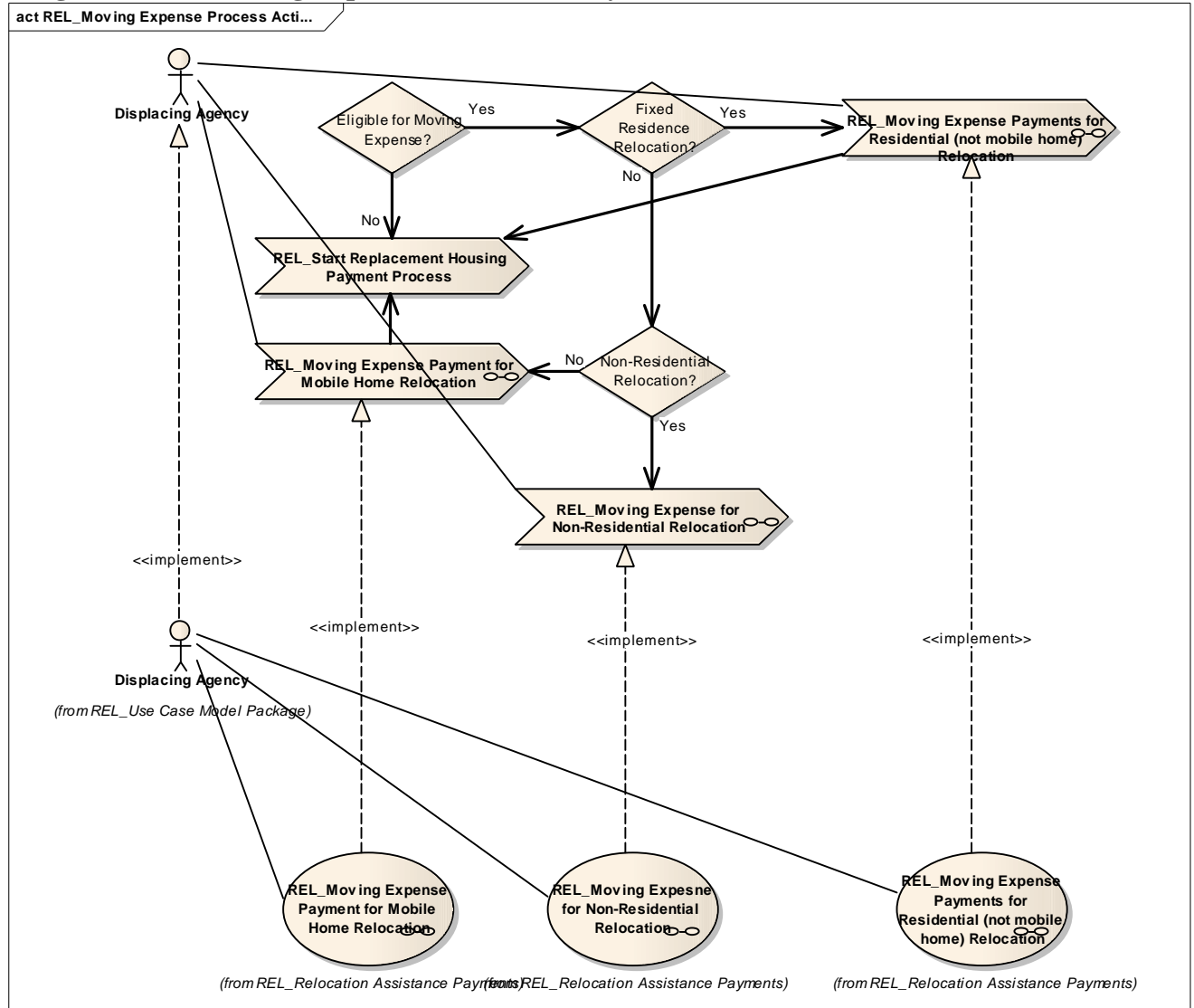
Diagram: REL_Moving Expense Process Activity

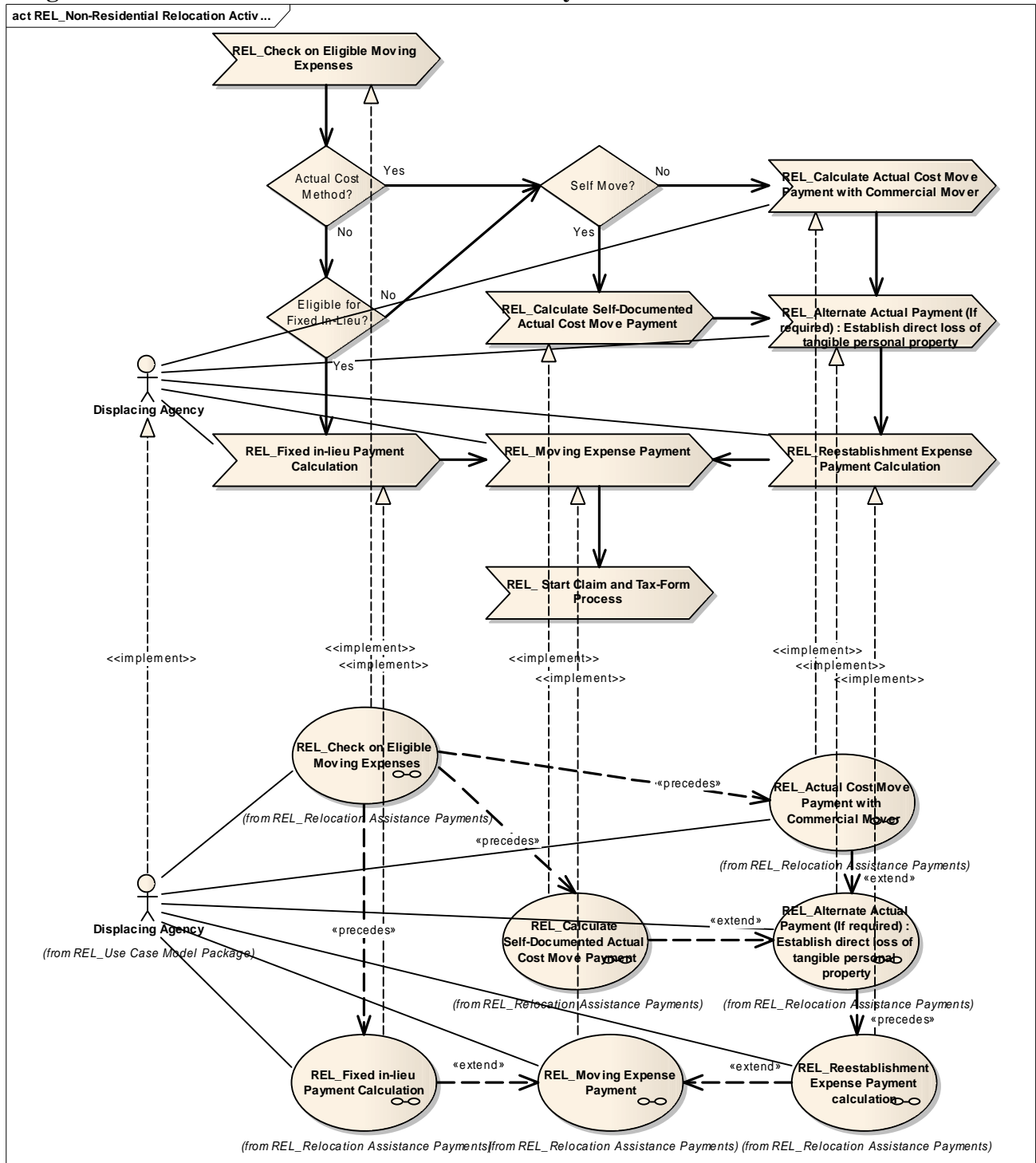
Diagram: REL_Non-Residential Relocation Activity

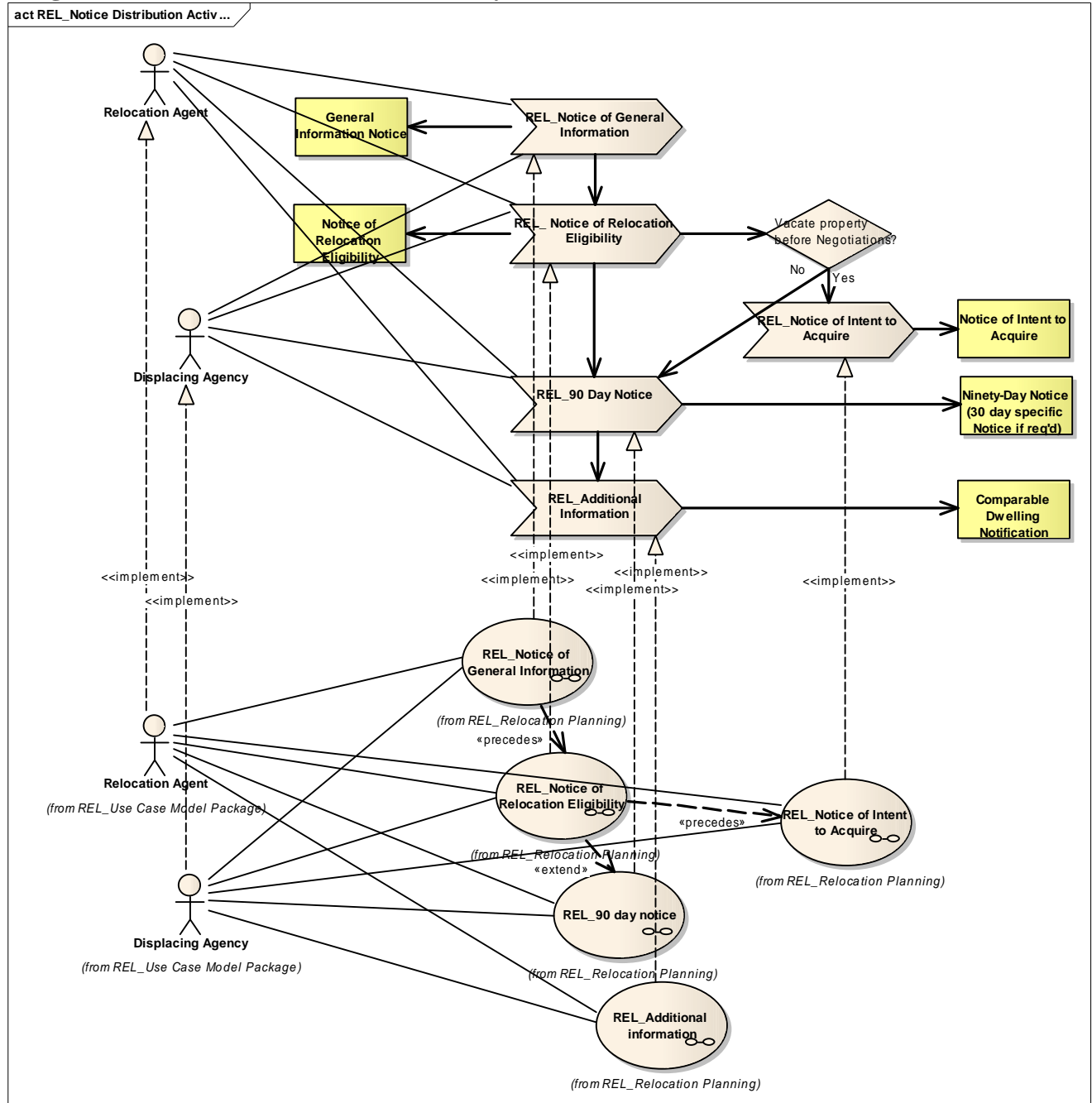
Diagram: REL_Notify Distribution Activity

Diagram: REL_Relocation Assistance Payments Activity

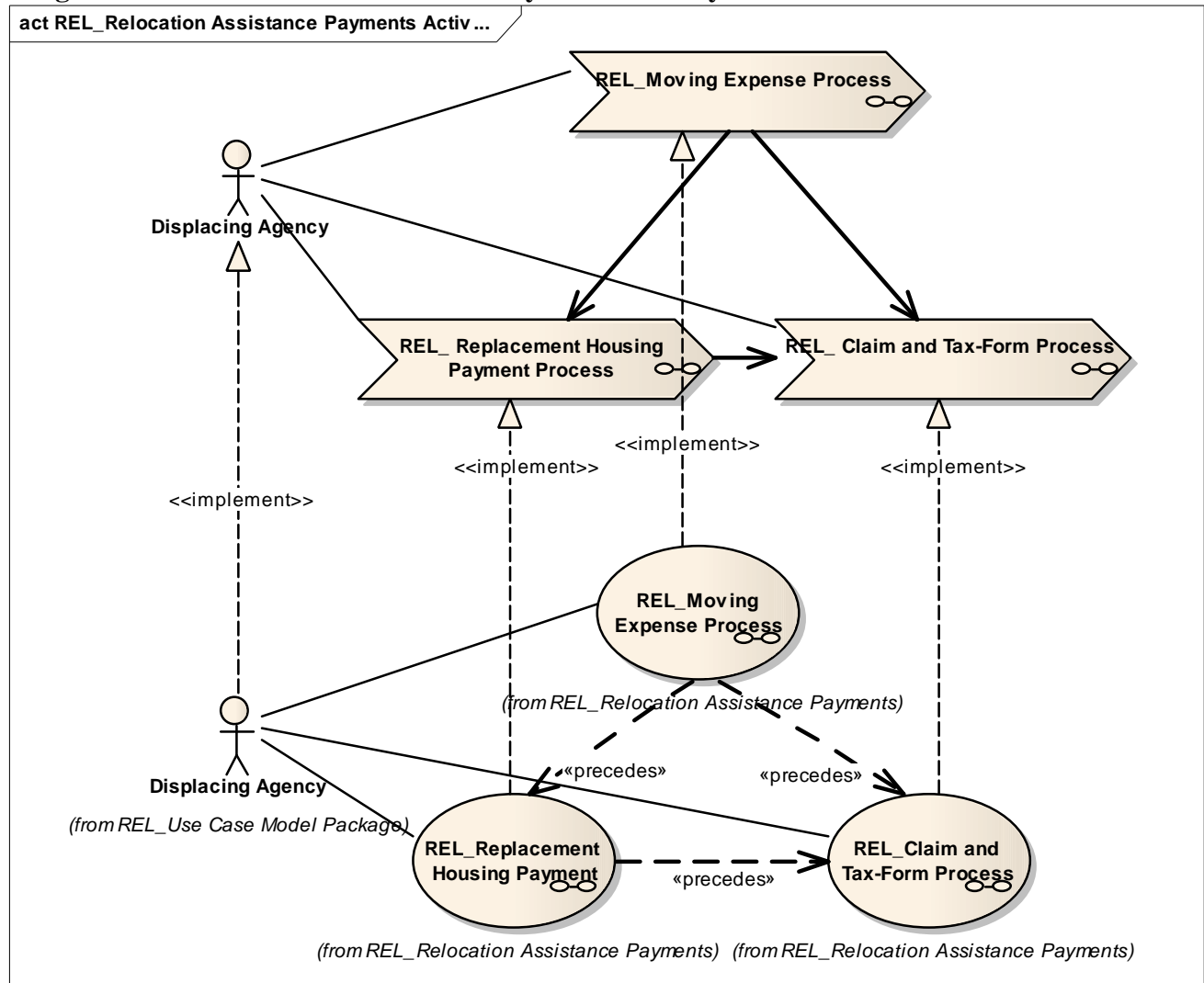


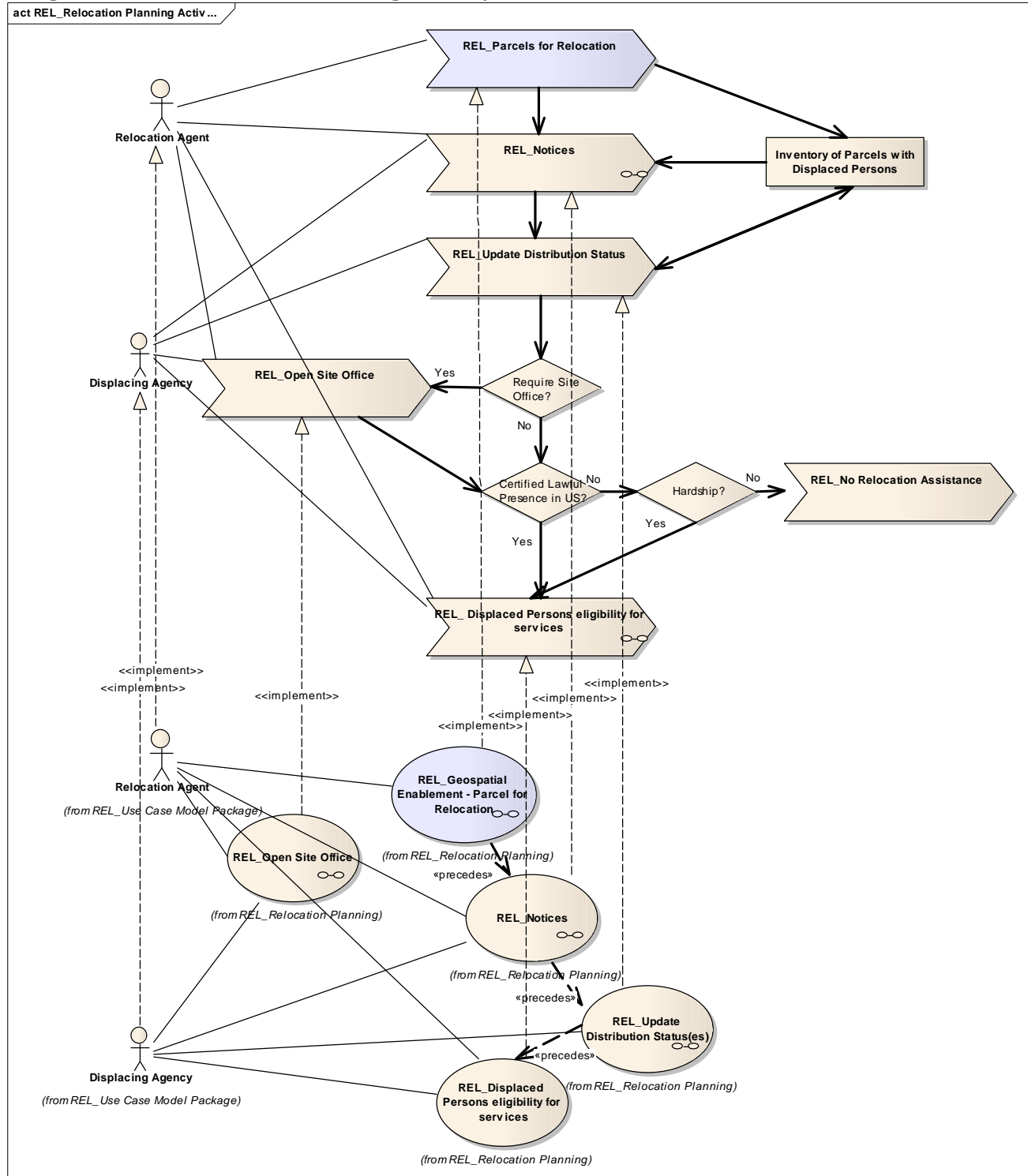
Diagram: REL Relocation Planning Activity

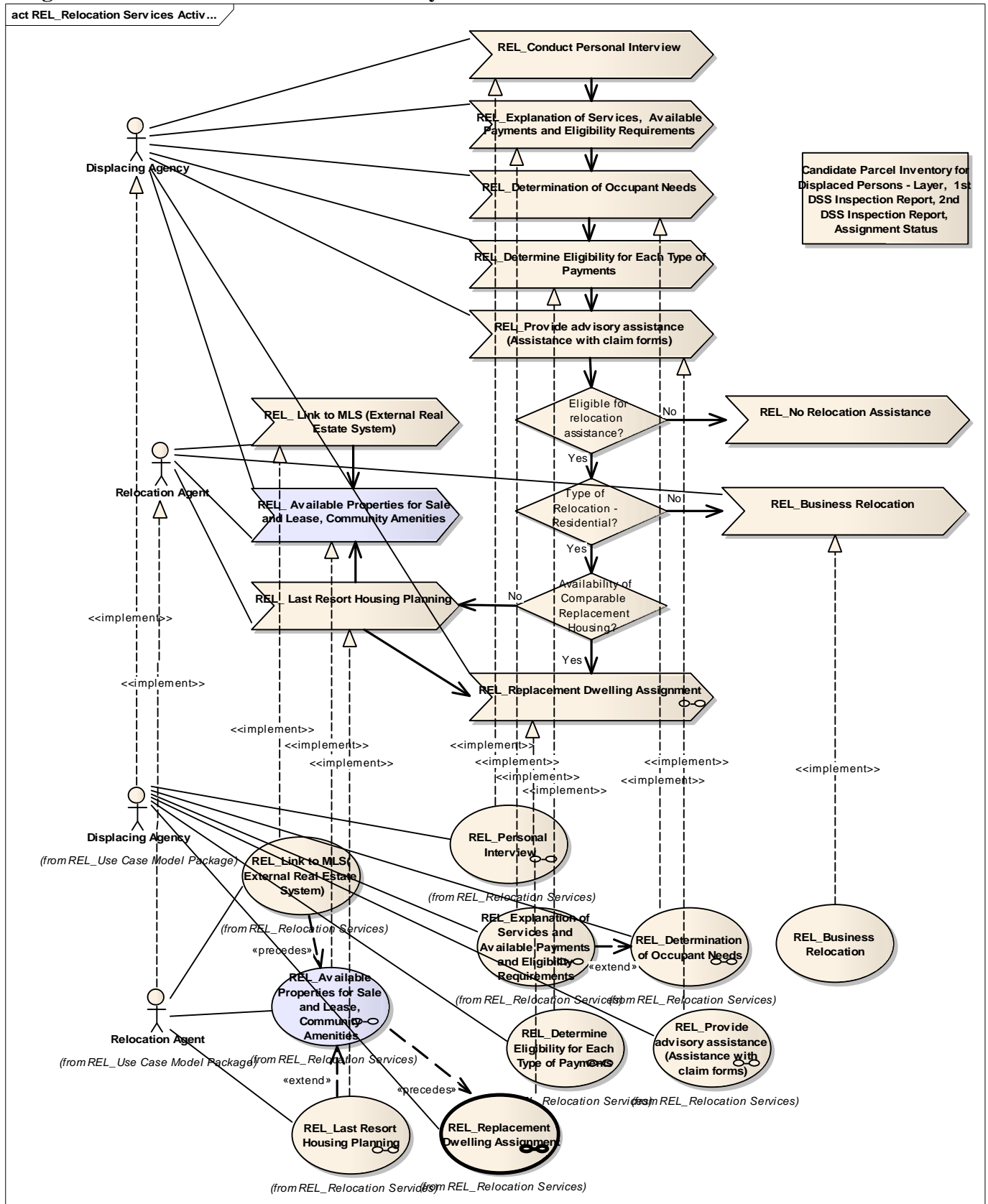
Diagram: REL_Relocation Services Activity

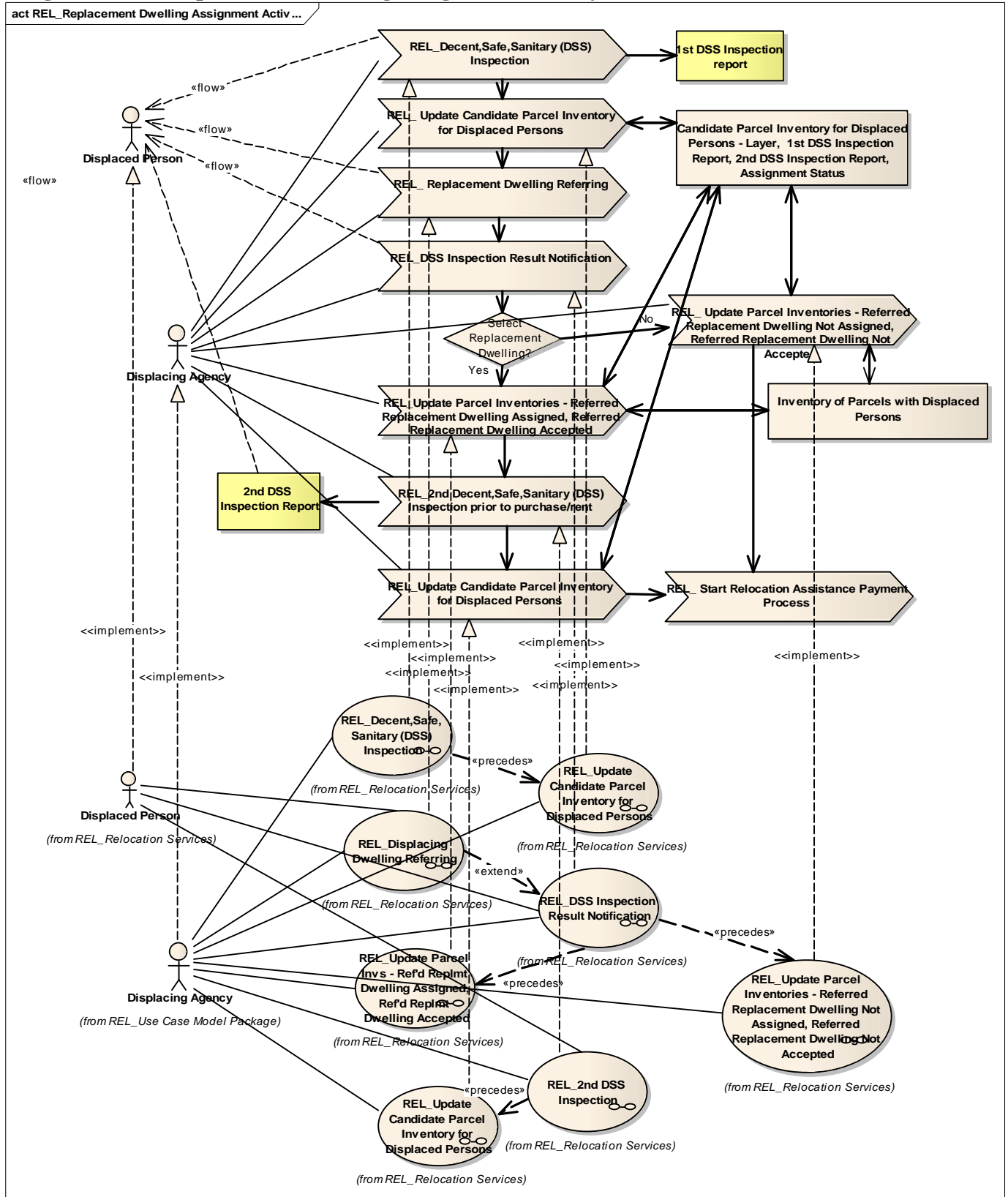
Diagram: REL_Replacement Dwelling Assignment Activity

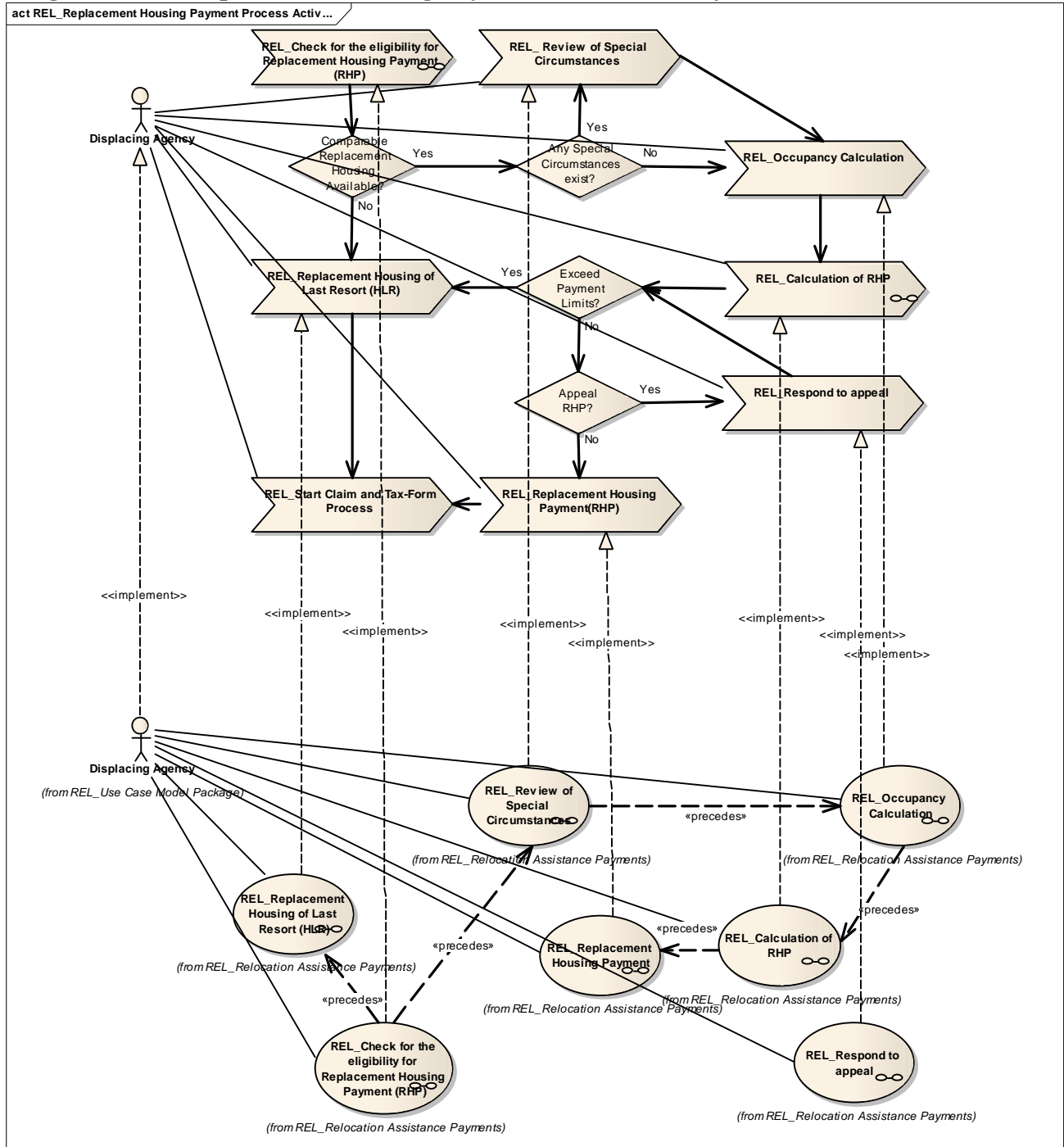
Diagram: REL Replacement Housing Payment Process Activity

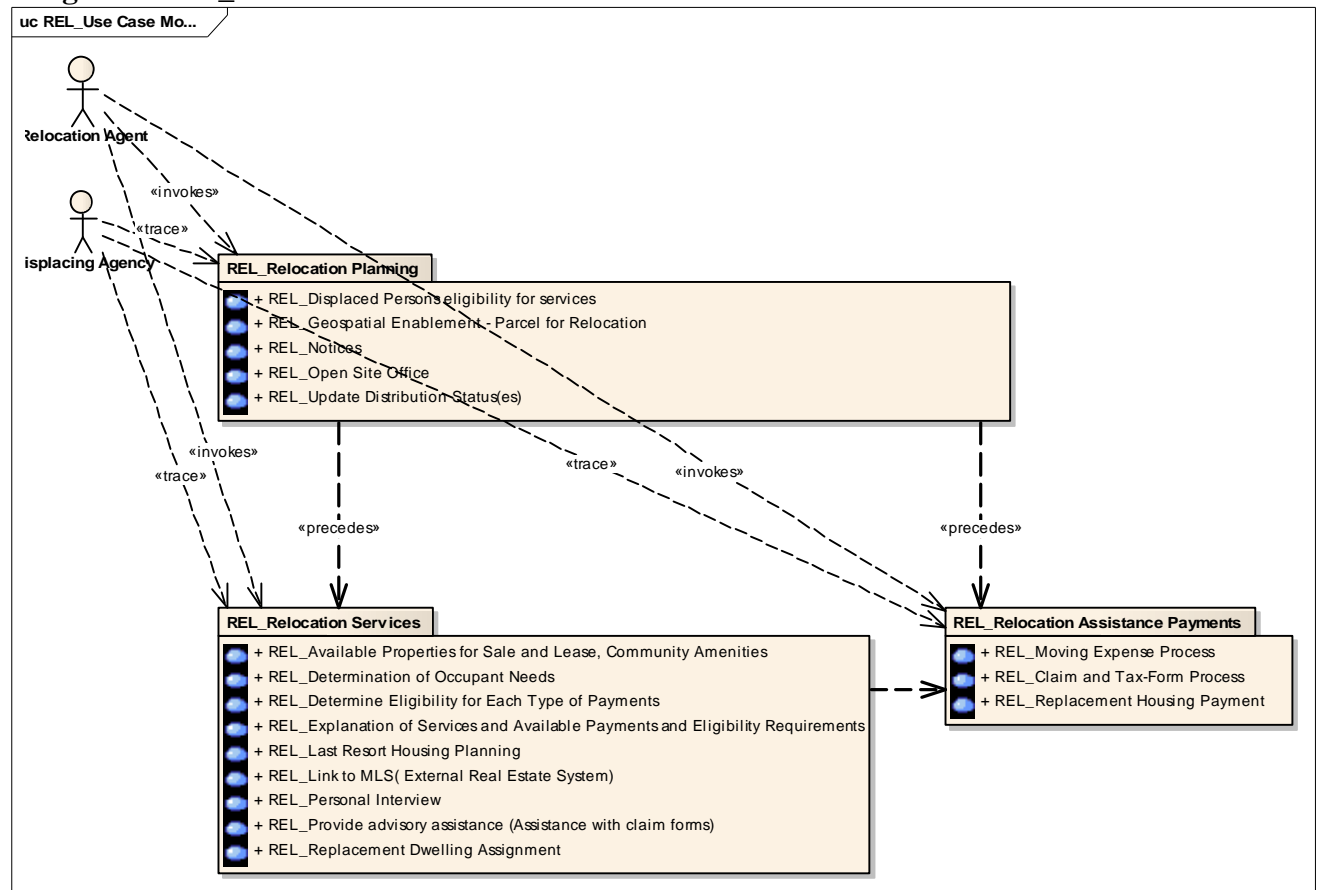
Diagram: REL Use Case Model

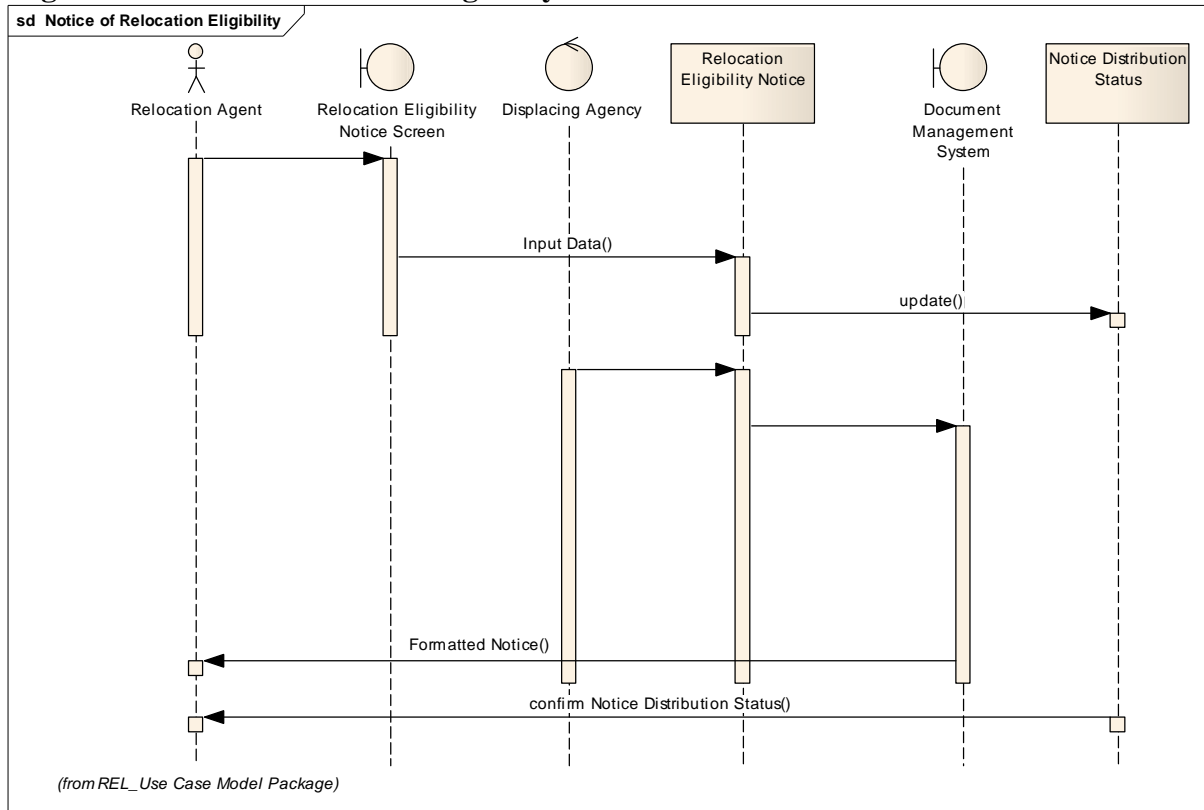
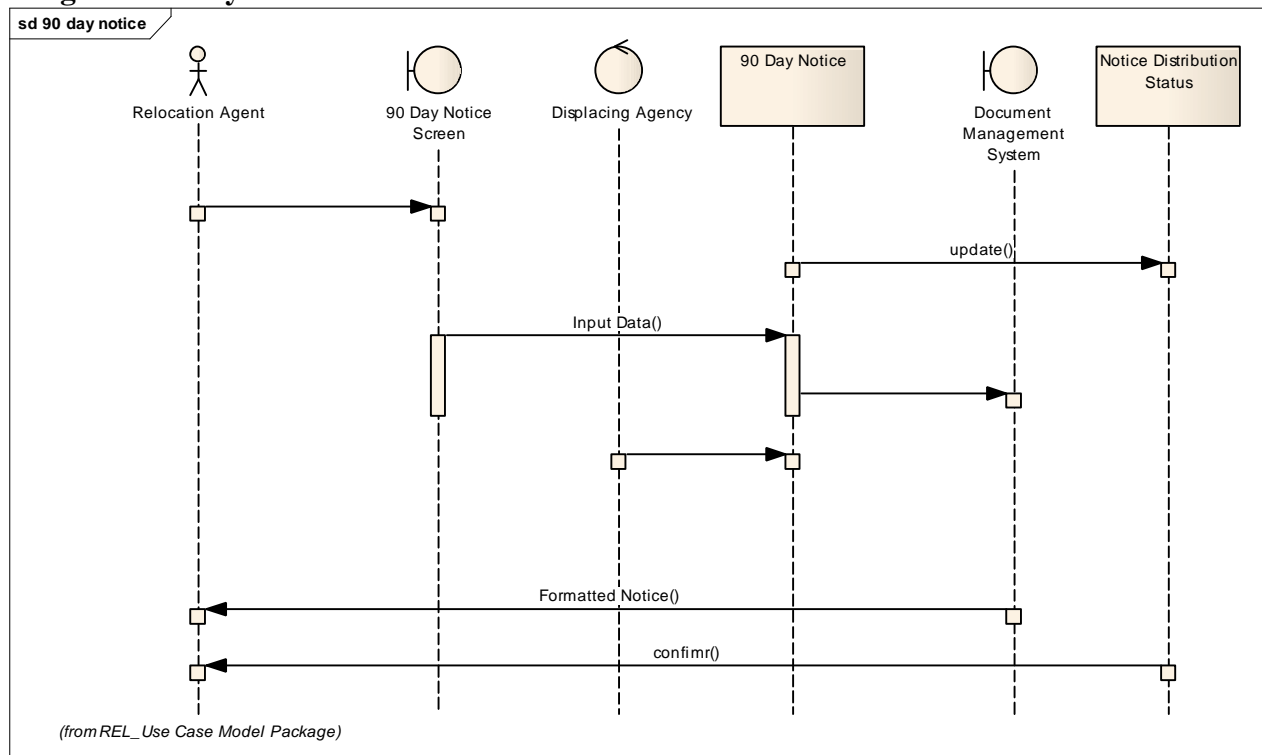
Diagram: Notice of Relocation Eligibility**Diagram: 90 day notice**

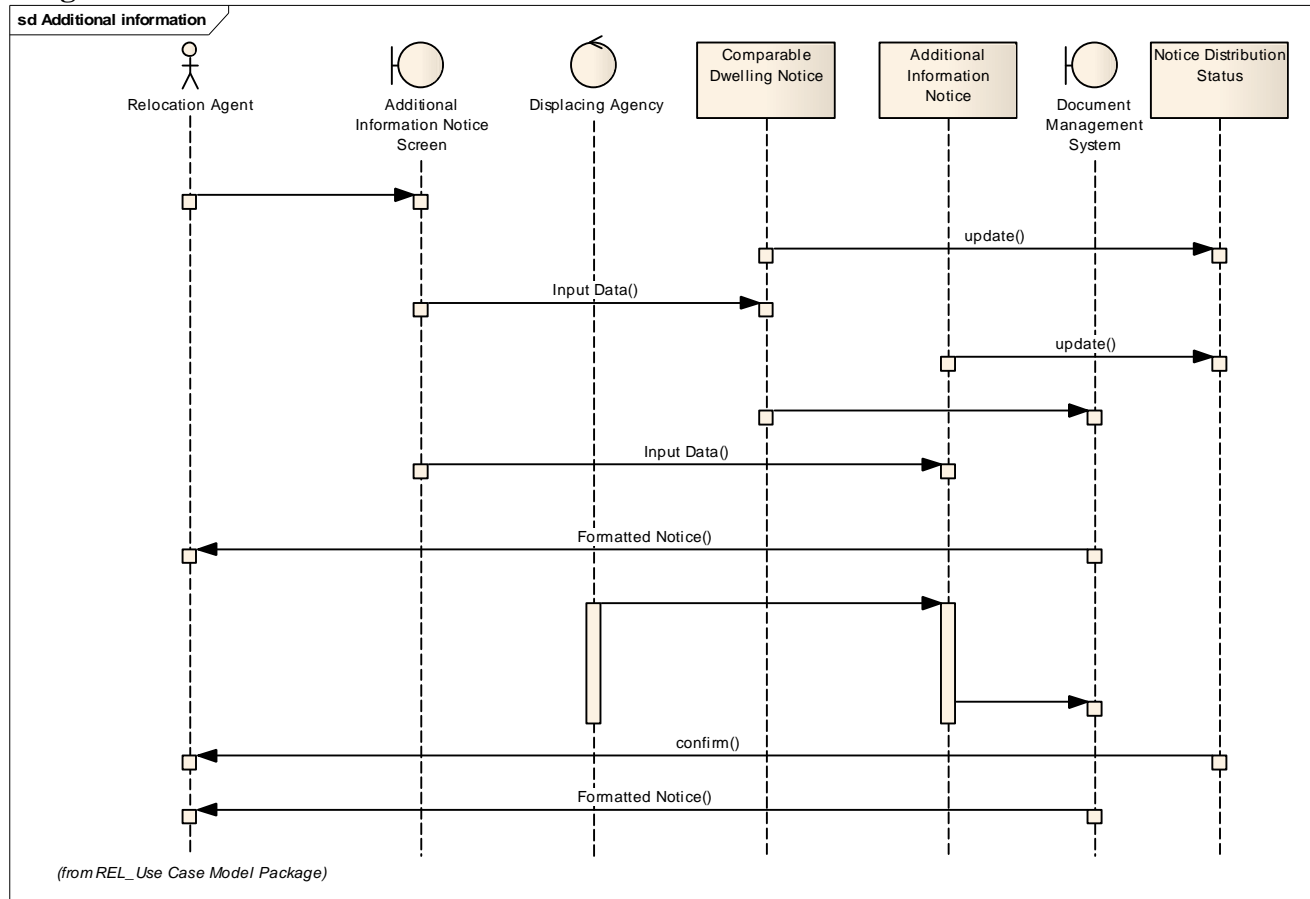
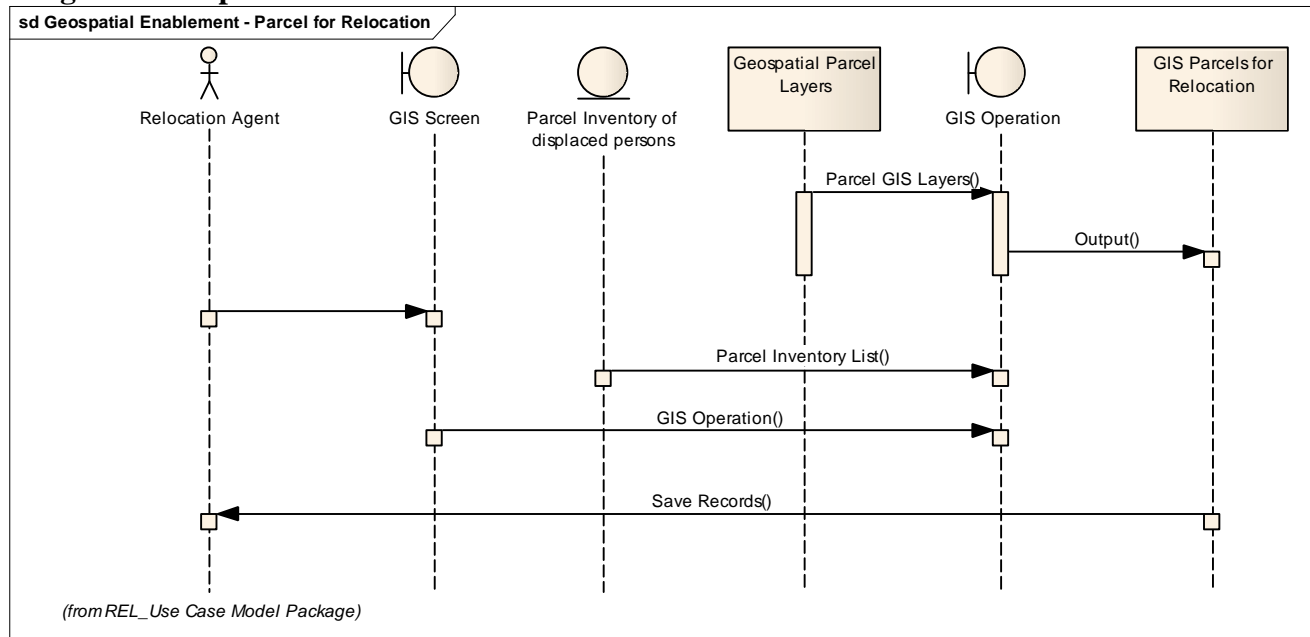
Diagram: Additional information**Diagram: Geospatial Enablement - Parcel for Relocation**

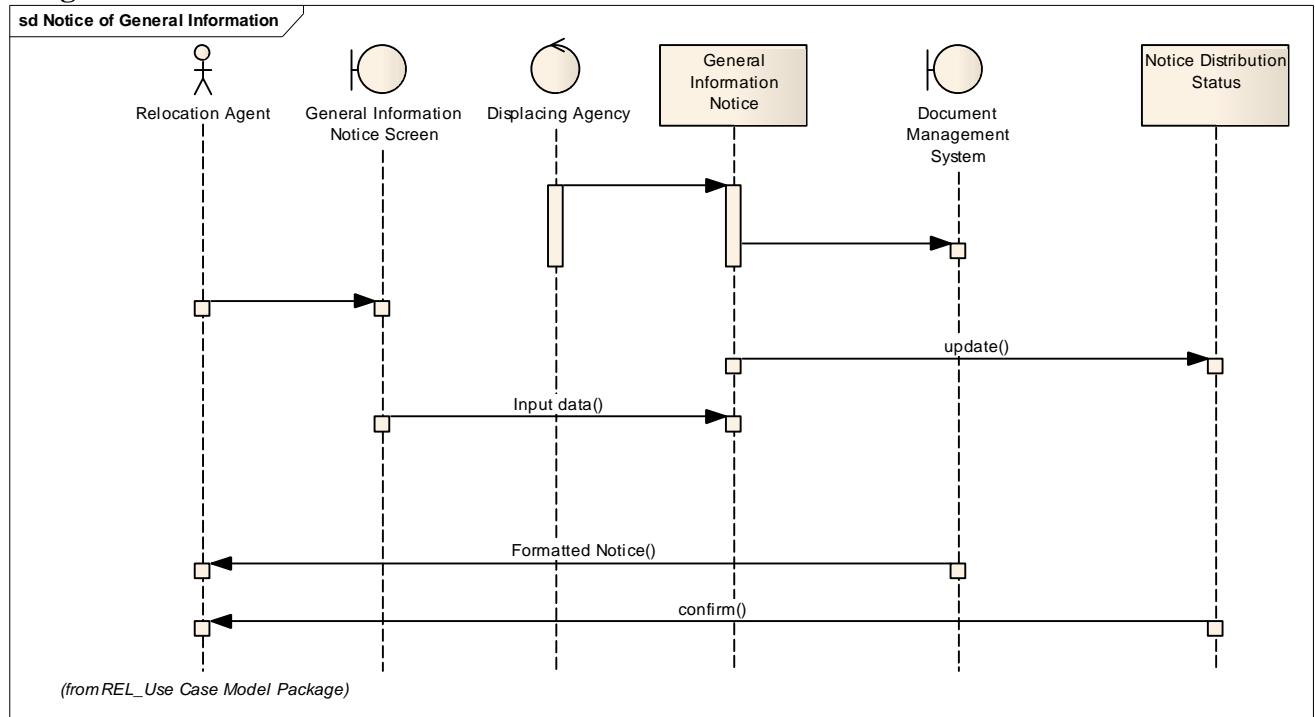
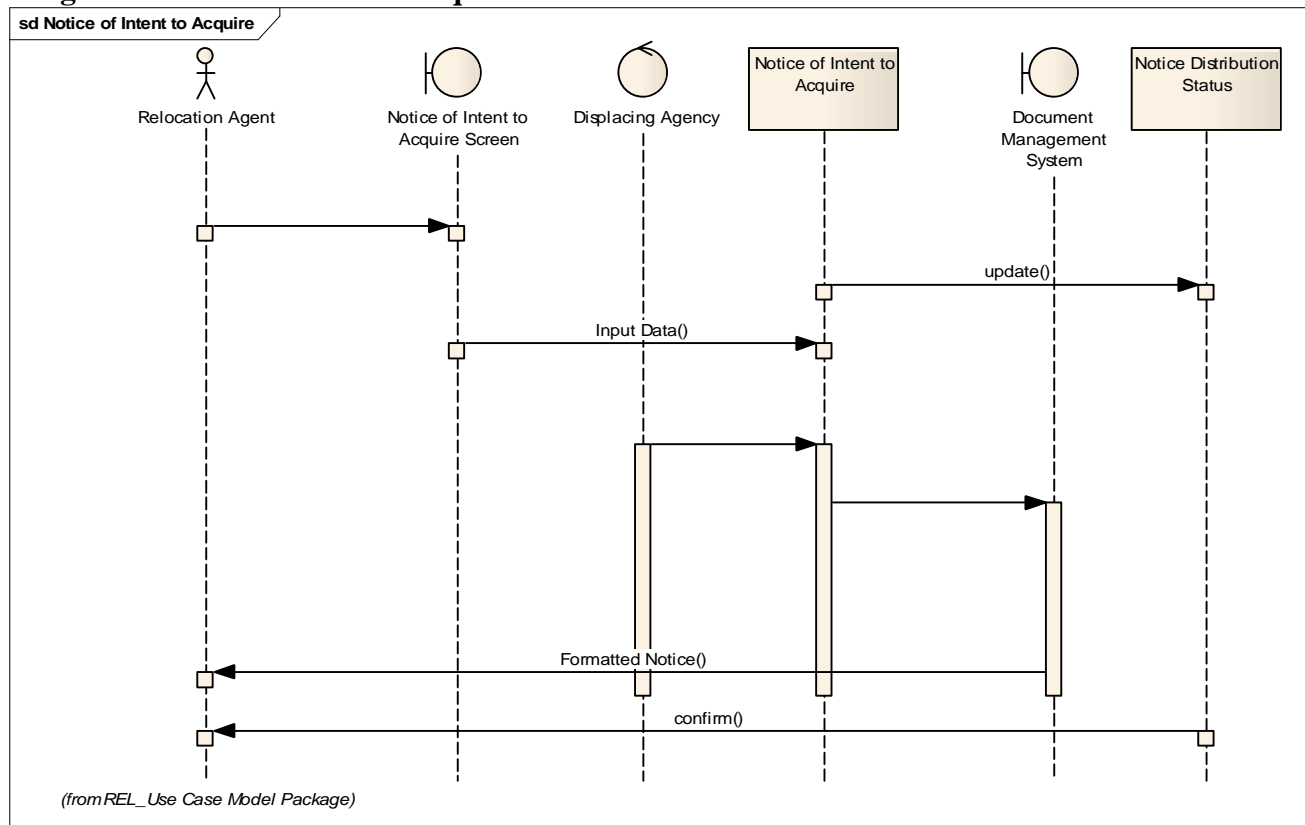
Diagram: Notice of General Information**Diagram: Notice of Intent to Acquire**

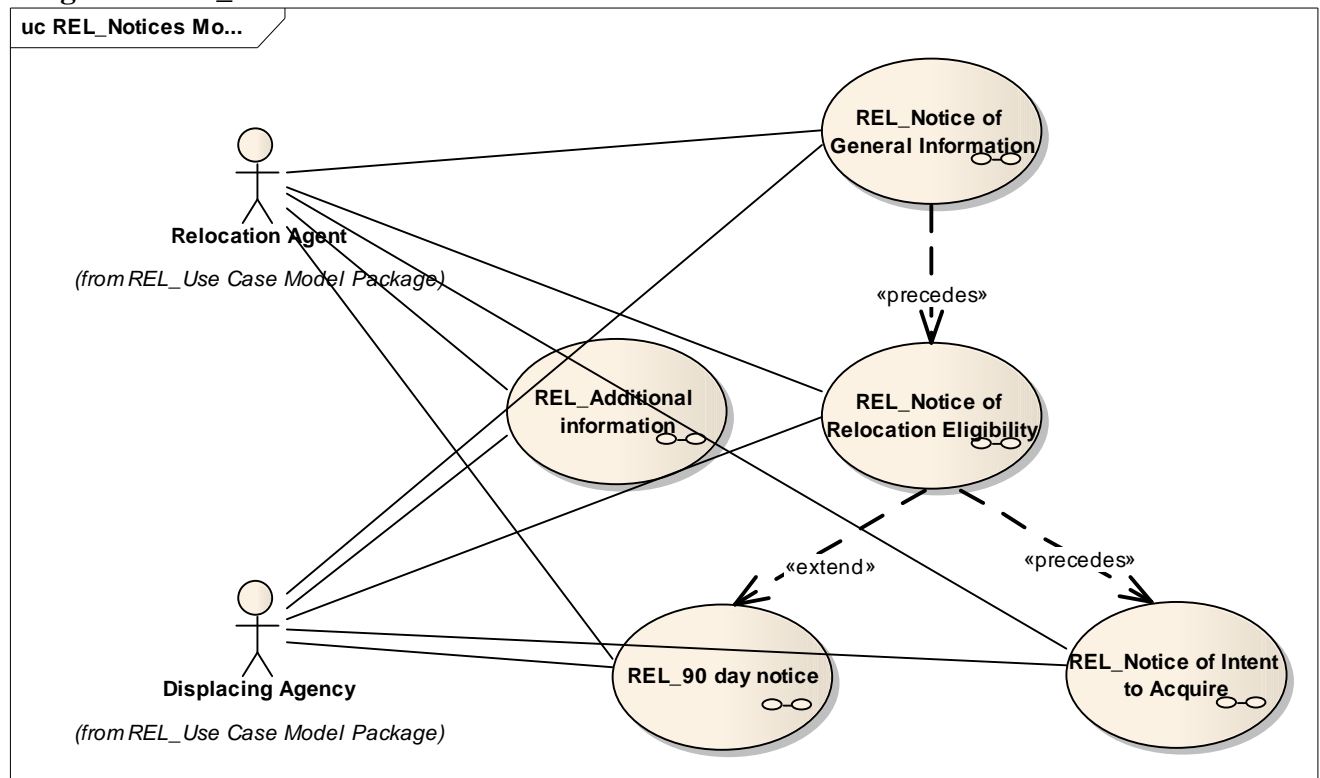
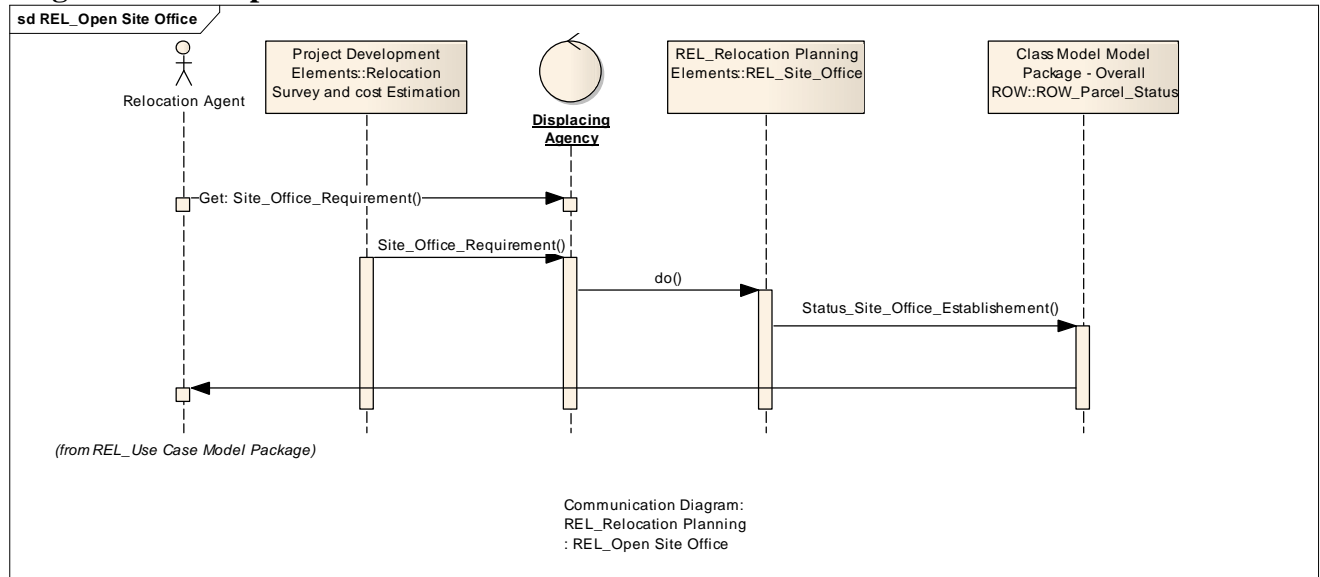
Diagram: REL_Notices Model**Diagram: REL_Open Site Office**

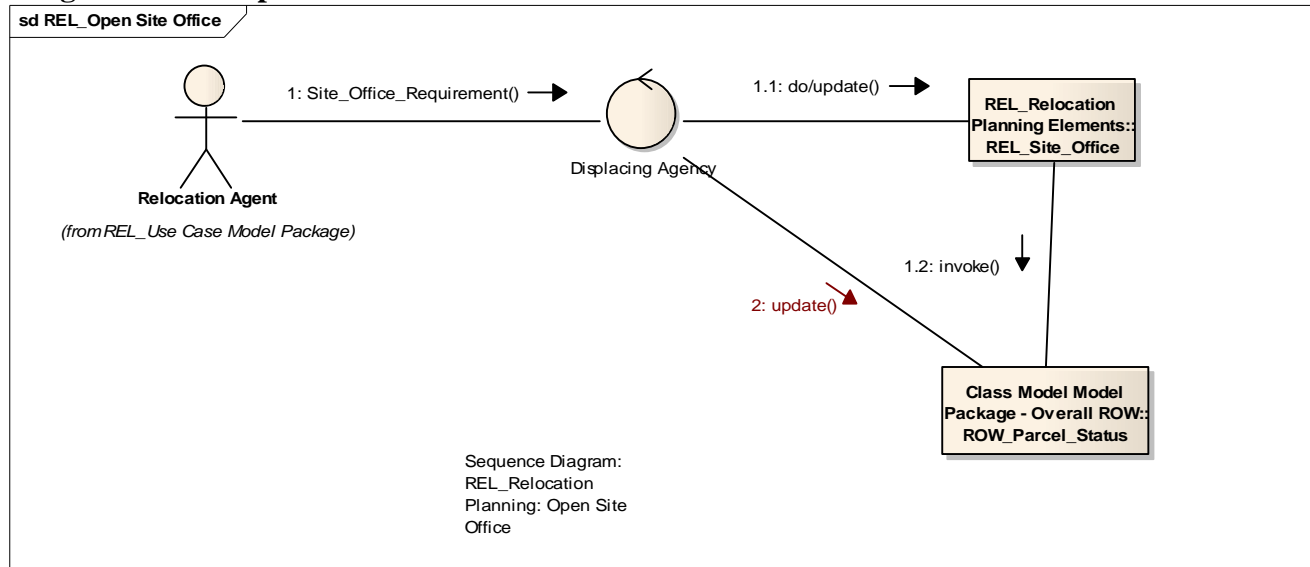
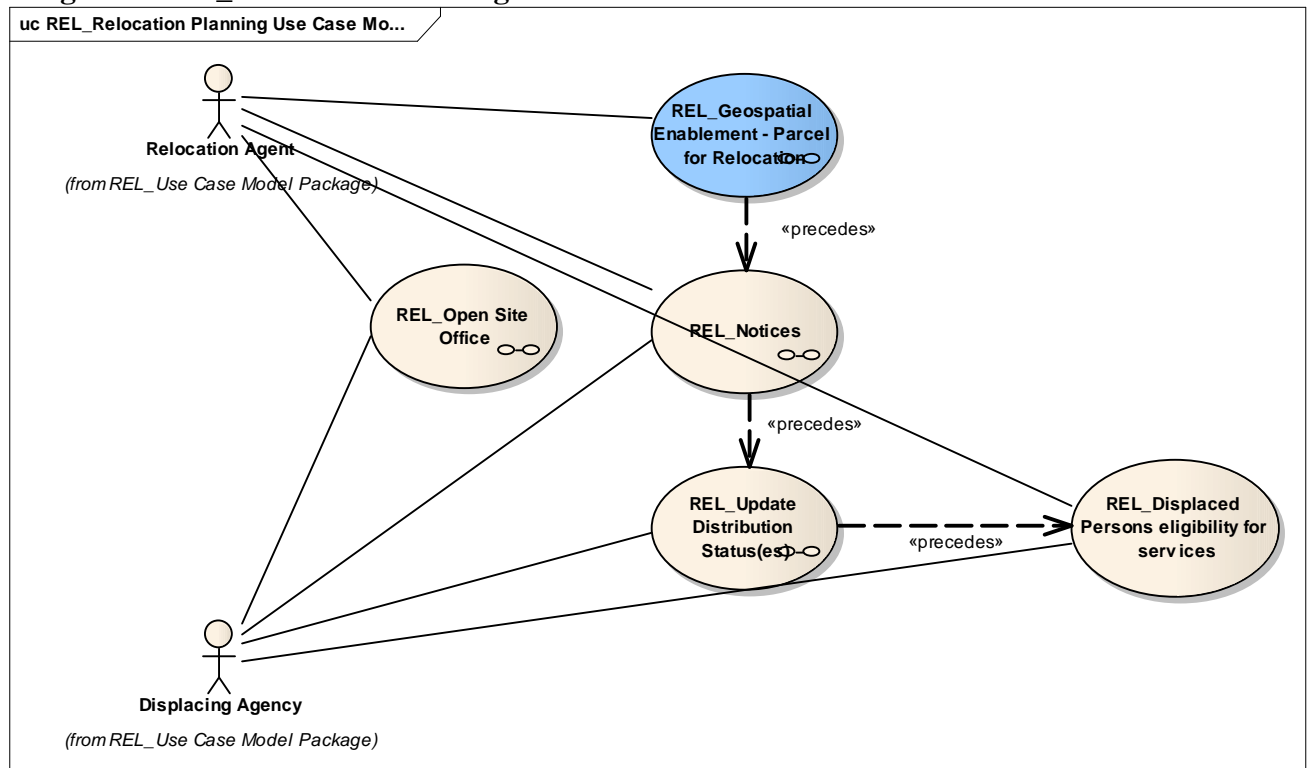
Diagram: REL_Open Site Office**Diagram: REL_Relocation Planning Use Case Model**

Diagram: Update Distribution Status(es) In the Inventory of Parcels with Displaced Persons

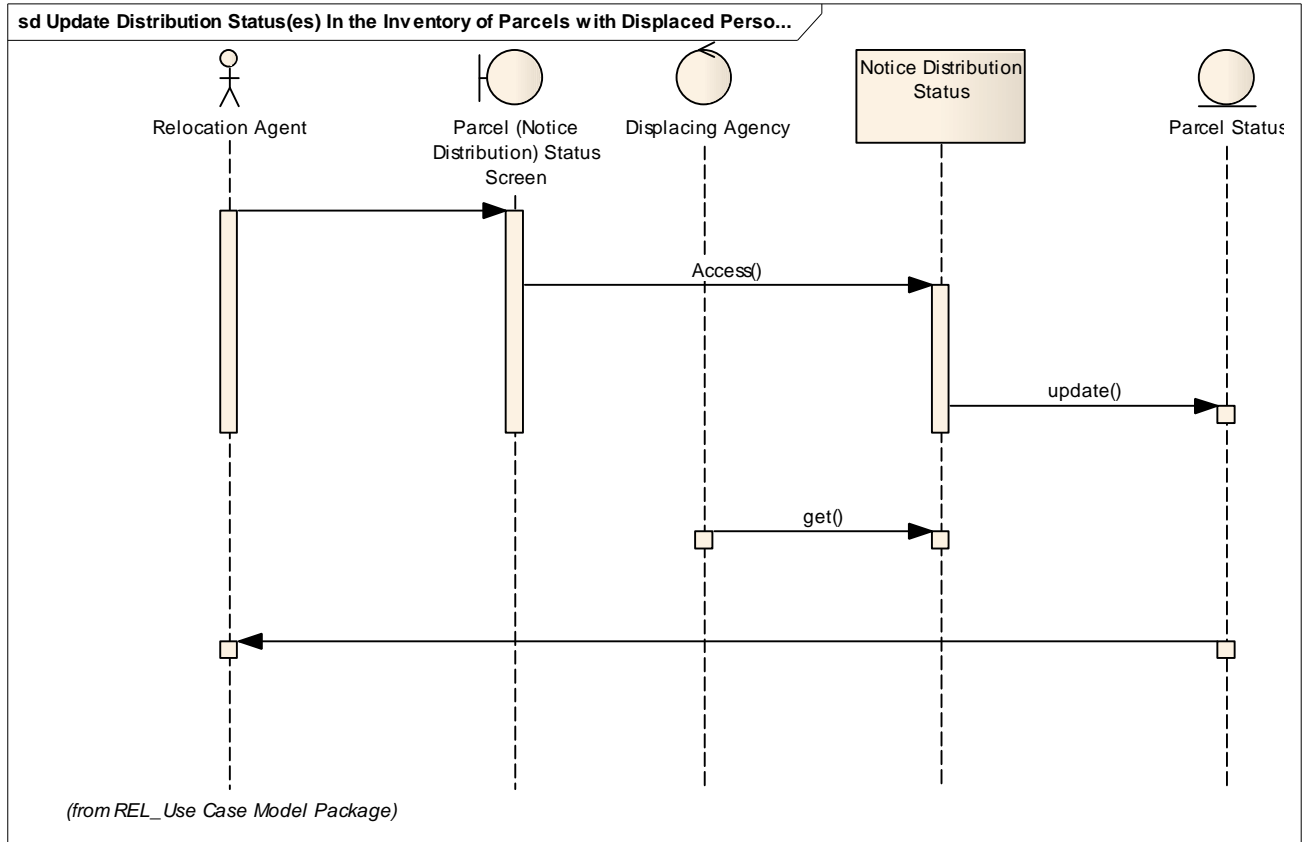


Diagram: Provide advisory assistance (Assistance with claim forms)

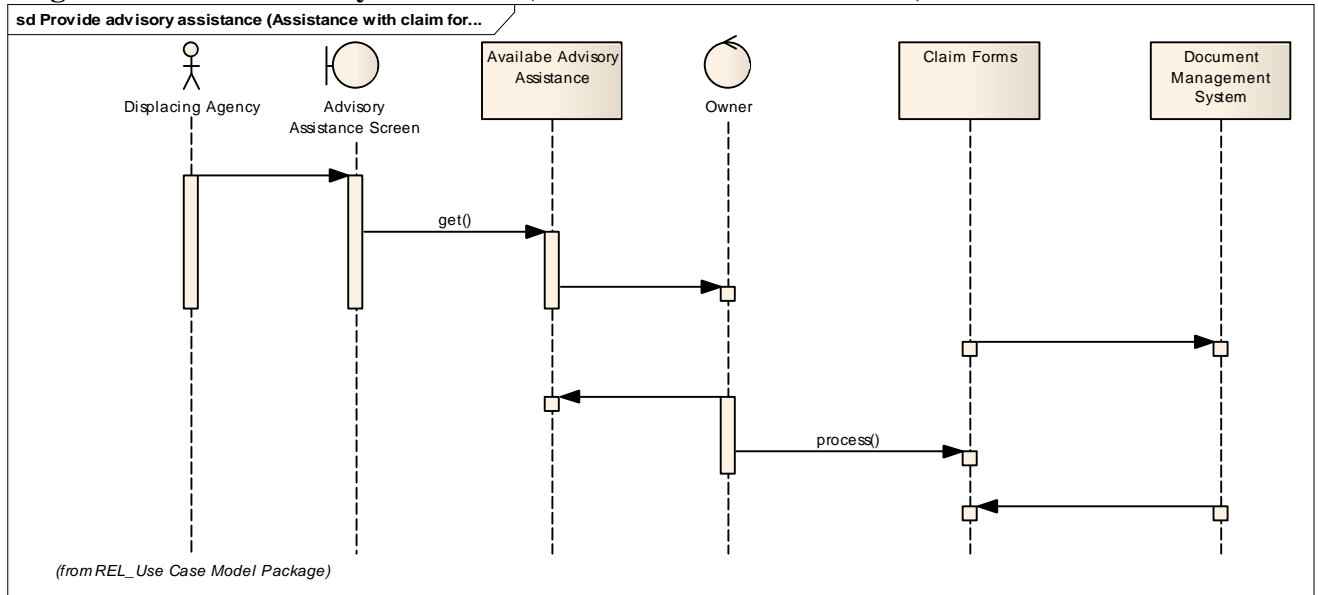


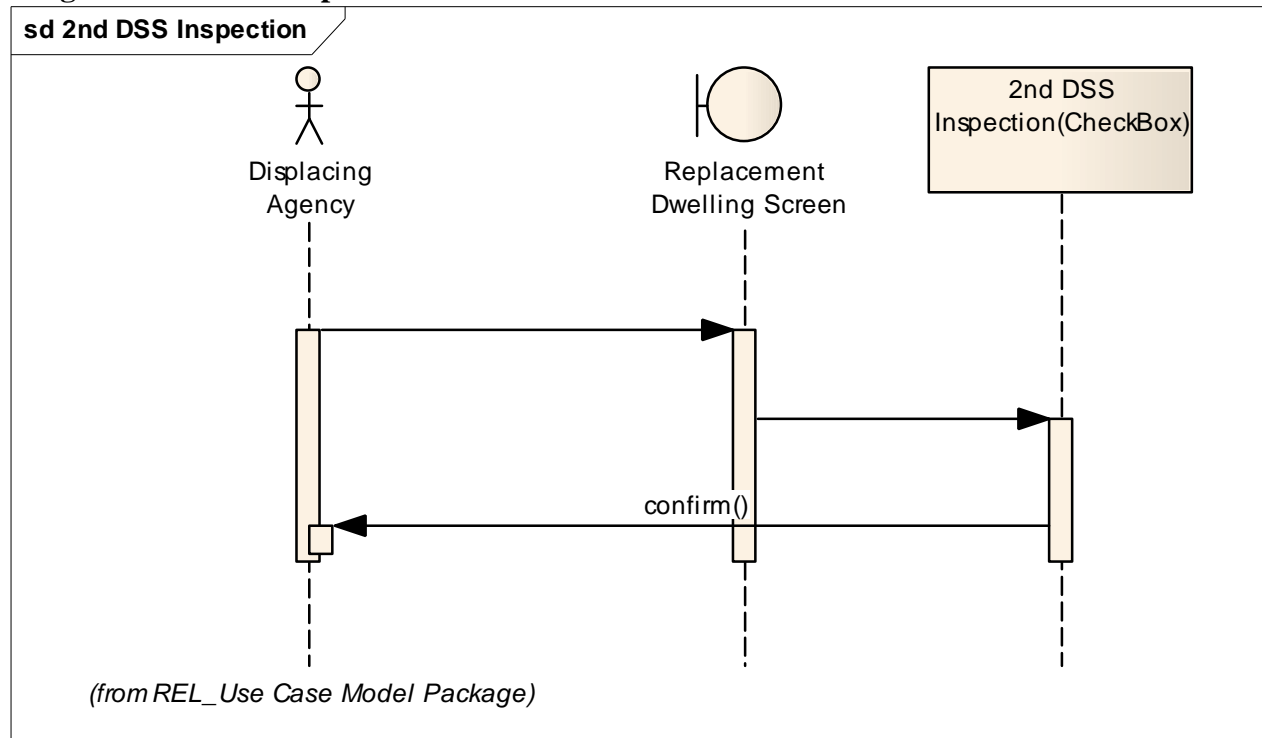
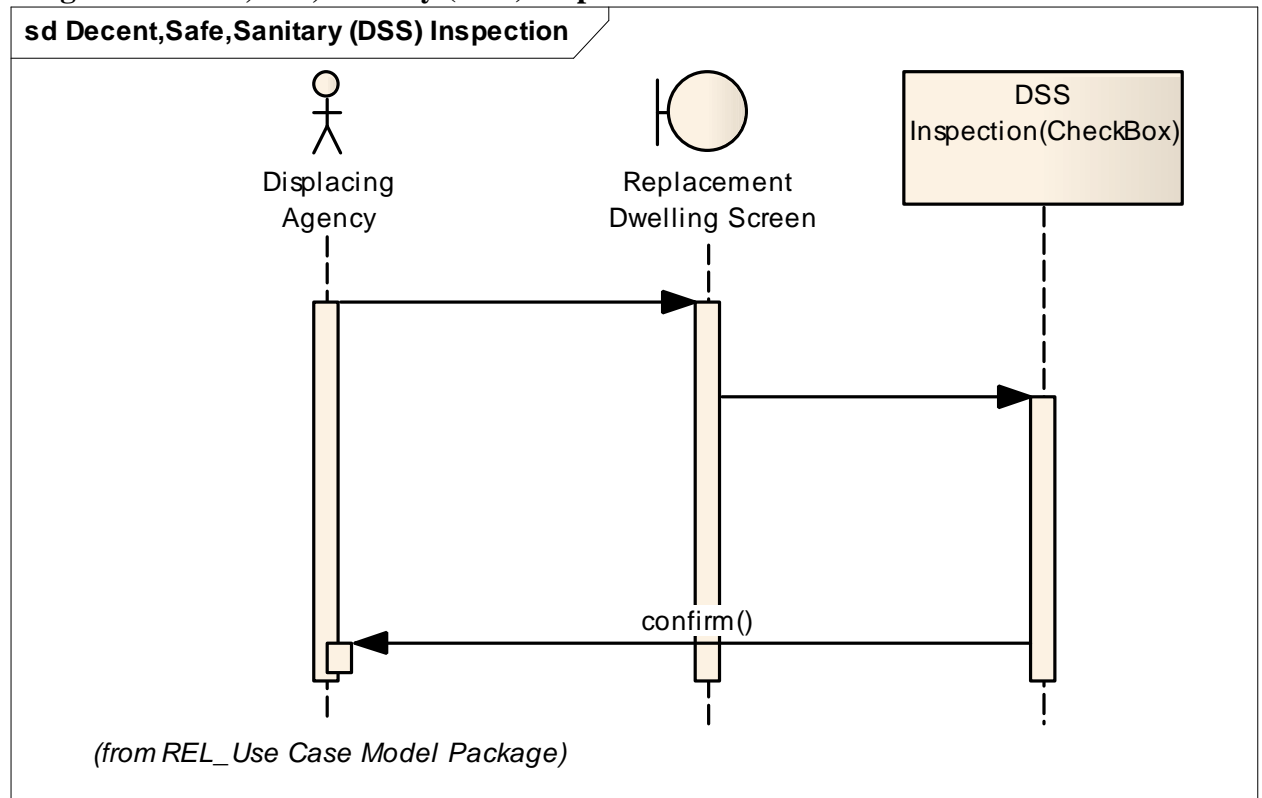
Diagram: 2nd DSS Inspection**Diagram: Decent, Safe, Sanitary (DSS) Inspection**

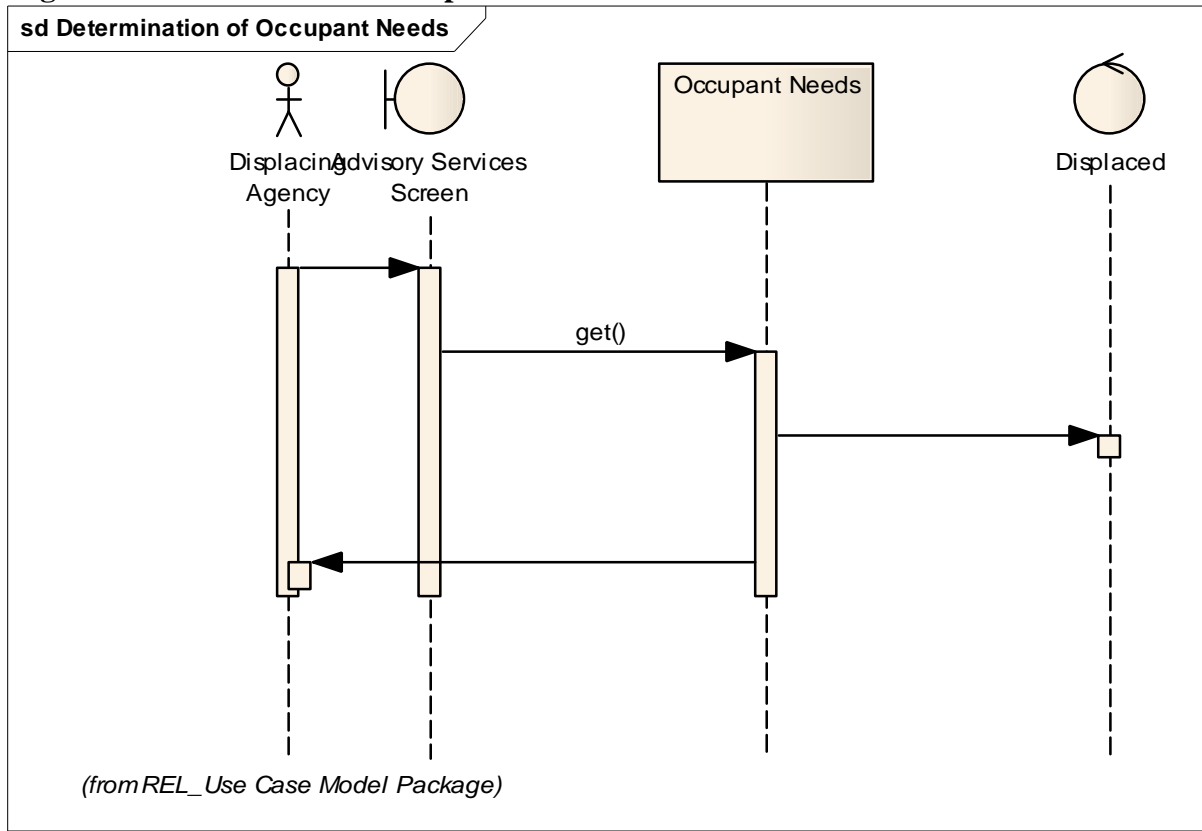
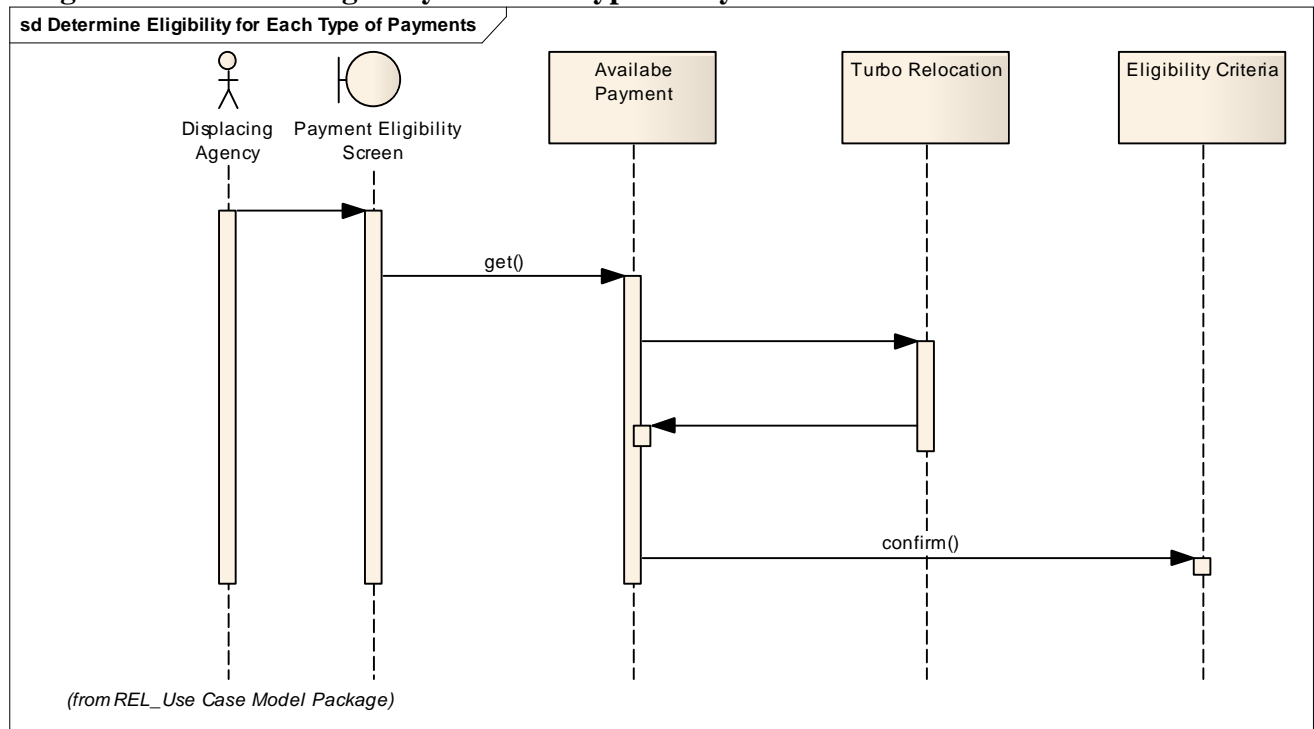
Diagram: Determination of Occupant Needs**Diagram: Determine Eligibility for Each Type of Payments**

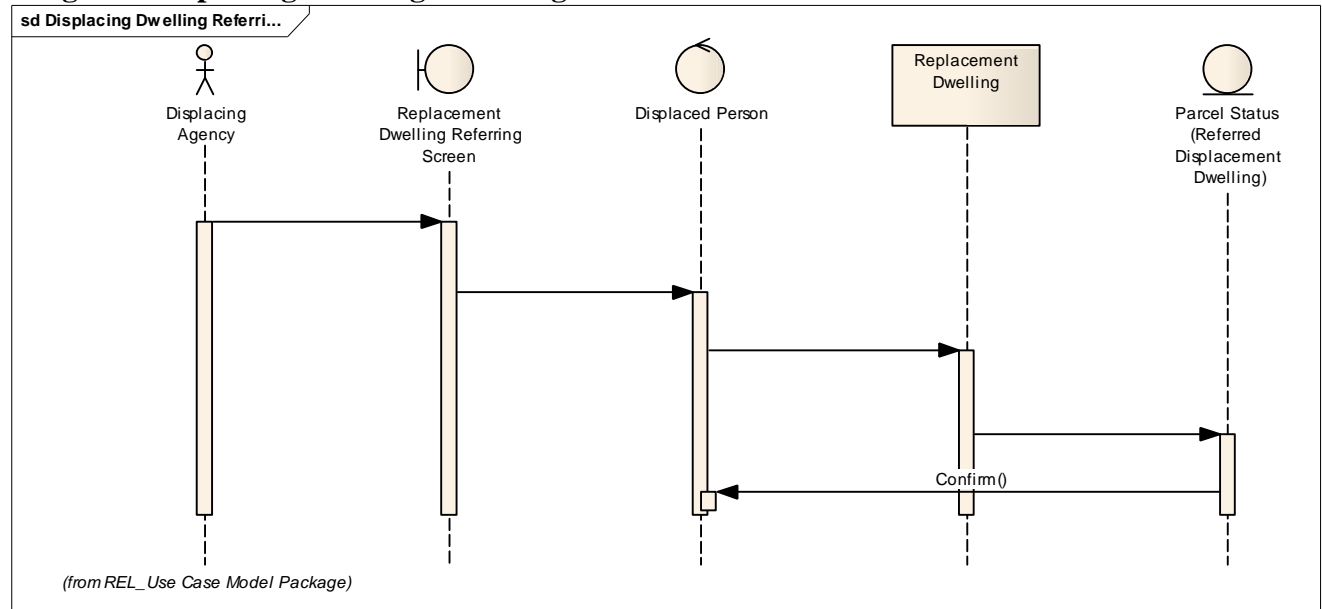
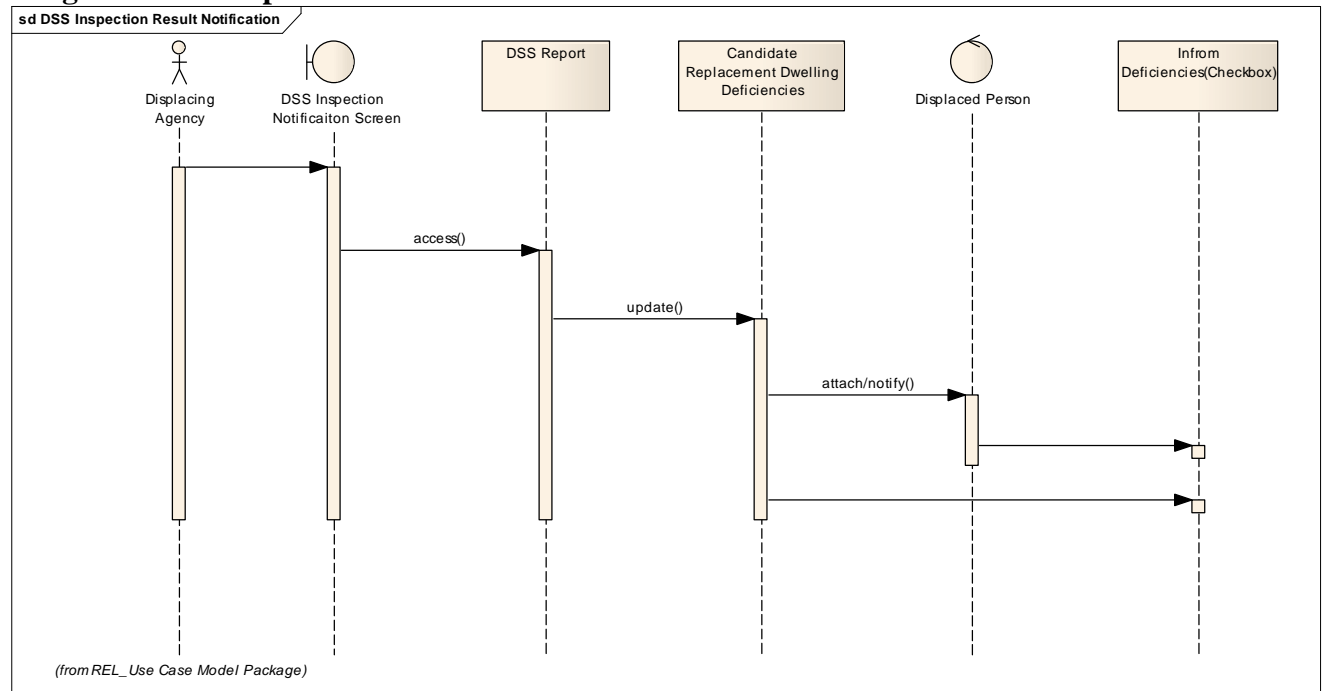
Diagram: Displacing Dwelling Referring**Diagram: DSS Inspection Result Notification**

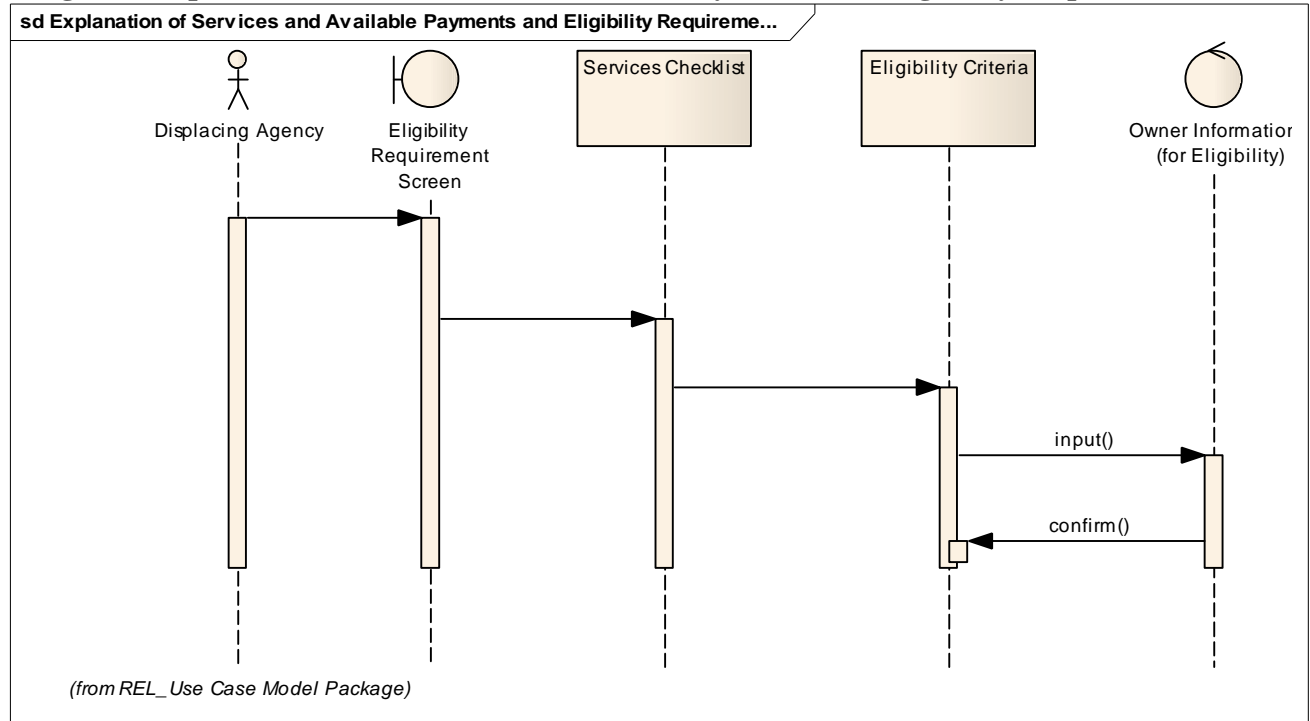
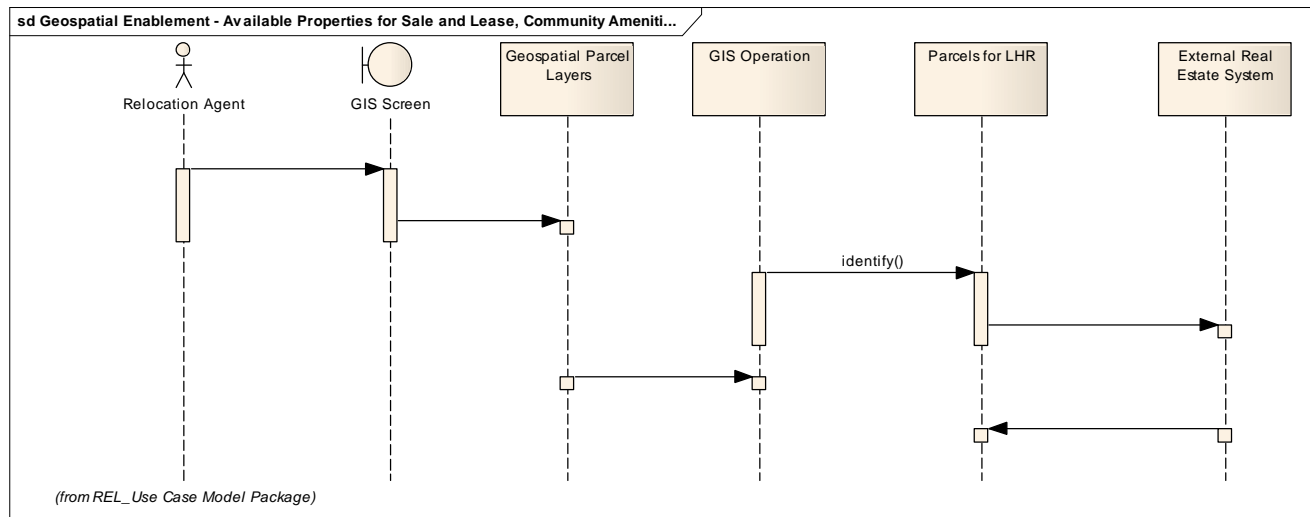
Diagram: Explanation of Services and Available Payments and Eligibility Requirements**Diagram: Geospatial Enablement - Available Properties for Sale and Lease, Community Amenities**

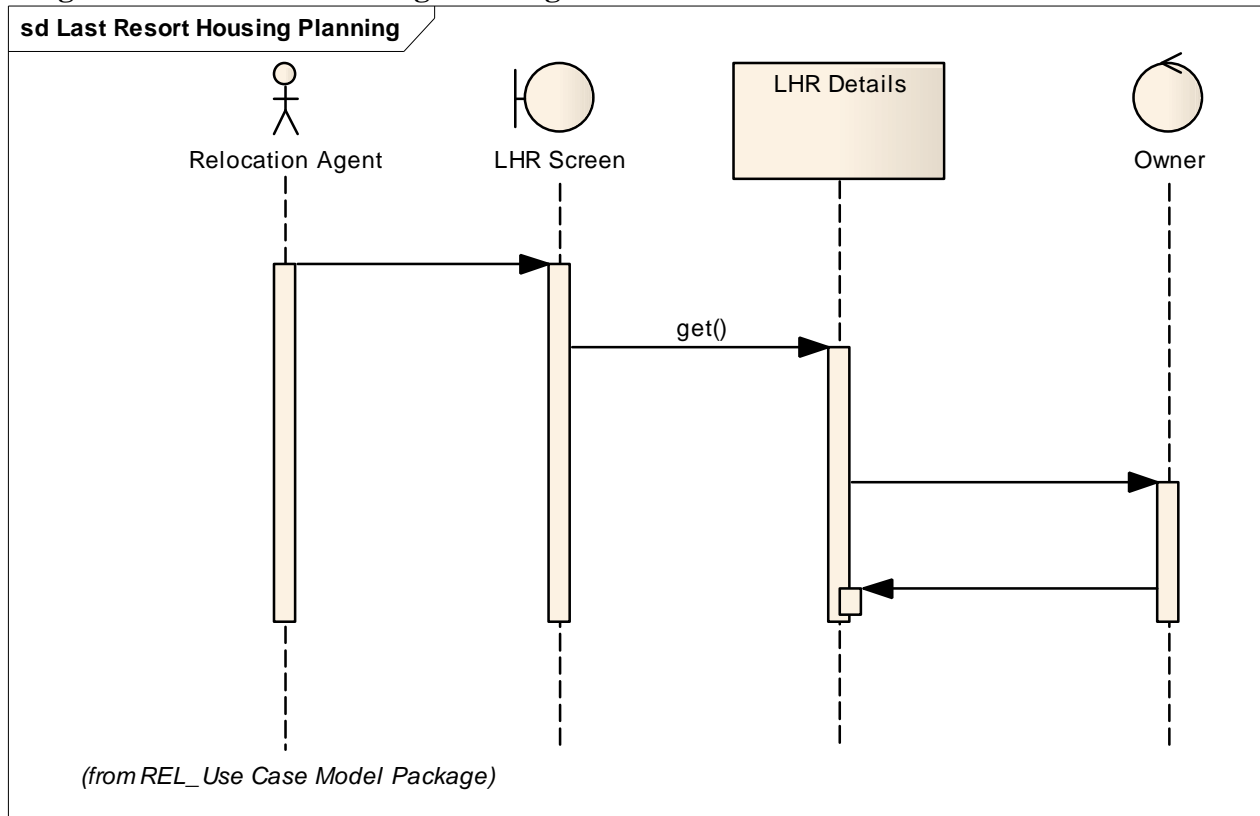
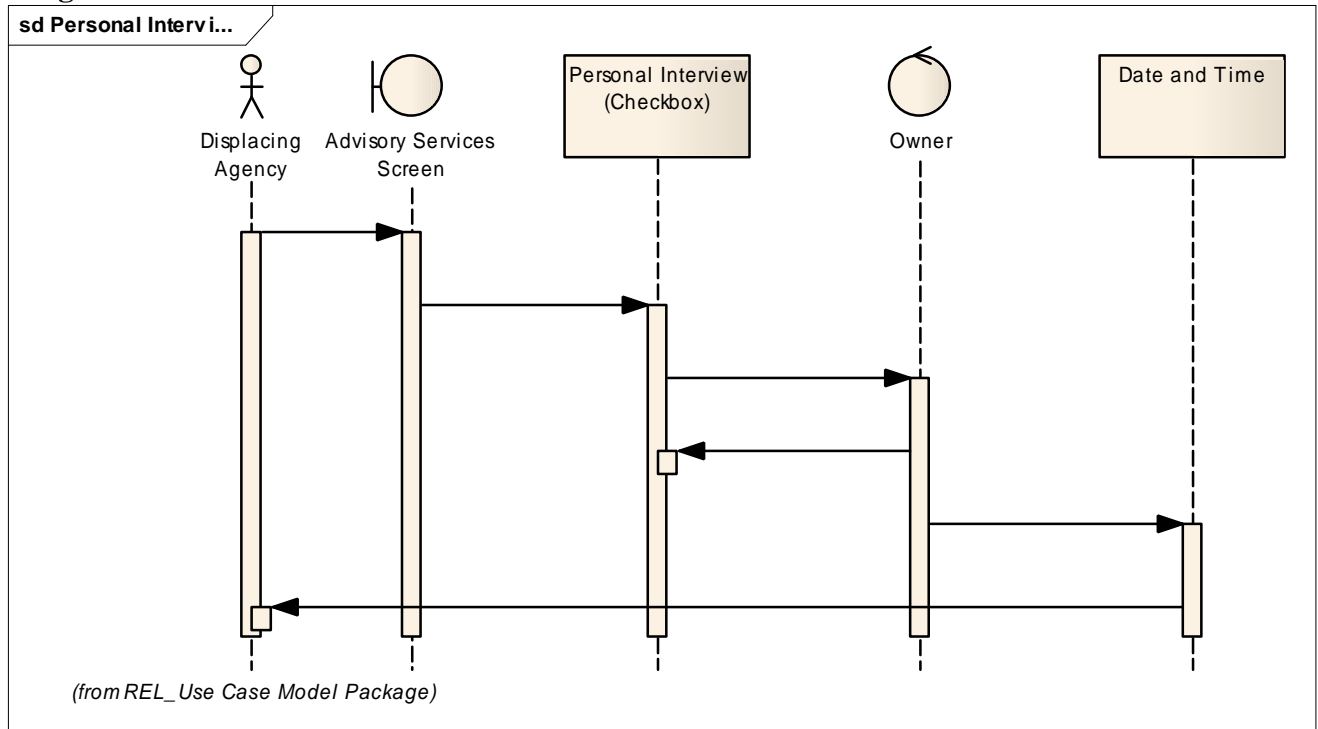
Diagram: Last Resort Housing Planning**sd Last Resort Housing Planning****Diagram: Personal Interview****sd Personal Intervi...**

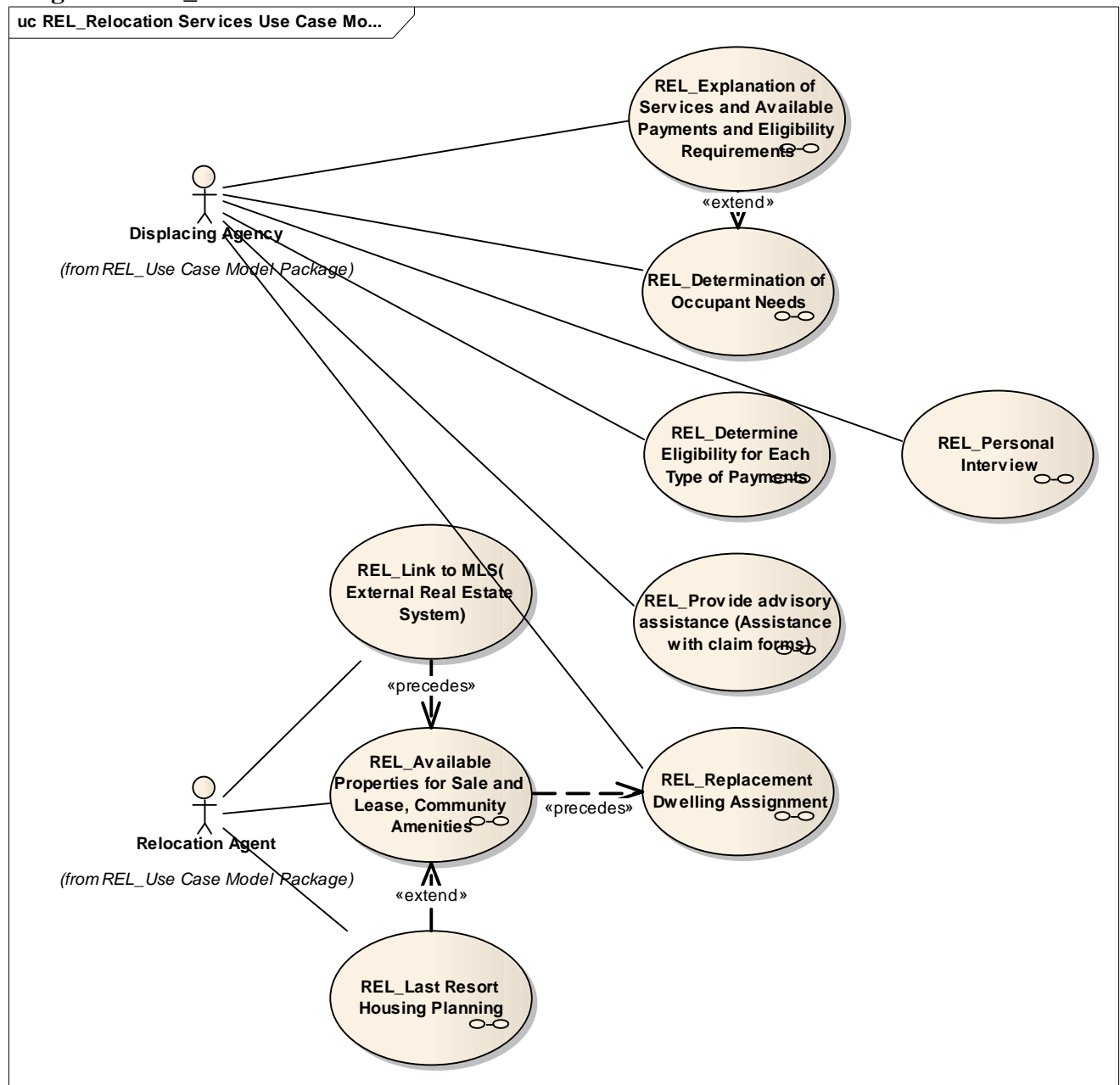
Diagram: REL_Relocation Services Use Case Model

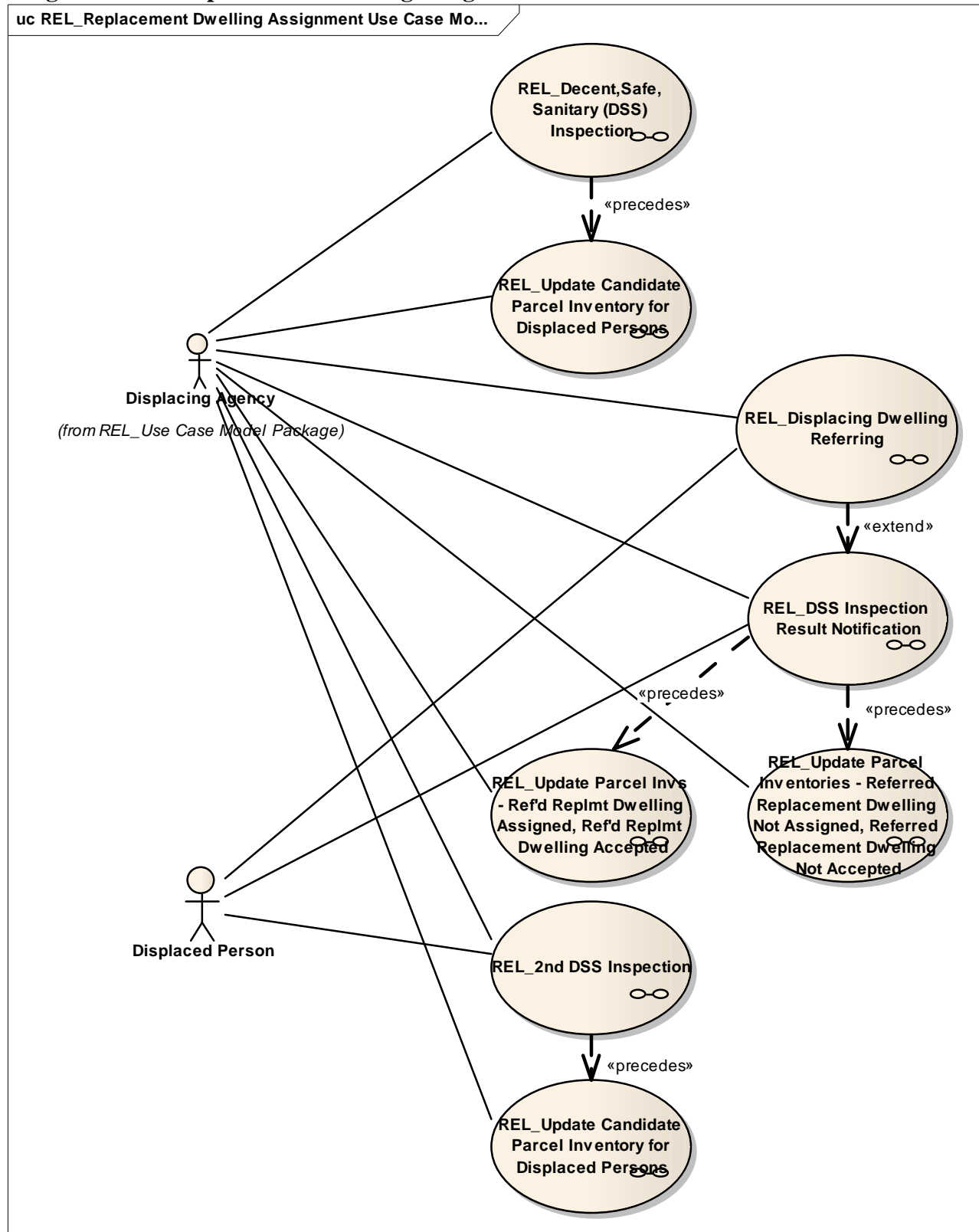
Diagram: REL_Replacement Dwelling Assignment Use Case Model

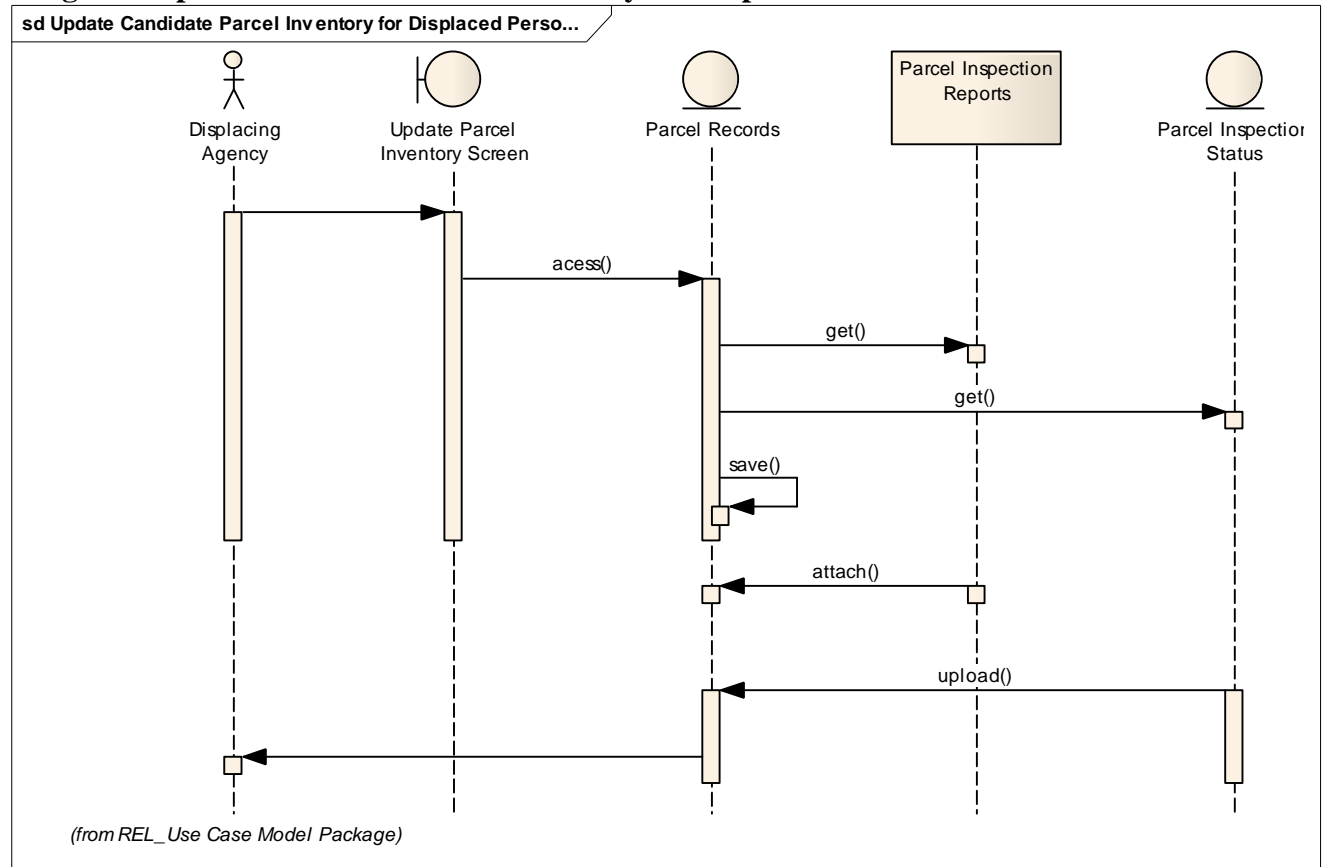
Diagram: Update Candidate Parcel Inventory for Displaced Persons

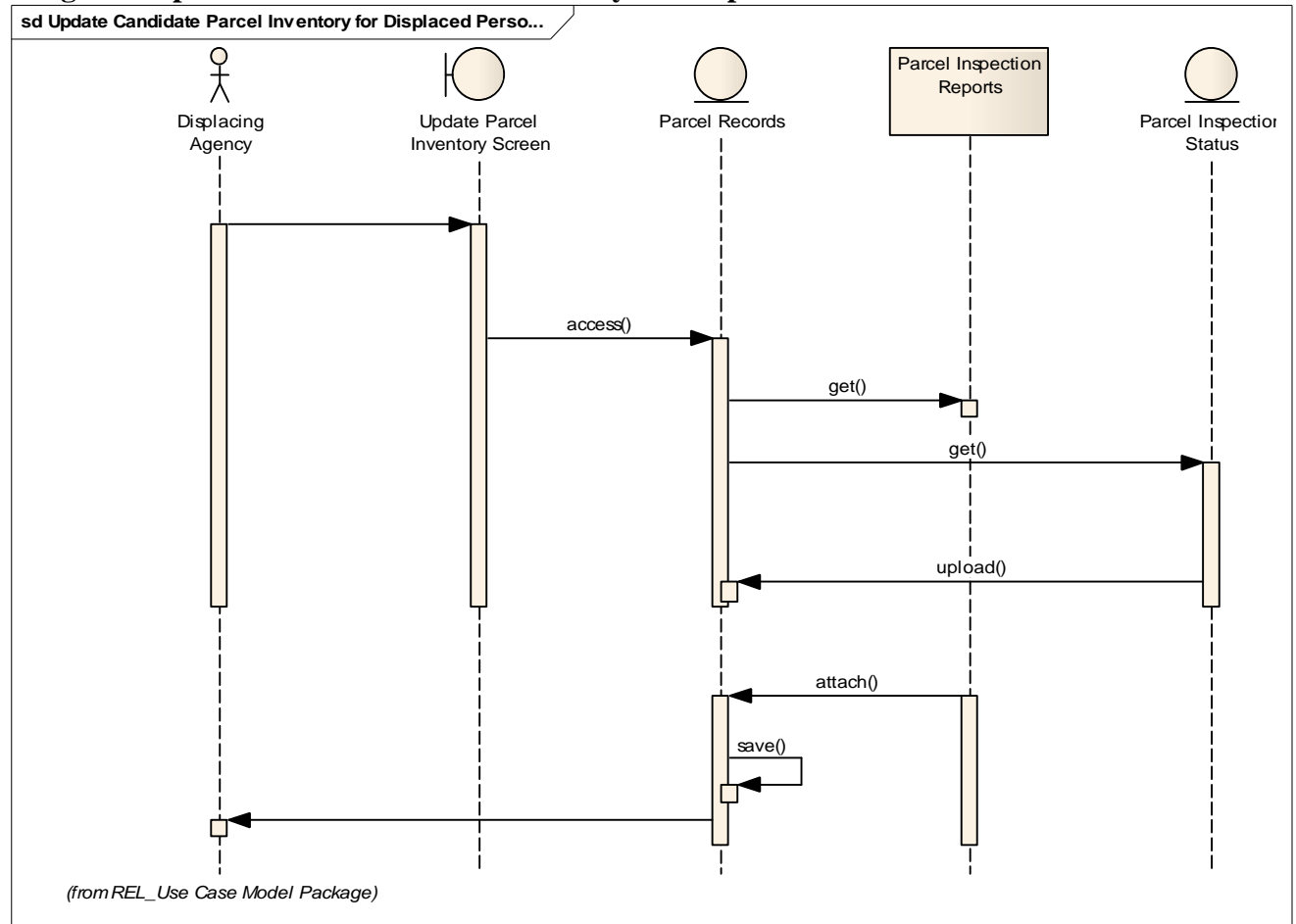
Diagram: Update Candidate Parcel Inventory for Displaced Persons

Diagram: Update Parcel Inventories - Referred Replacement Dwelling Assigned, Referred Replacement Dwelling Accepted

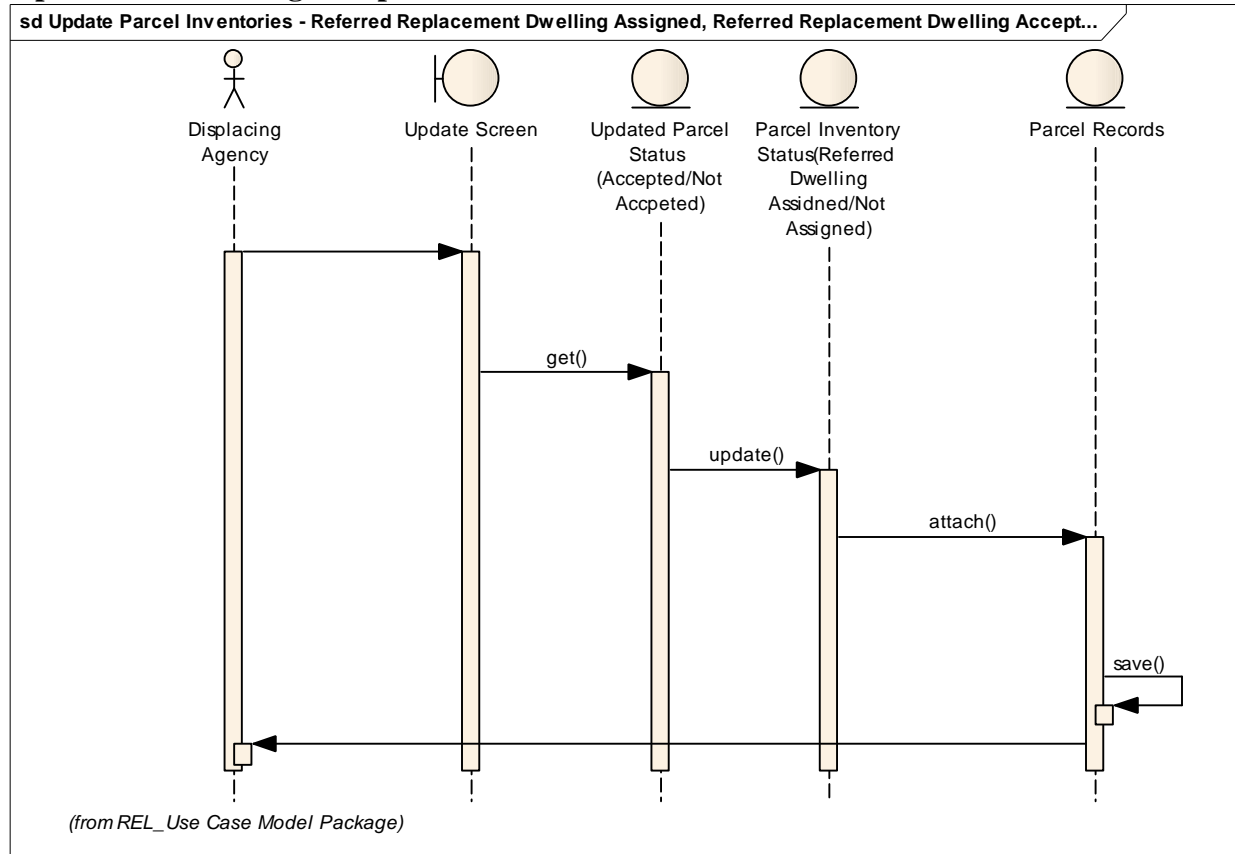


Diagram: Update Parcel Inventories - Referred Replacement Dwelling Not Assigned, Referred Replacement Dwelling Not Accepted

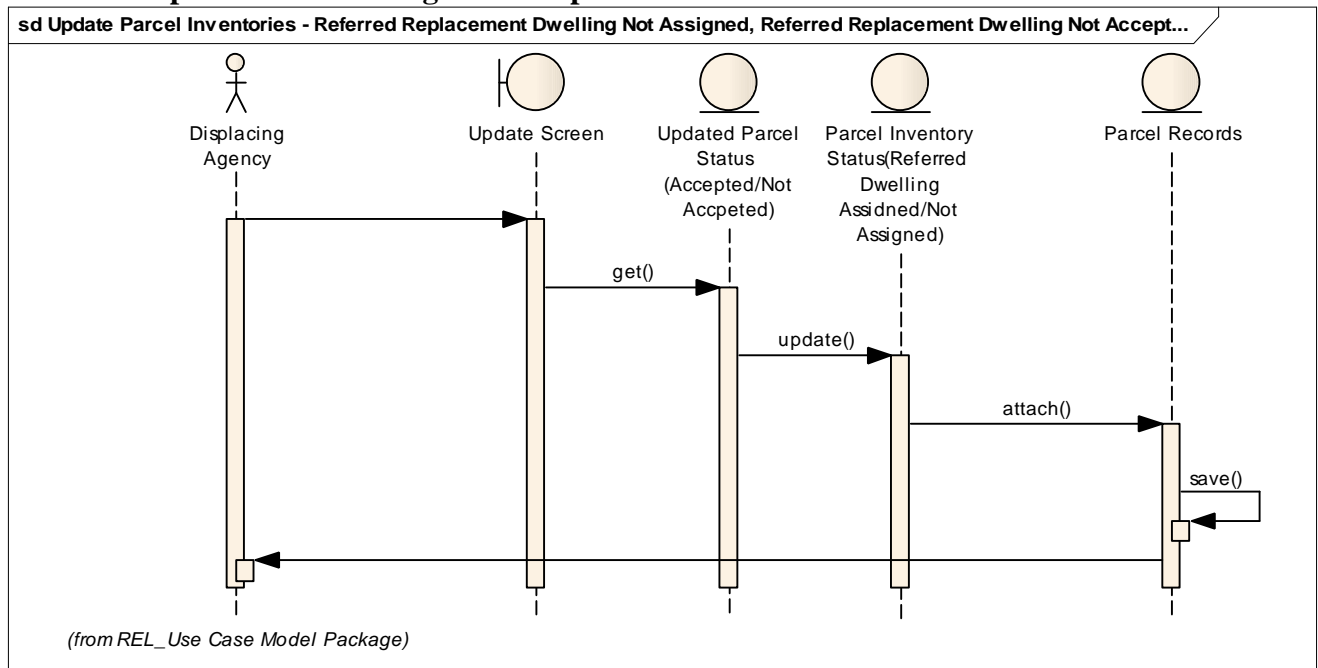


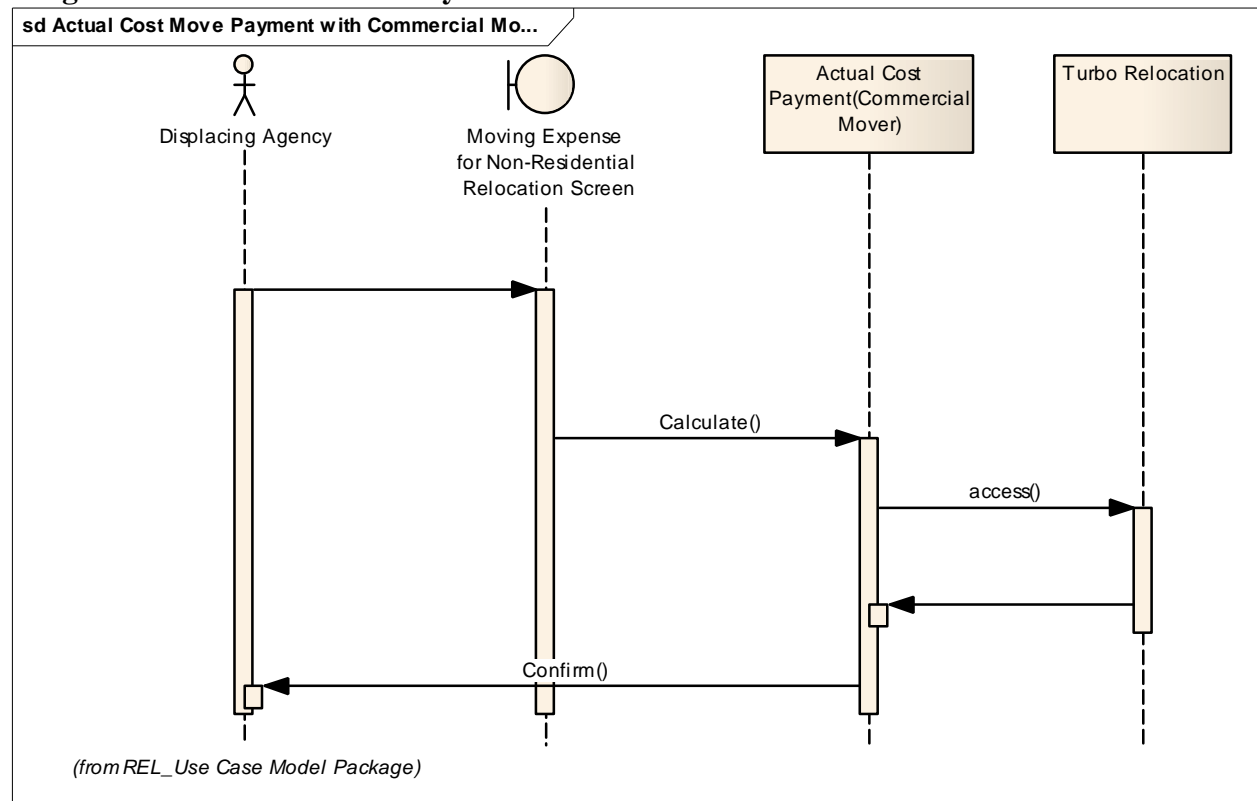
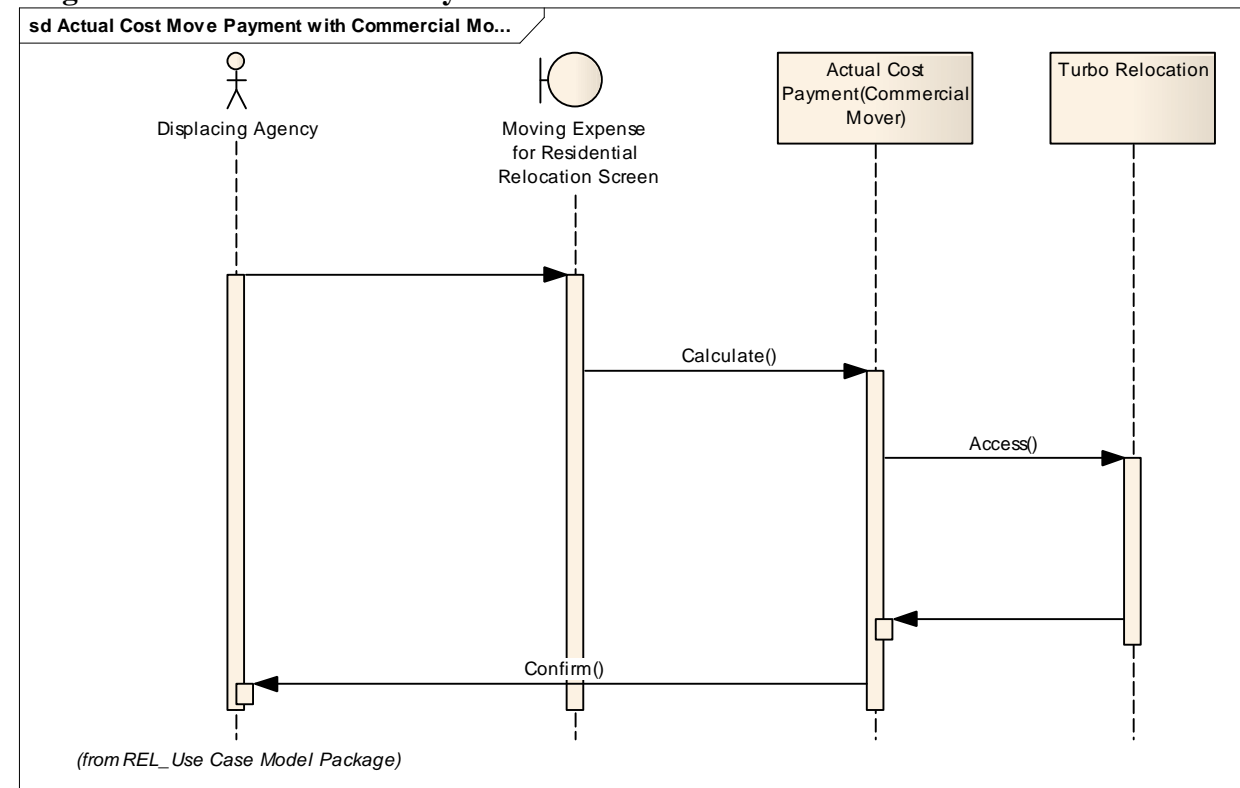
Diagram: Actual Cost Move Payment with Commercial Mover**Diagram: Actual Cost Move Payment with Commercial Mover**

Diagram: Alternate Actual Payment (If required) : Establish direct loss of tangible personal property

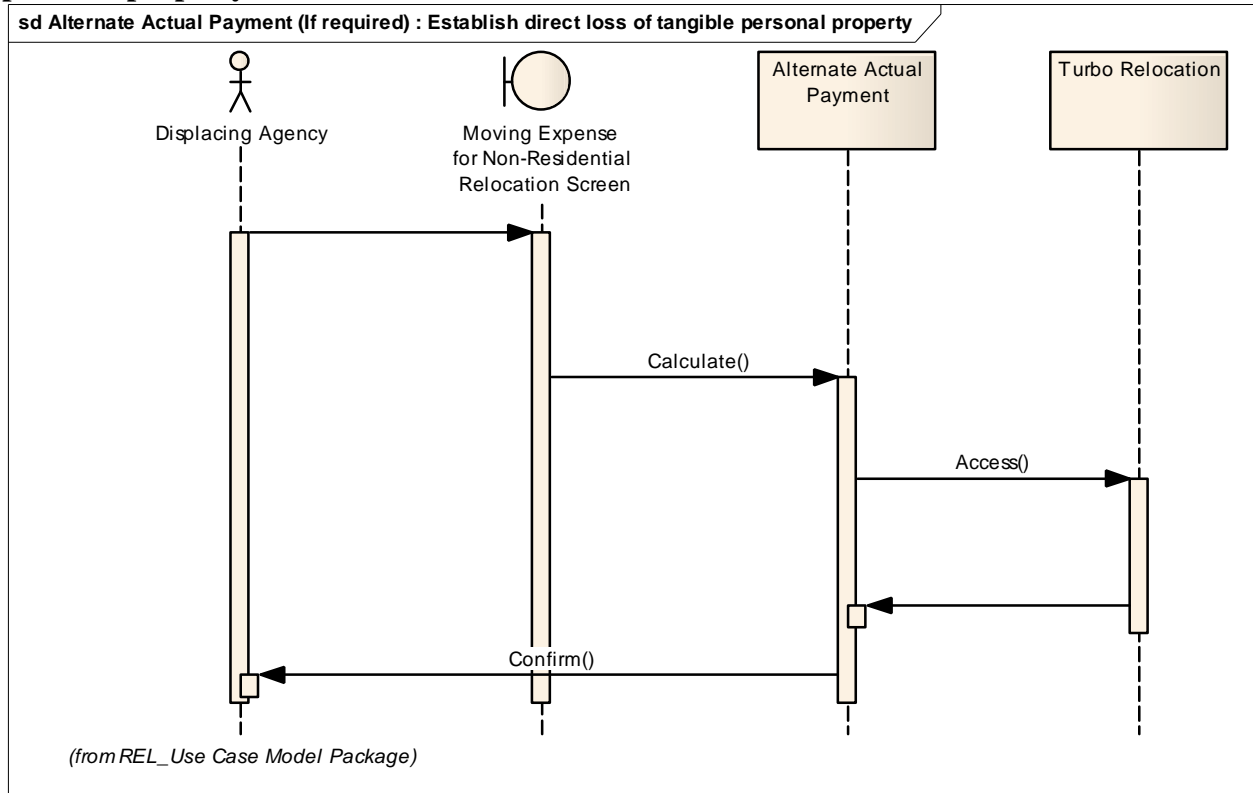


Diagram: Calculate Self-Documented Actual Cost Move Payment

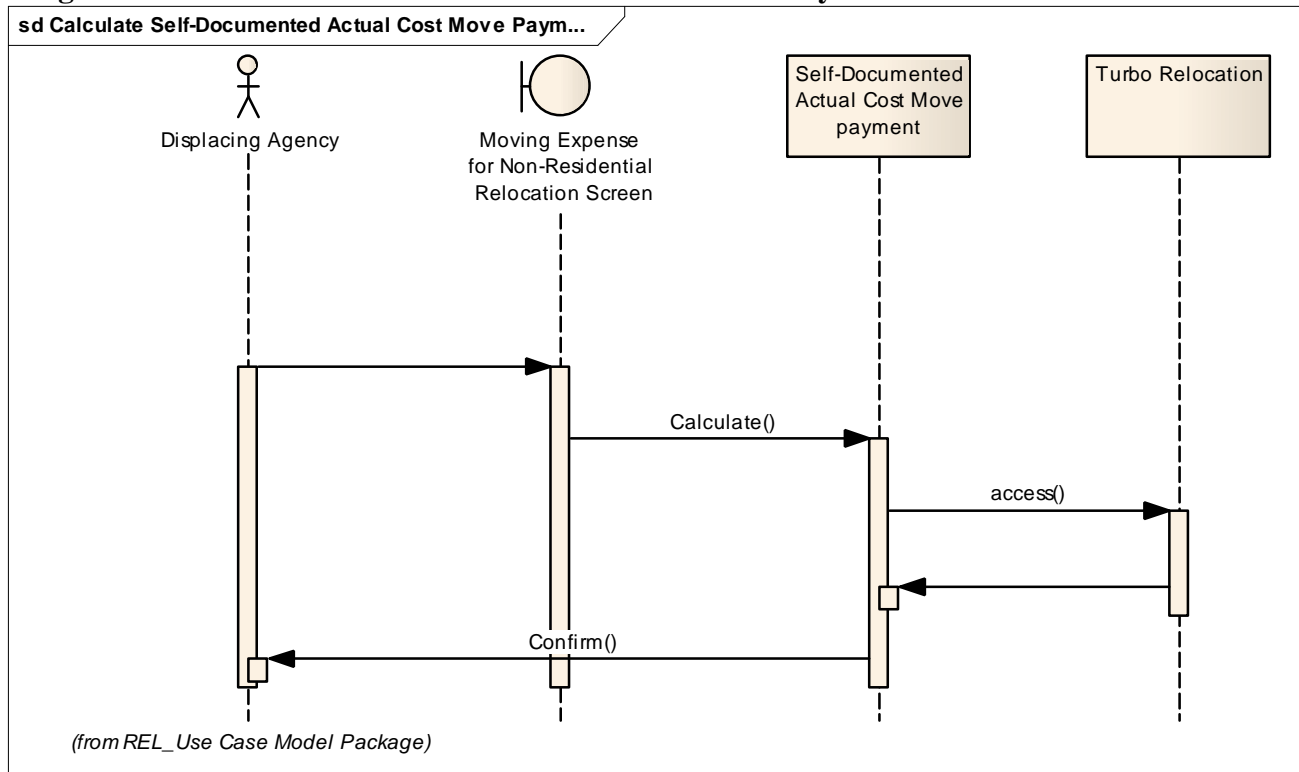


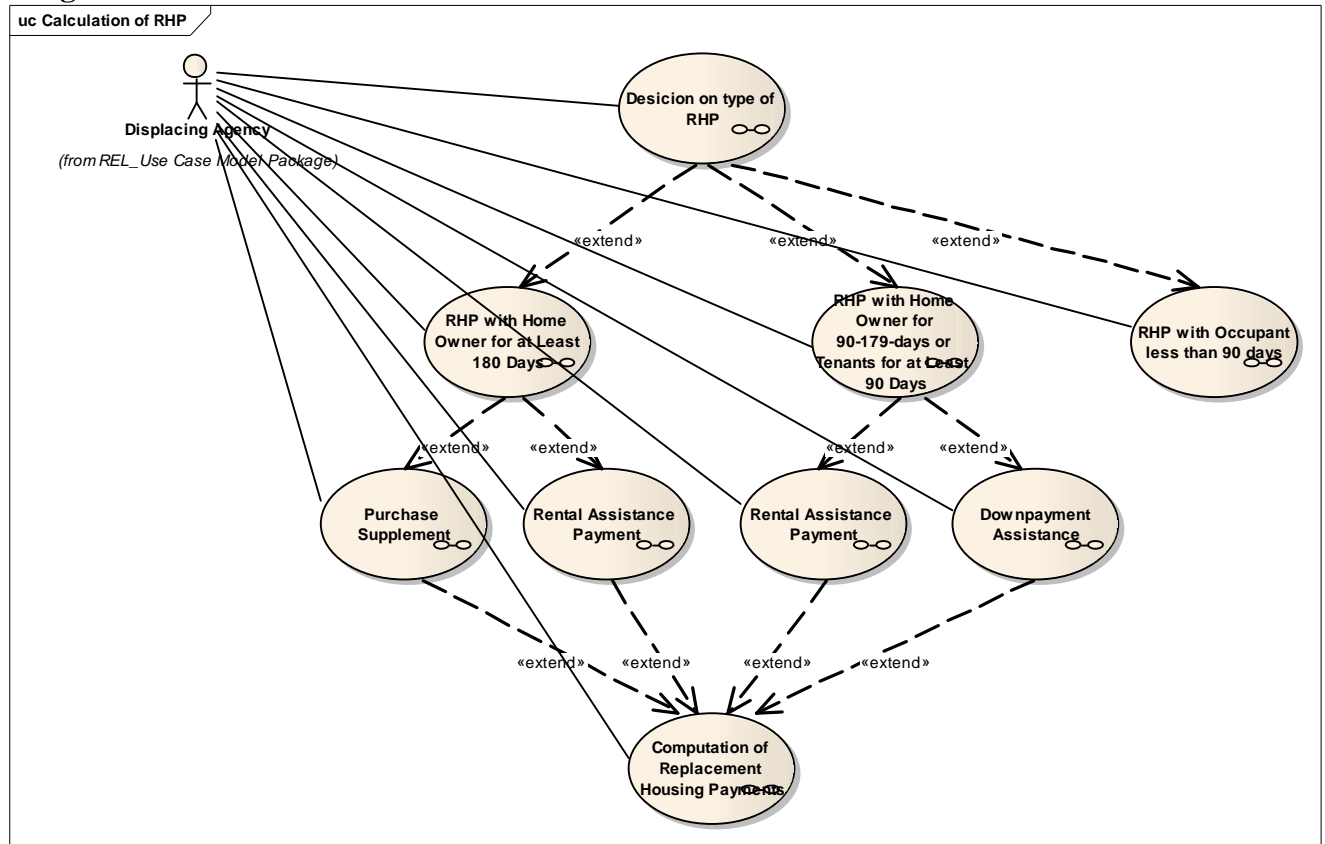
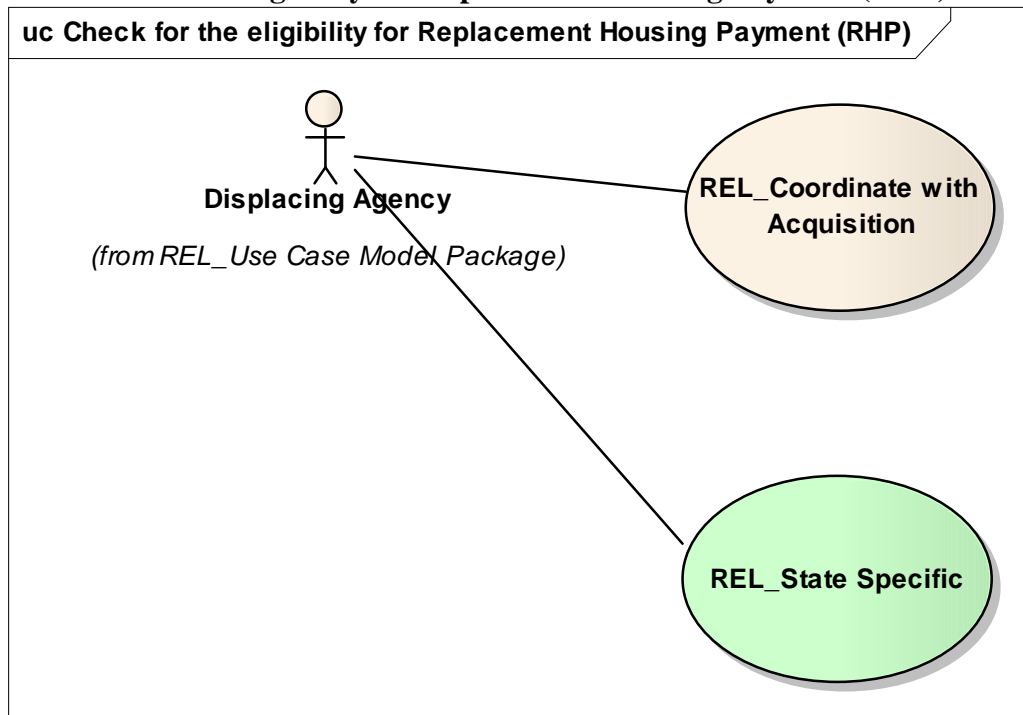
Diagram: Calculation of RHP**Diagram: Check for the eligibility for Replacement Housing Payment (RHP)**

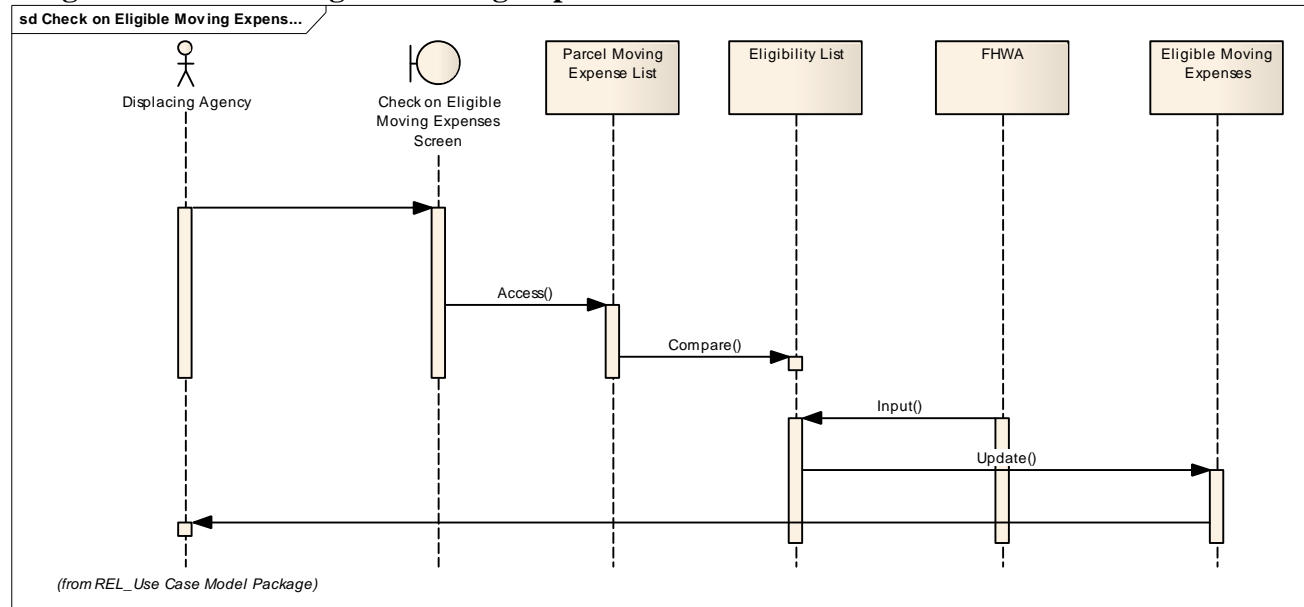
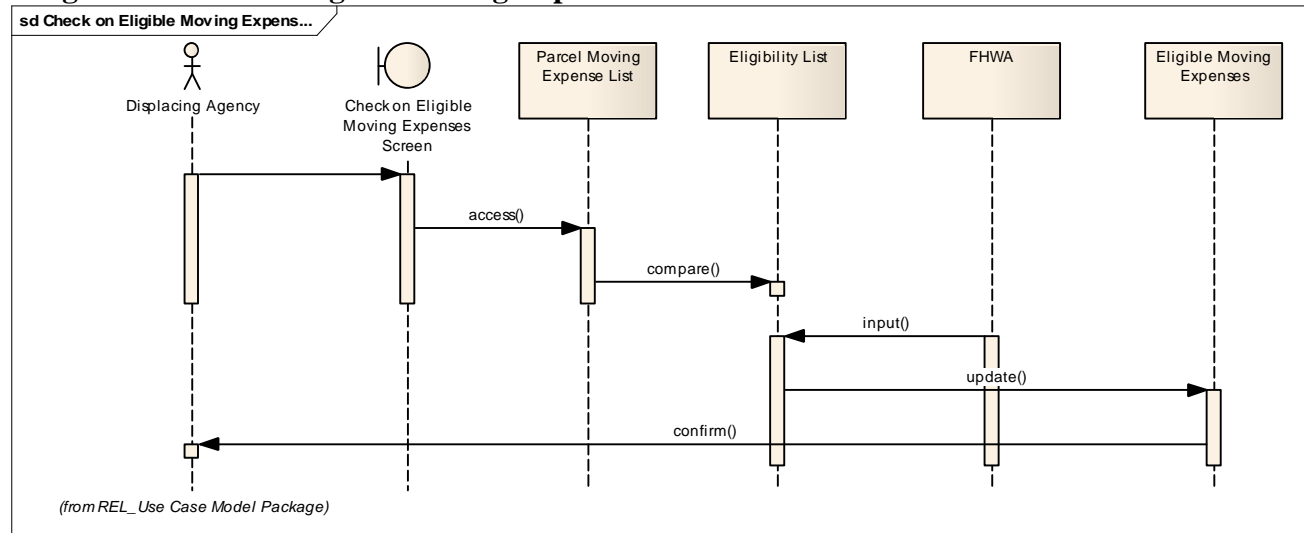
Diagram: Check on Eligible Moving Expenses**Diagram: Check on Eligible Moving Expenses**

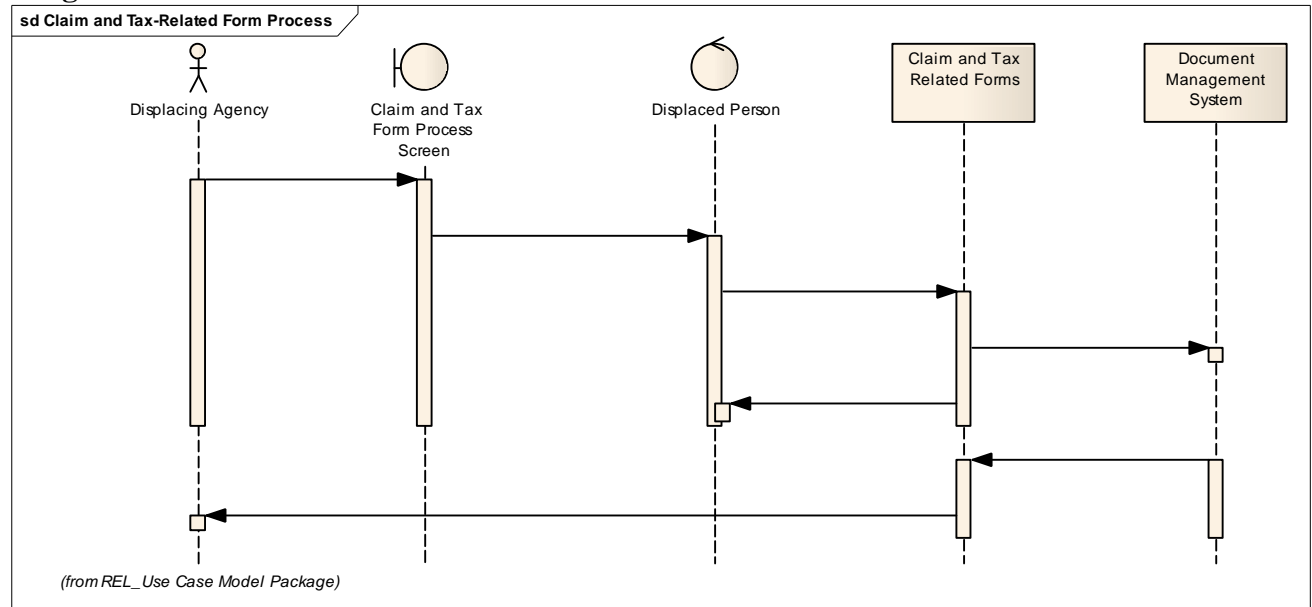
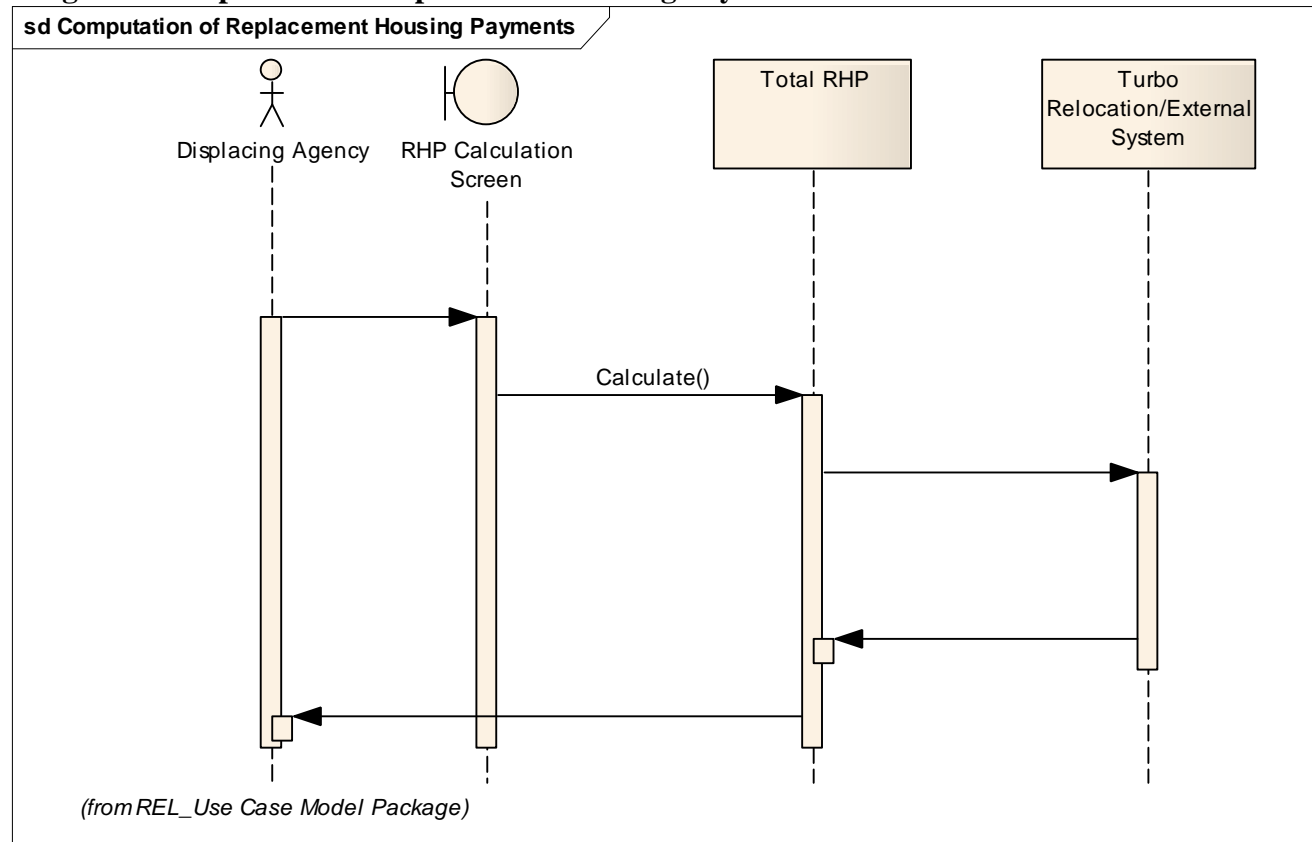
Diagram: Claim and Tax-Related Form Process**Diagram: Computation of Replacement Housing Payments**

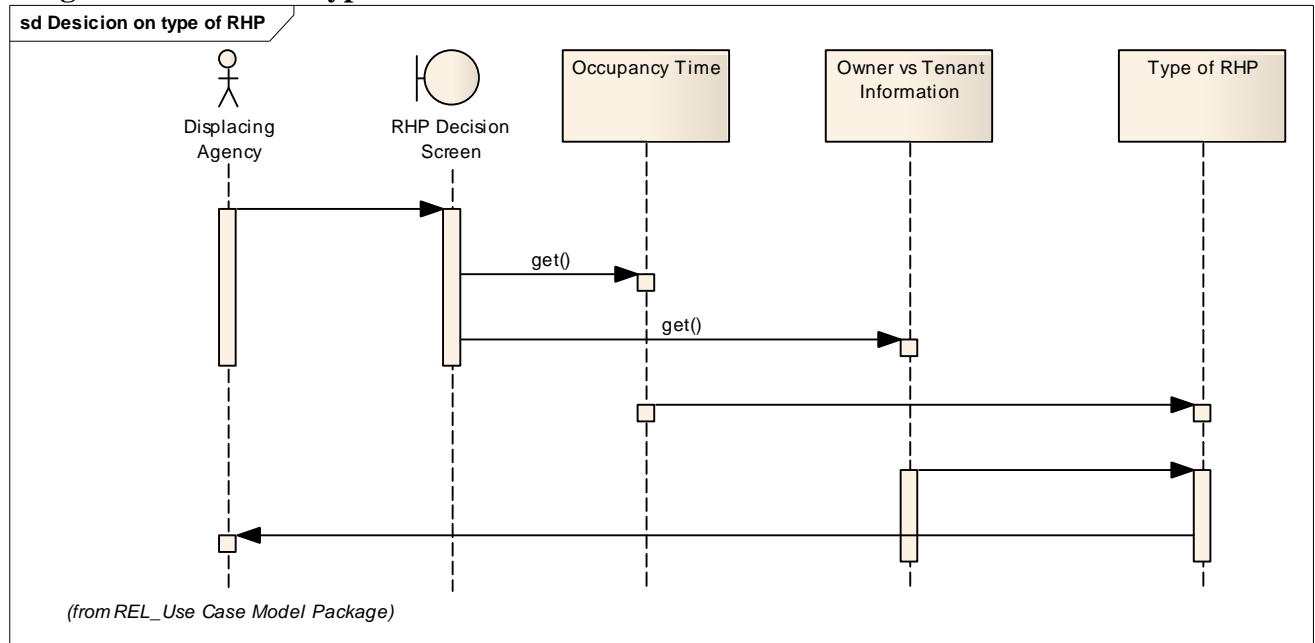
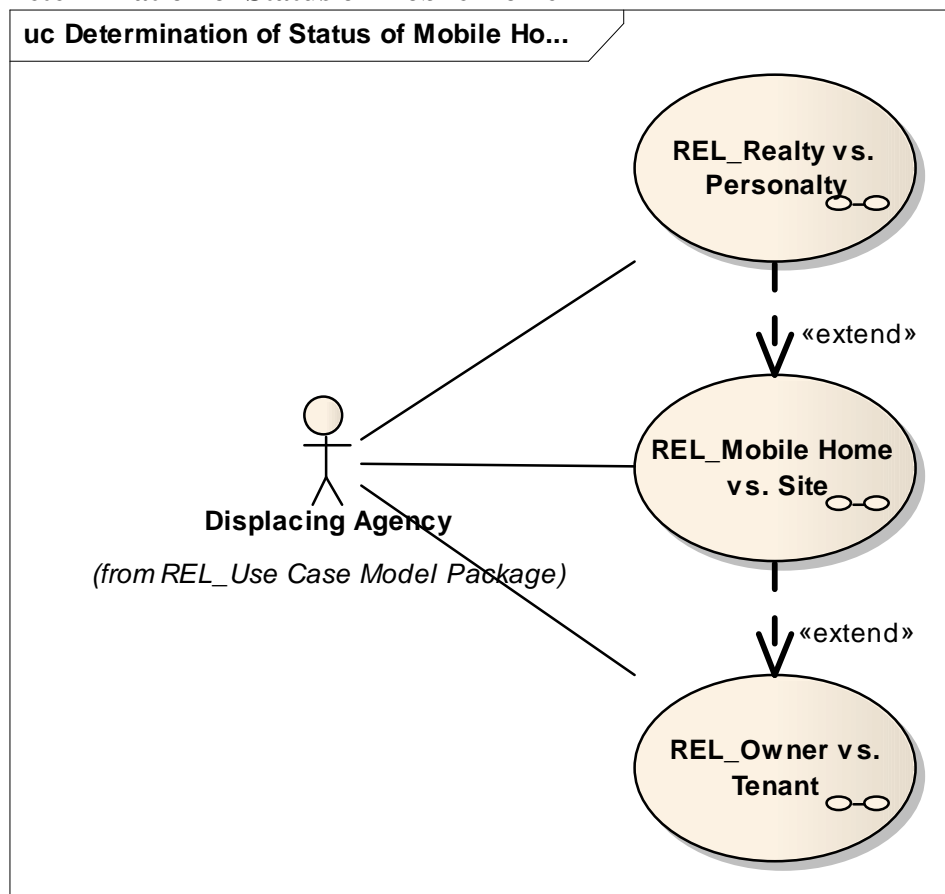
Diagram: Decision on type of RHP**Diagram: Determination of Status of Mobile Home**

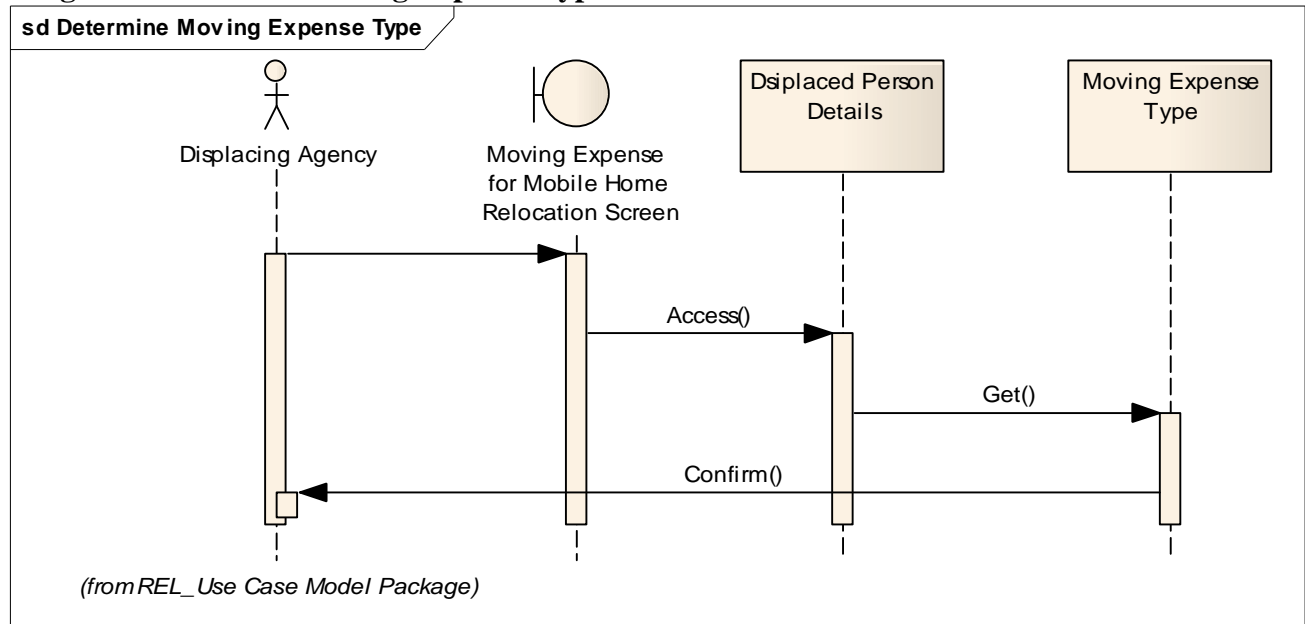
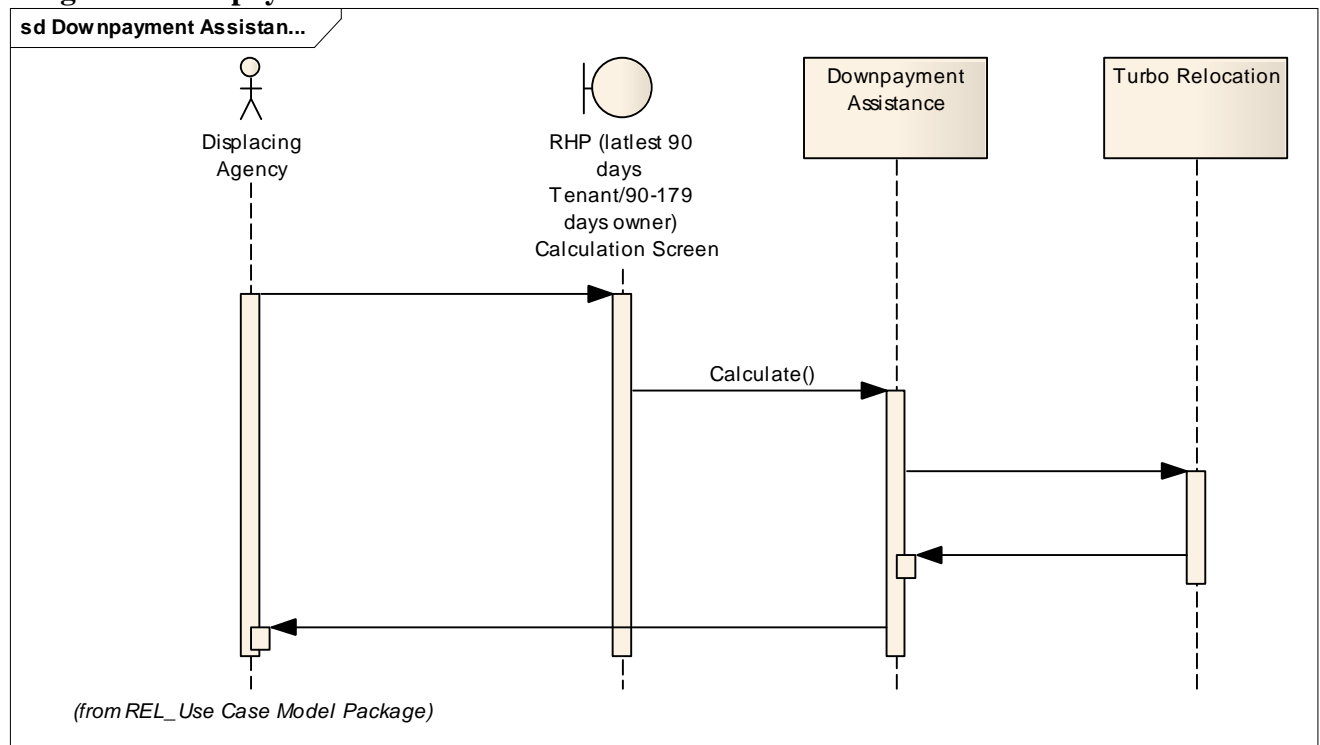
Diagram: Determine Moving Expense Type**Diagram: Downpayment Assistance**

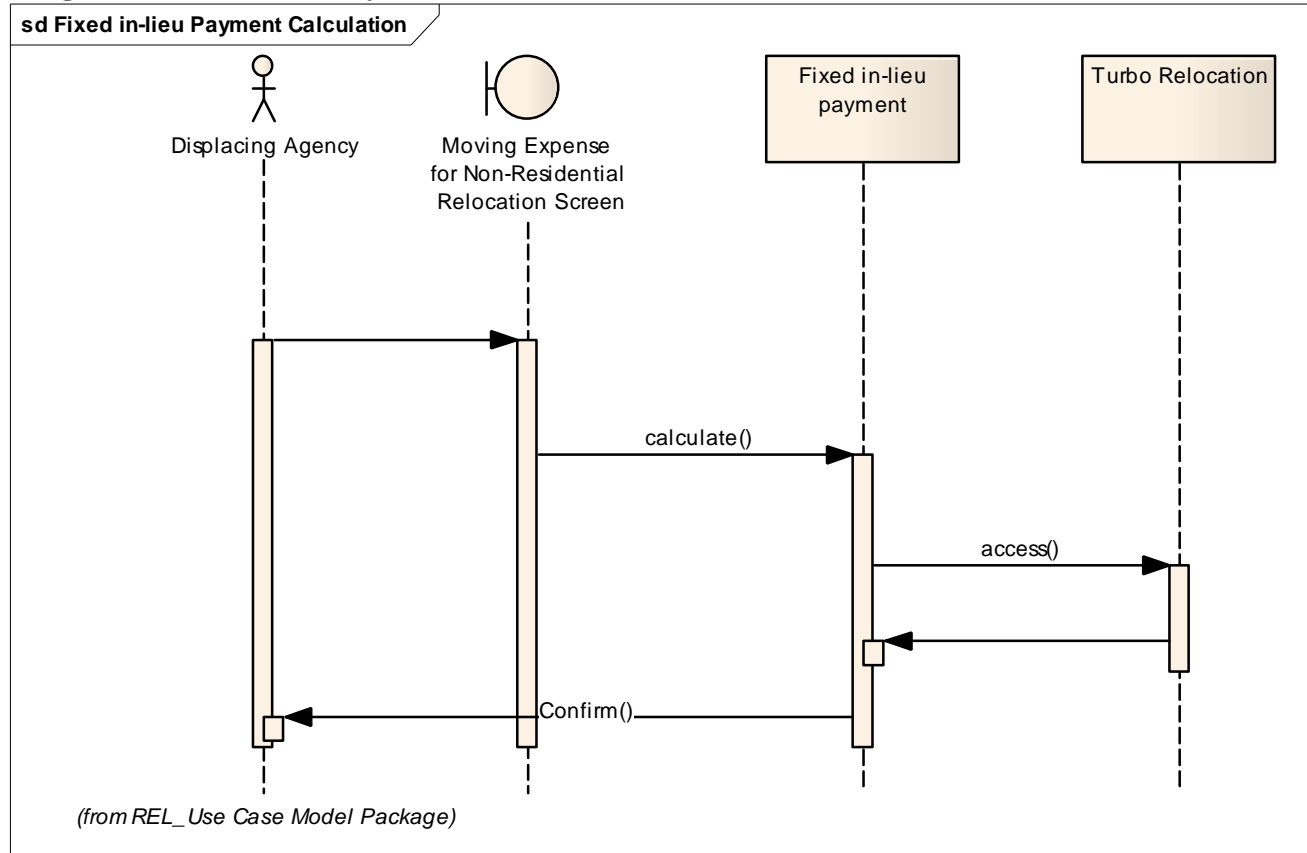
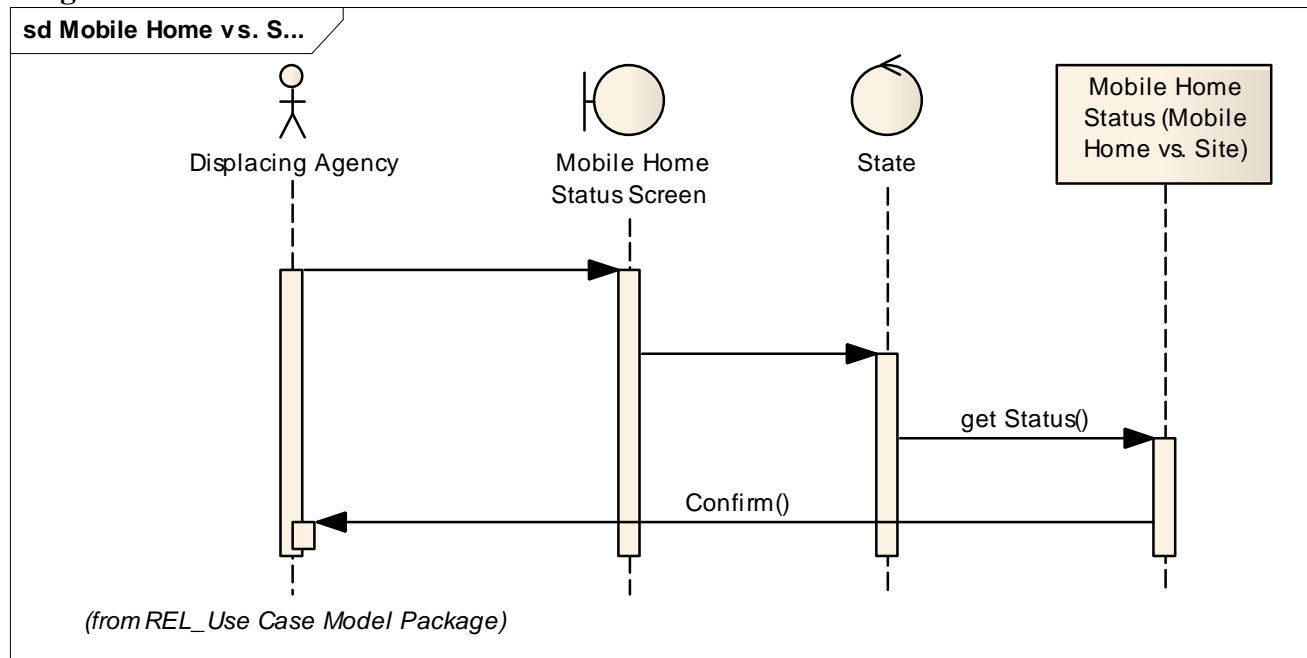
Diagram: Fixed in-lieu Payment Calculation**Diagram: Mobile Home vs. Site**

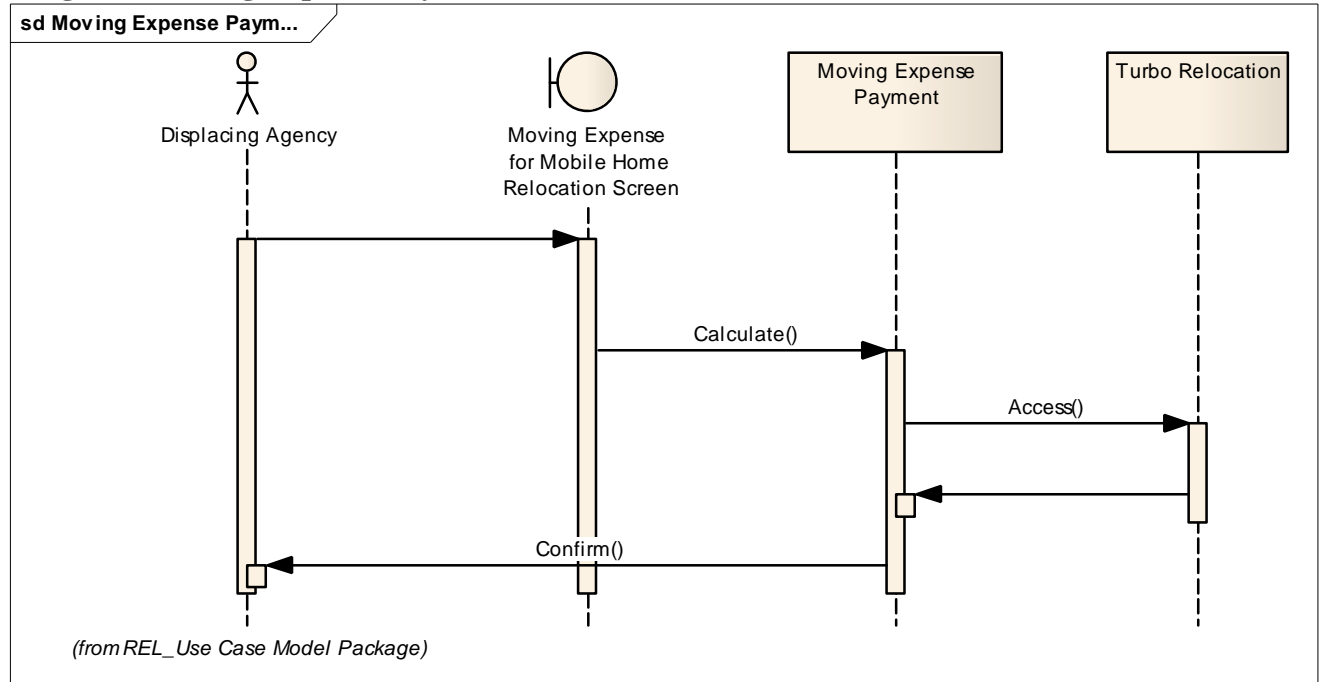
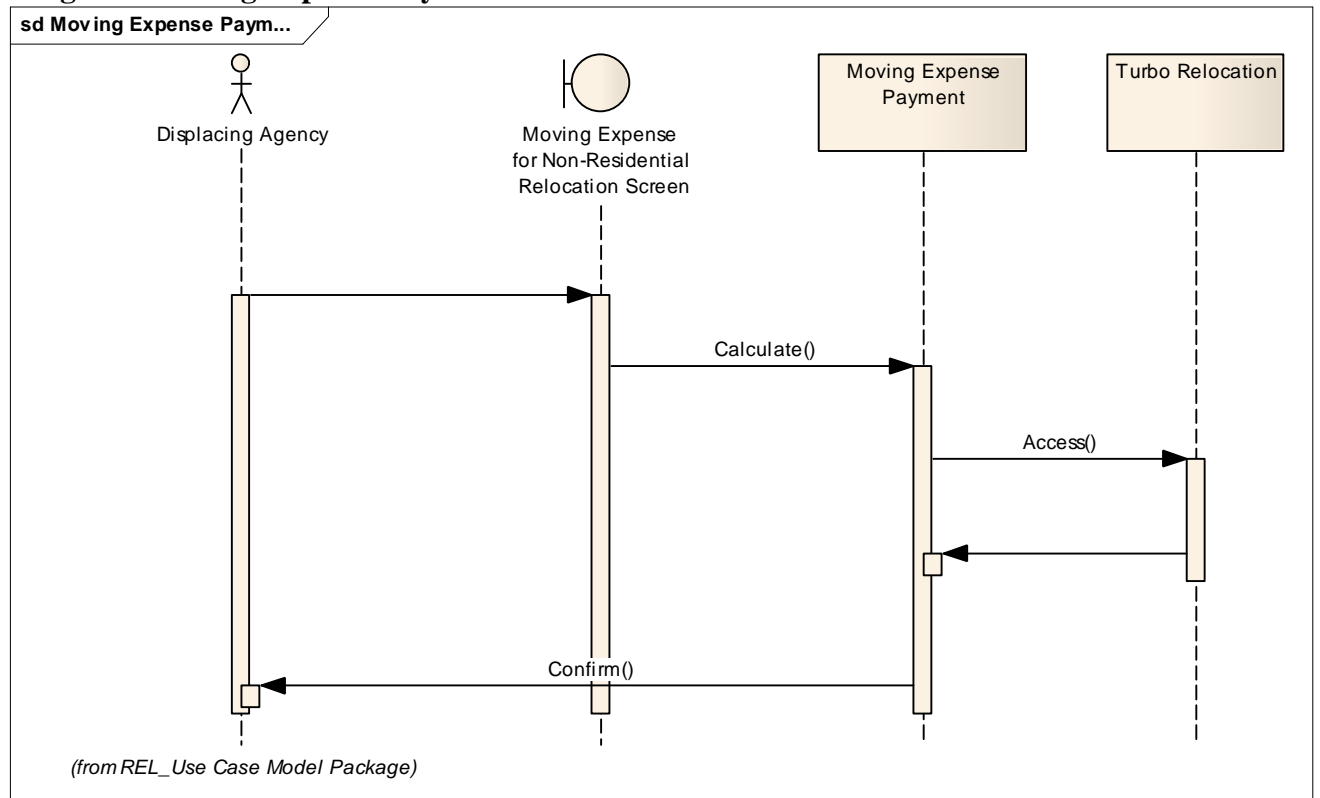
Diagram: Moving Expense Payment**Diagram: Moving Expense Payment**

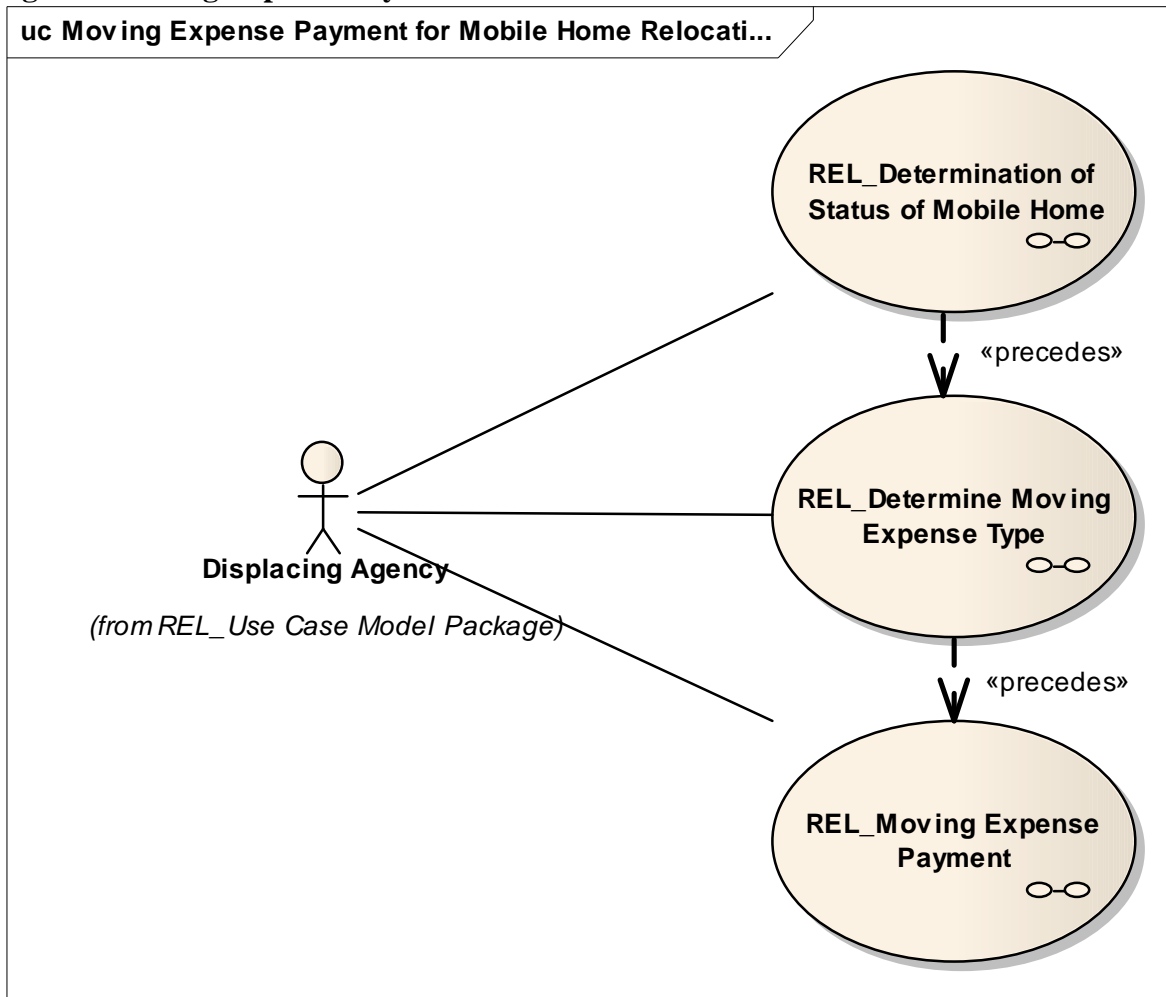
Diagram: Moving Expense Payment for Mobile Home Relocation

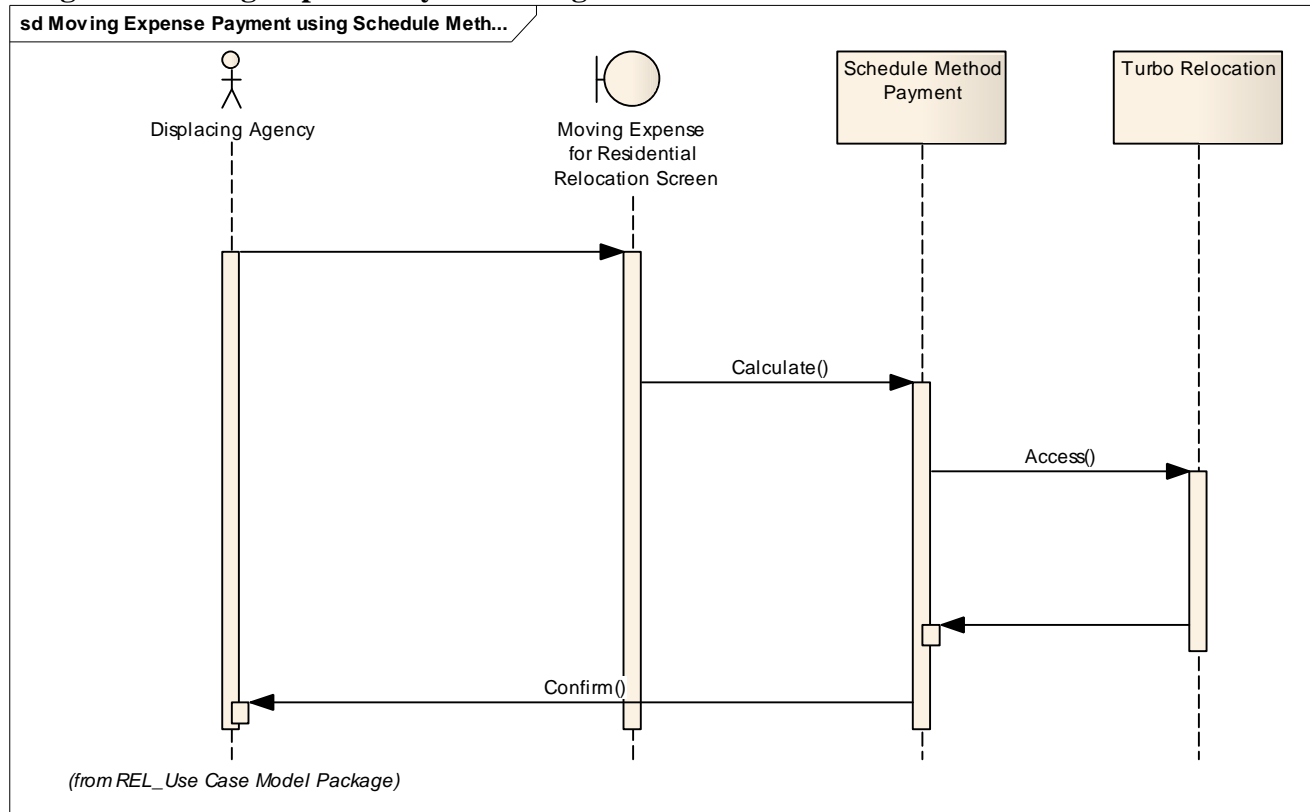
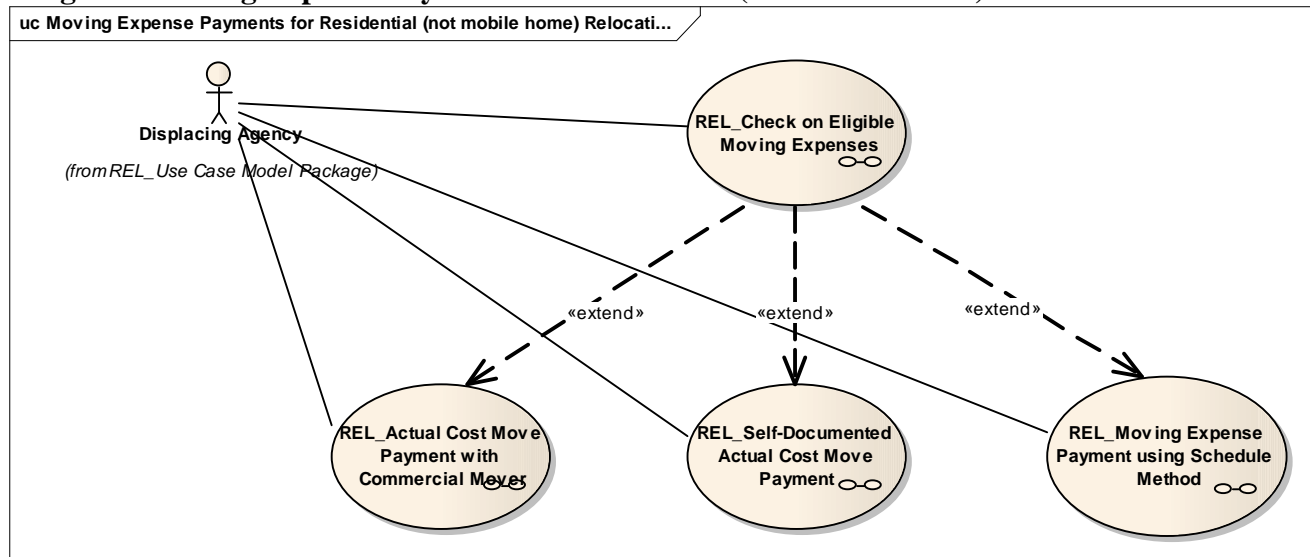
Diagram: Moving Expense Payment using Schedule Method**Diagram: Moving Expense Payments for Residential (not mobile home) Relocation**

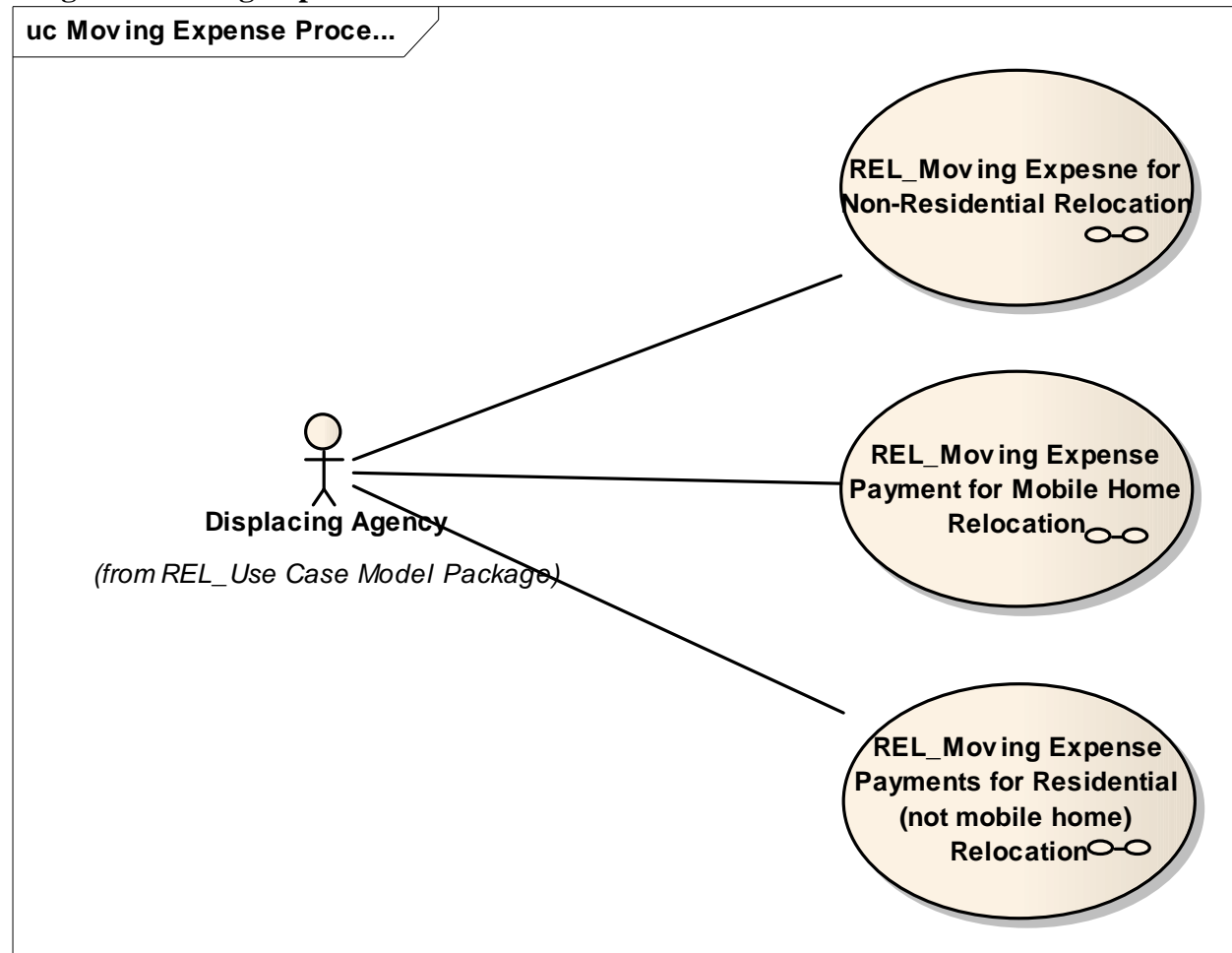
Diagram: Moving Expense Process

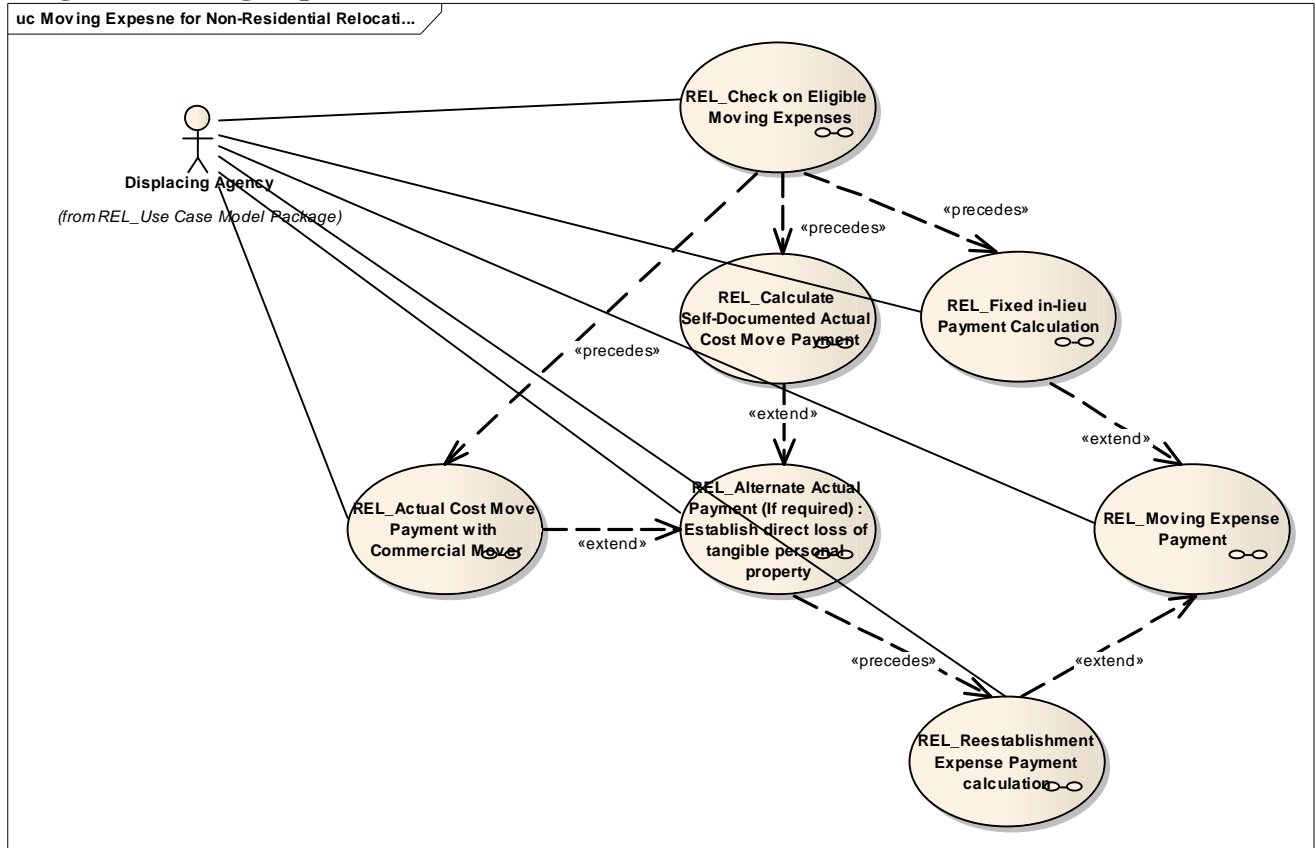
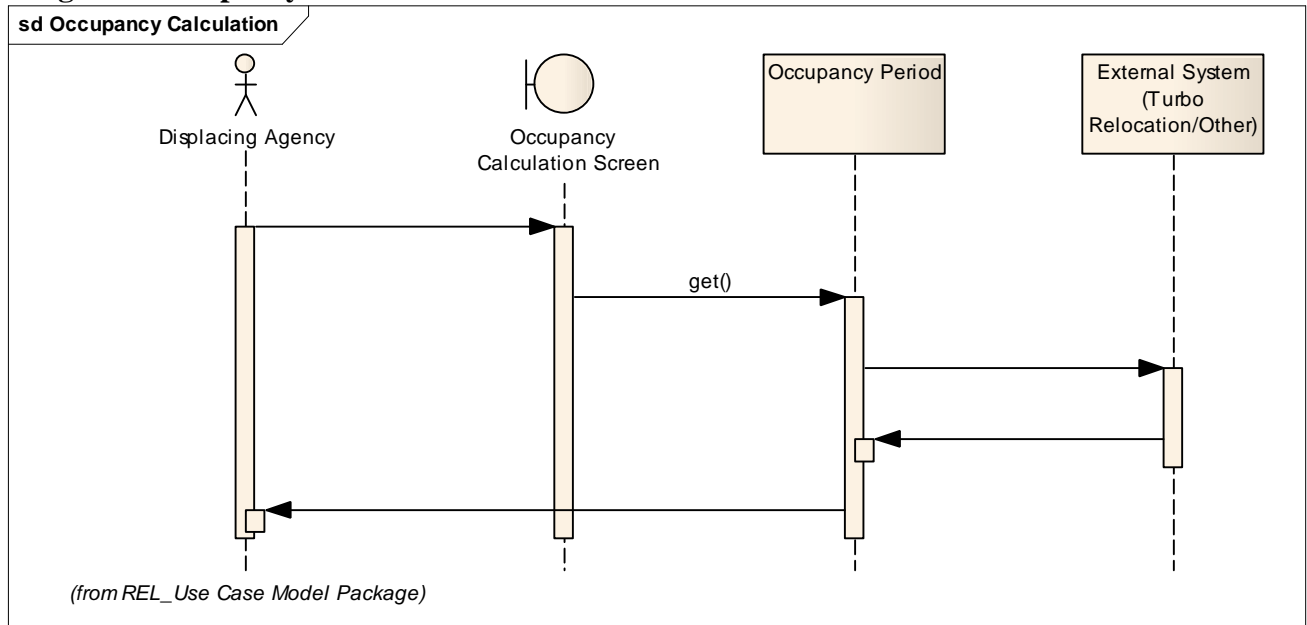
Diagram: Moving Expesne for Non-Residential Relocation**Diagram: Occupancy Calculation**

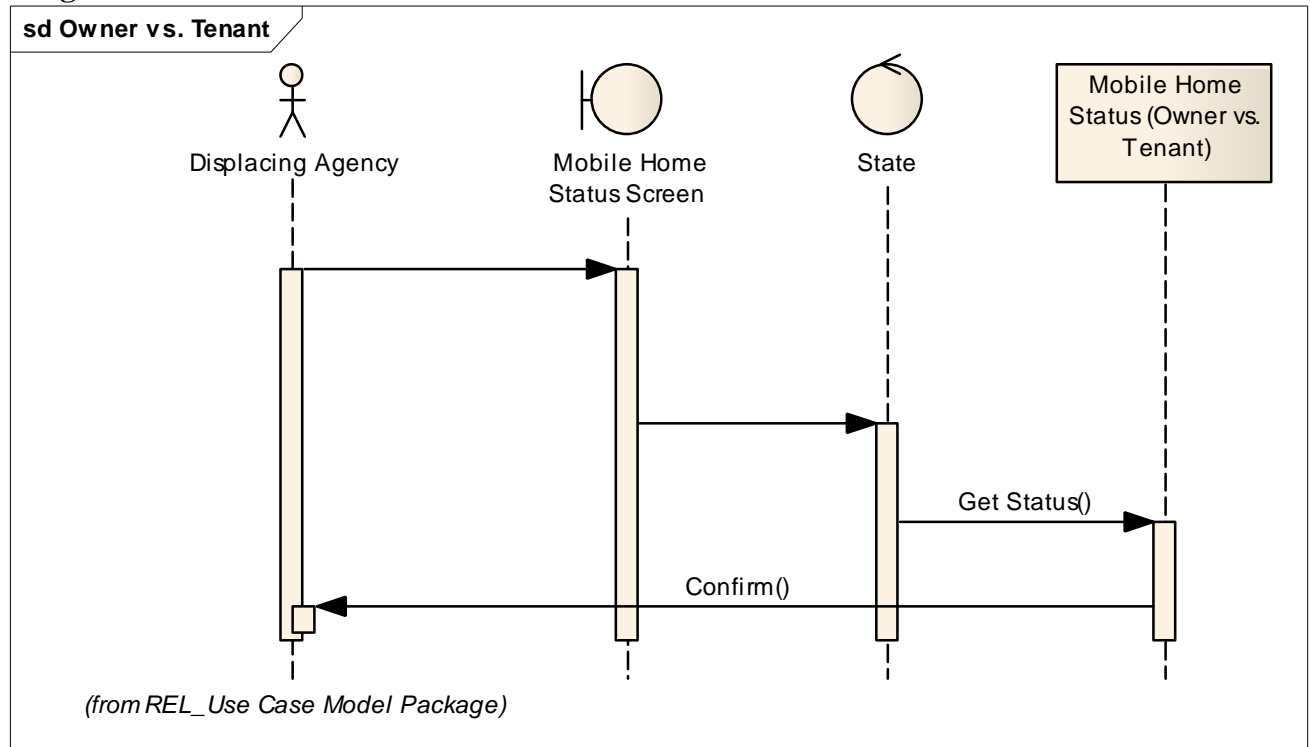
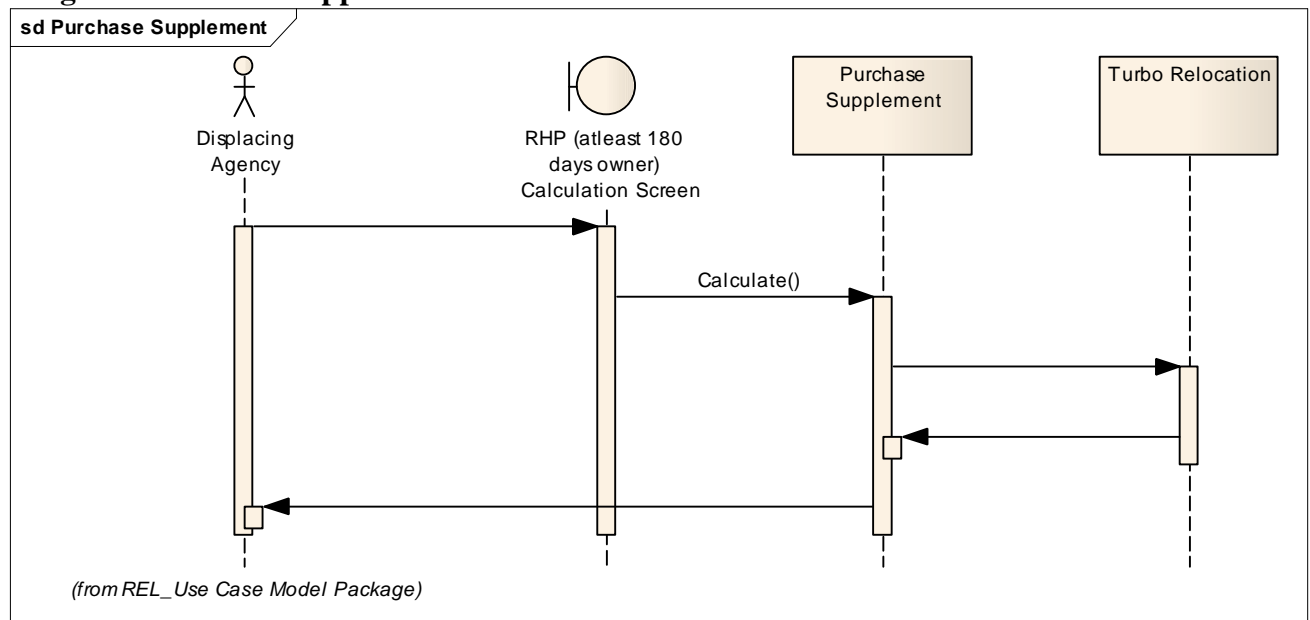
Diagram: Owner vs. Tenant**Diagram: Purchase Supplement**

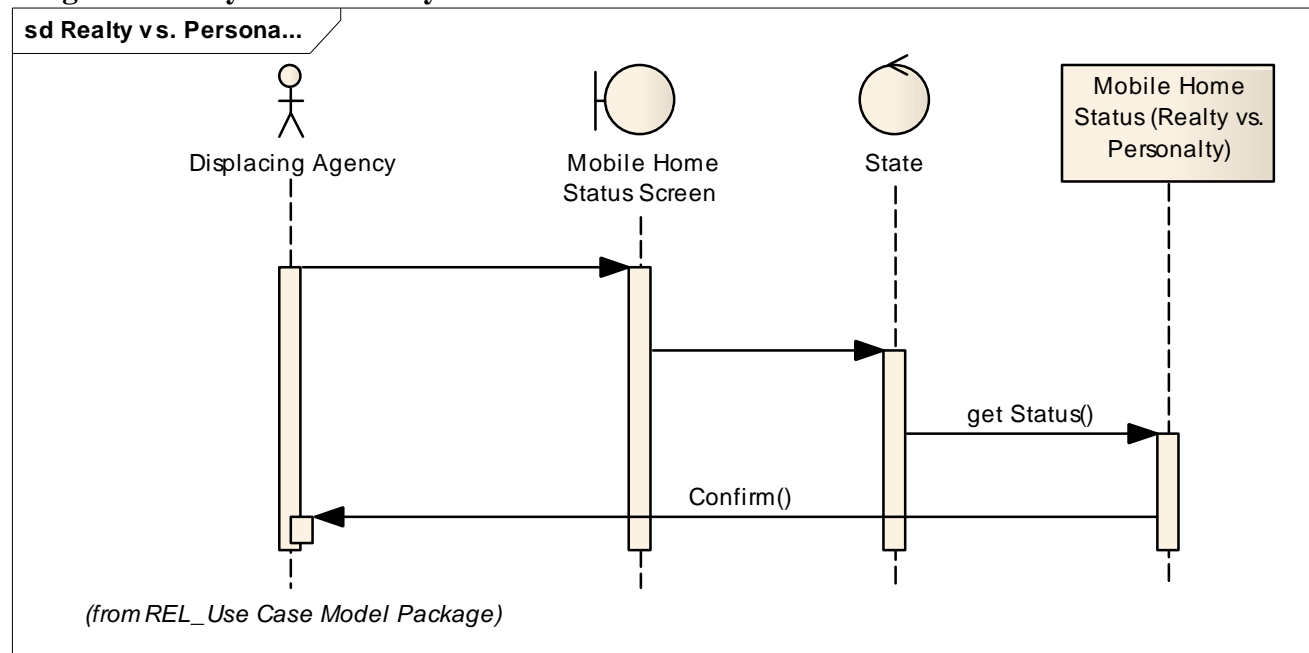
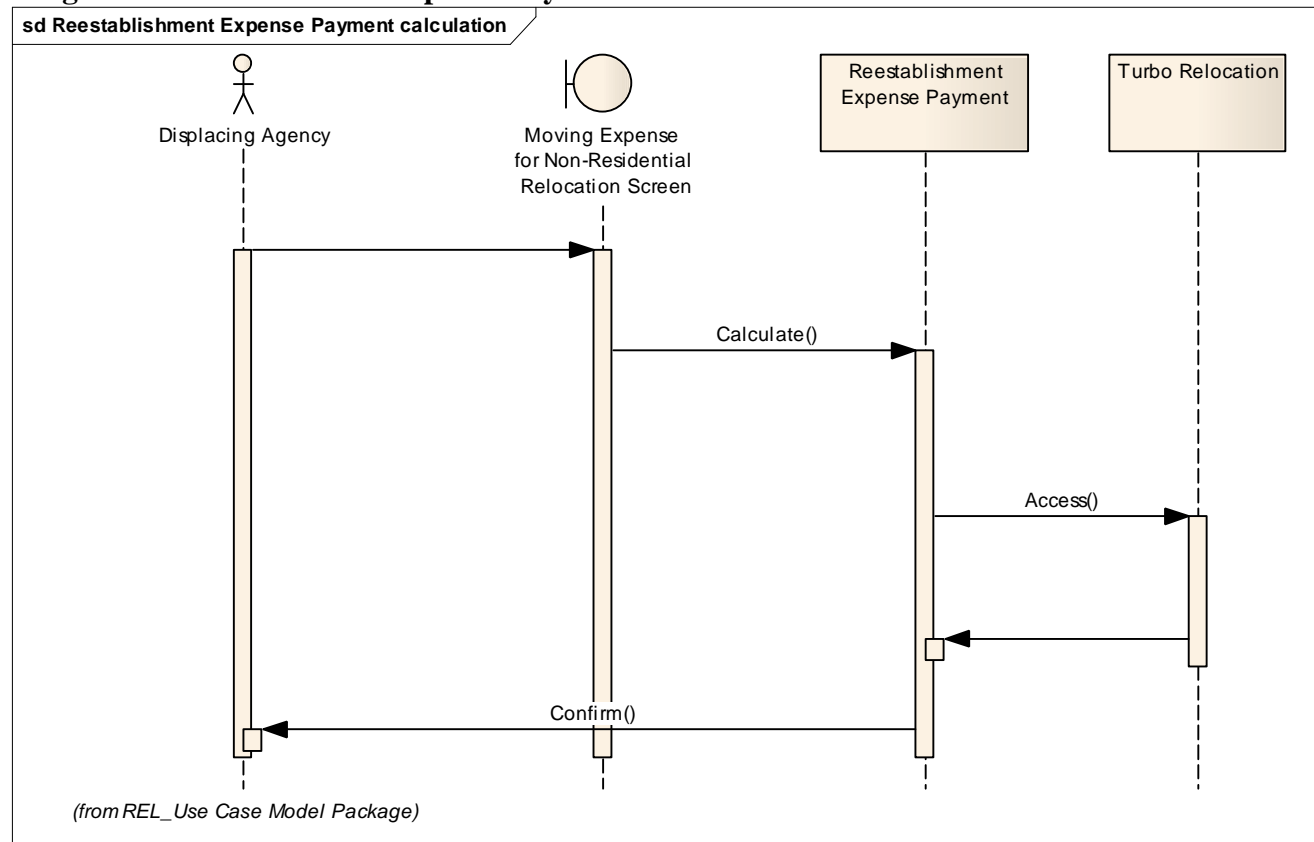
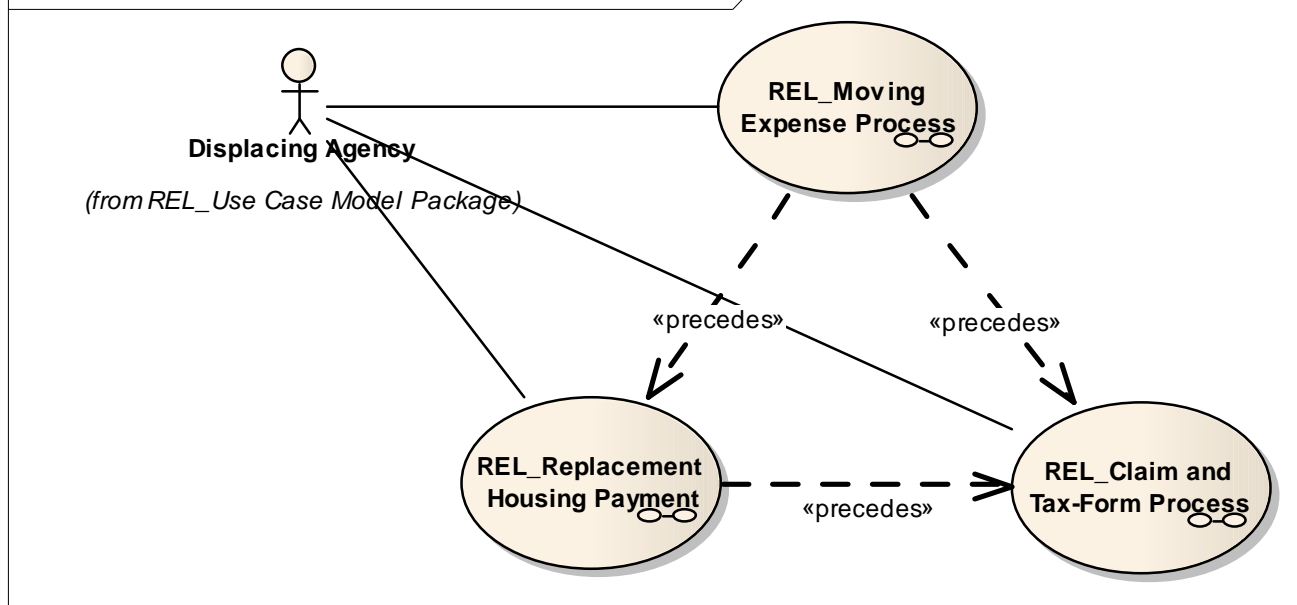
Diagram: Realty vs. Personalty**Diagram: Reestablishment Expense Payment calculation**

Diagram: REL_Relocation Assistance Payments Use Case Model

uc REL_Relocation Assistance Payments Use Case Mo...

**Diagram: Rental Assistance Payment**

sd Rental Assistance Payment

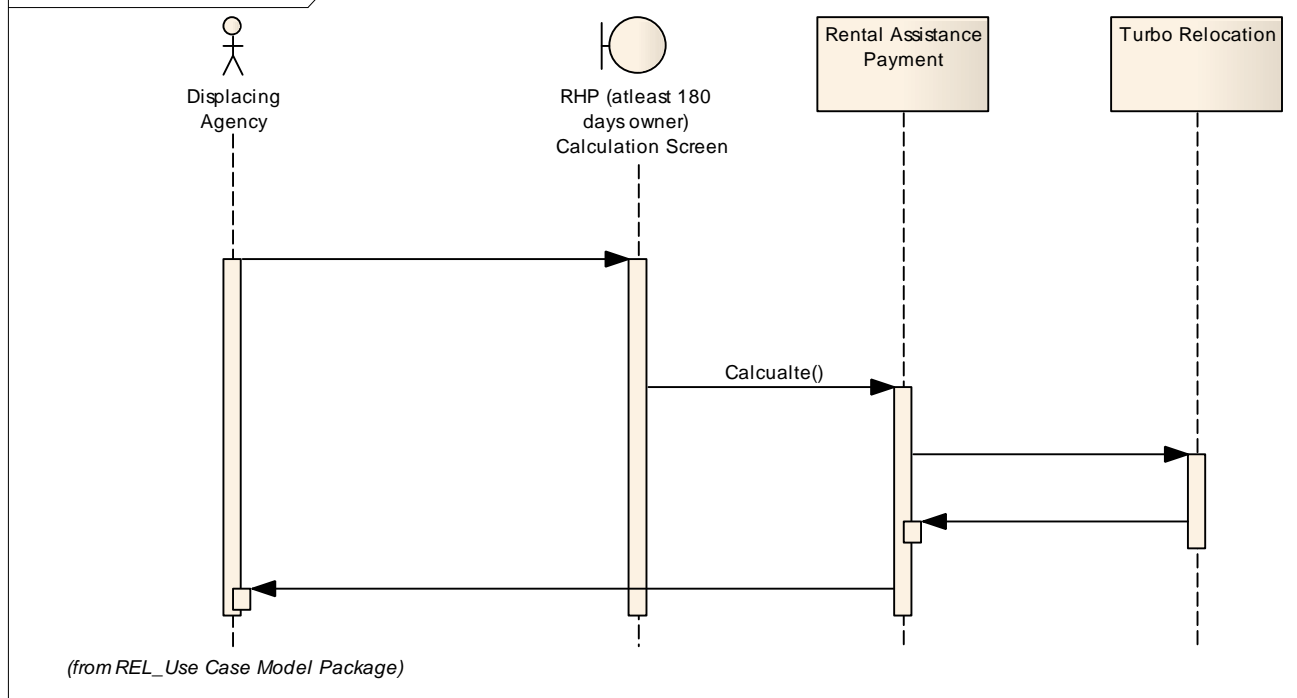


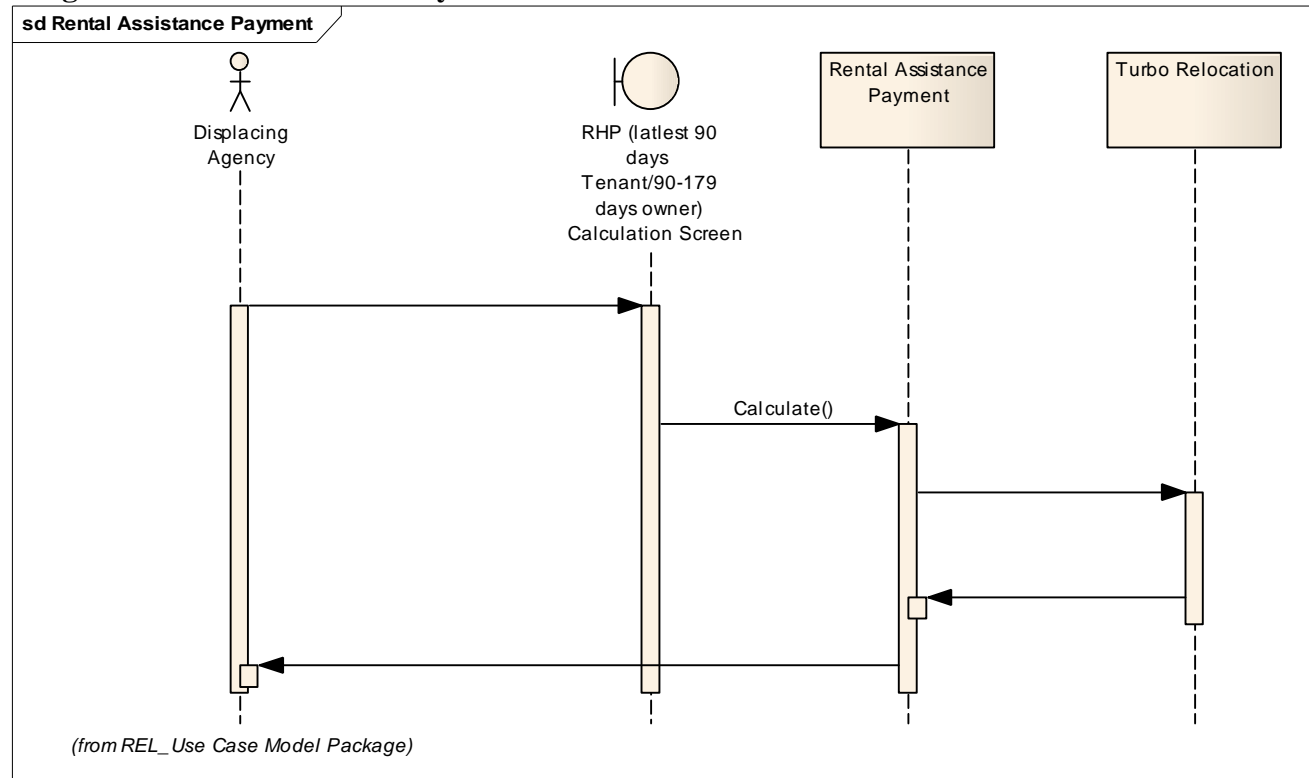
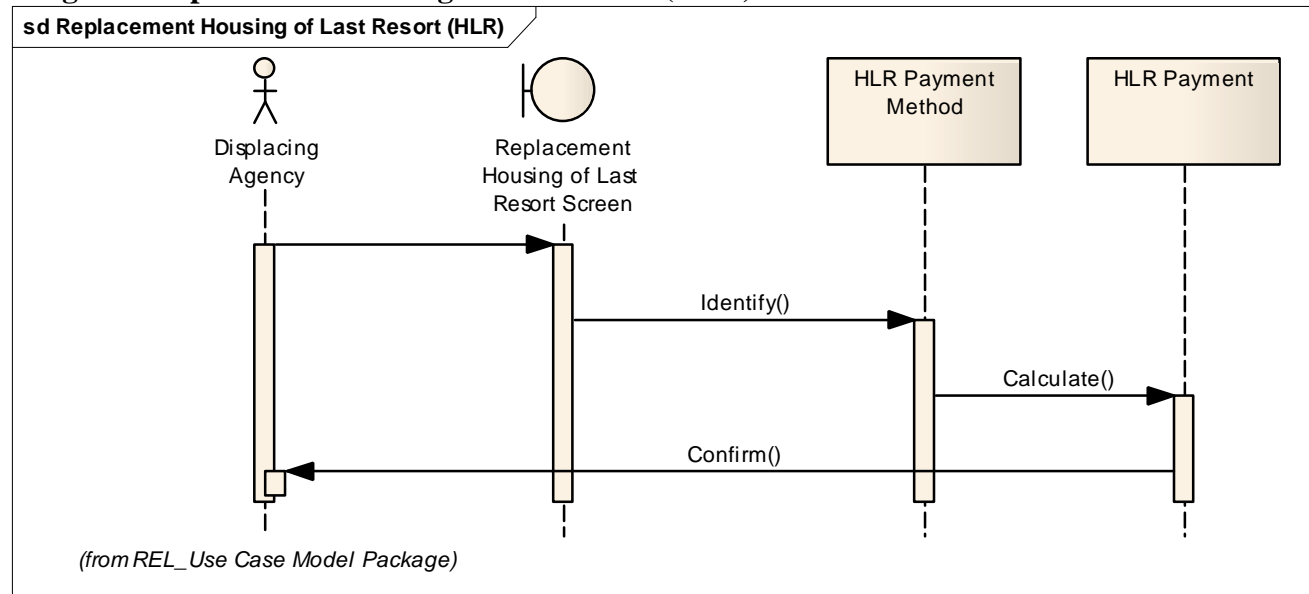
Diagram: Rental Assistance Payment**Diagram: Replacement Housing of Last Resort (HLR)**

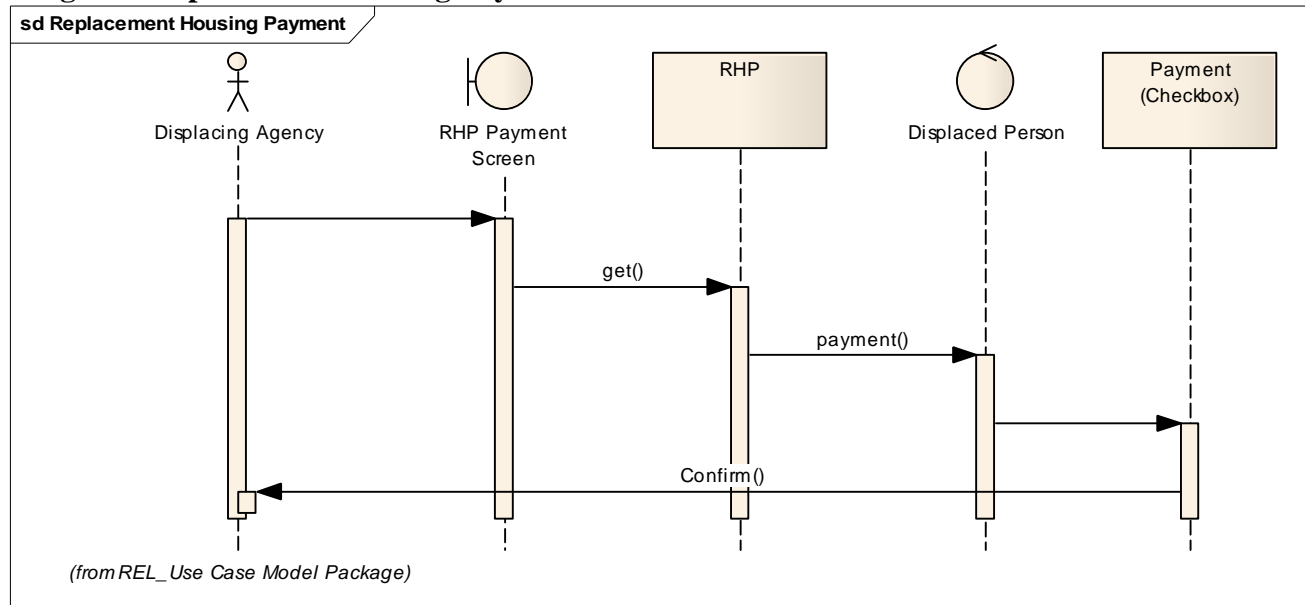
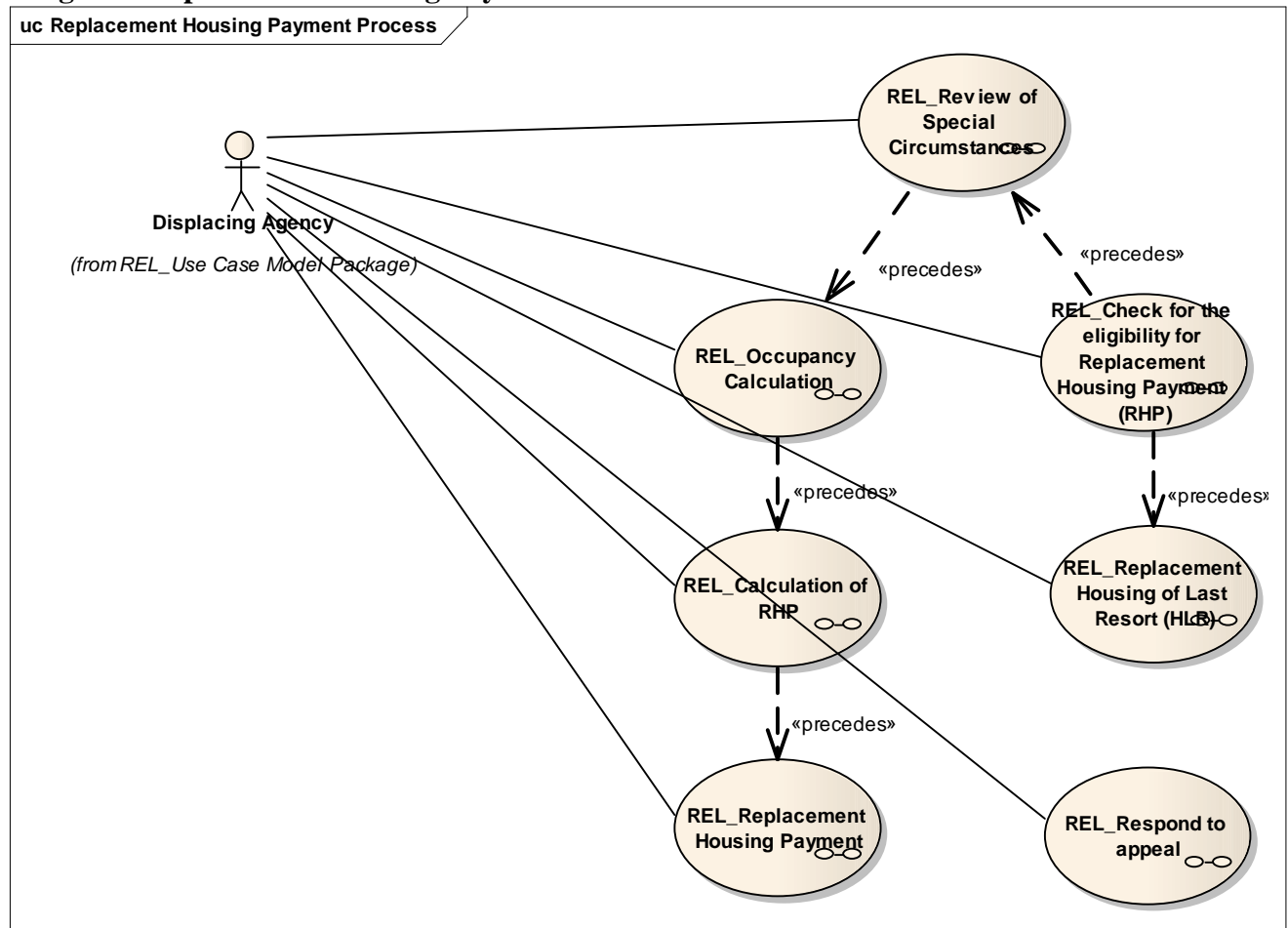
Diagram: Replacement Housing Payment**Diagram: Replacement Housing Payment Process**

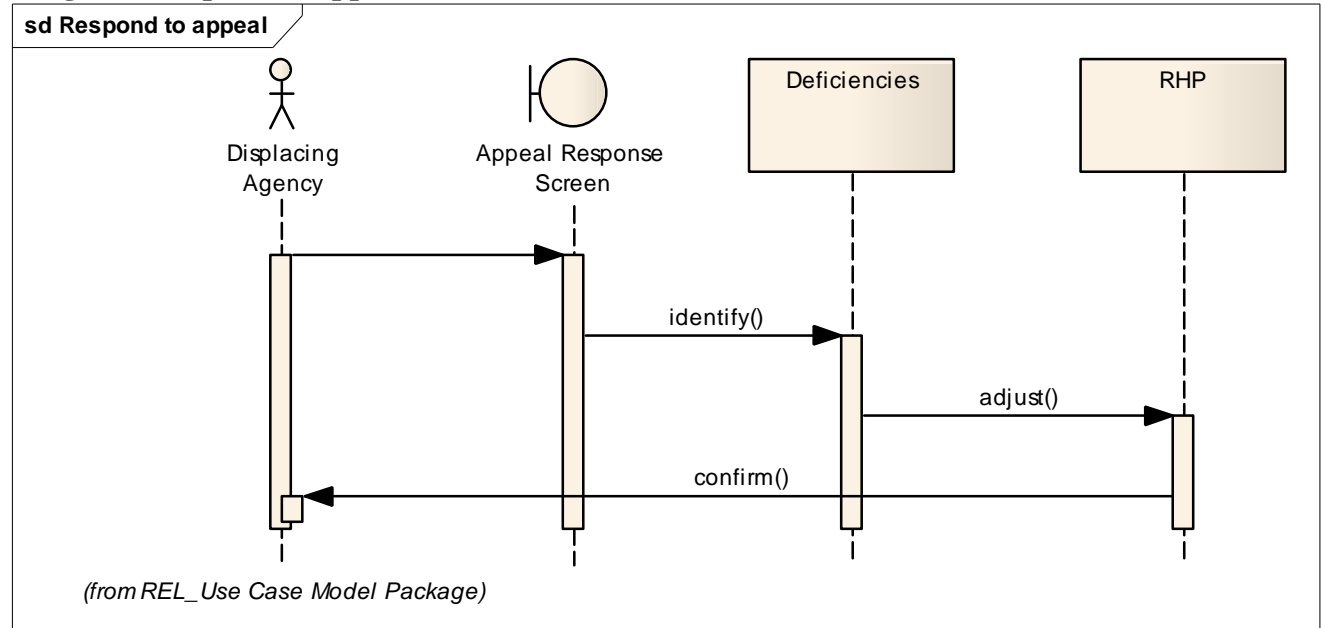
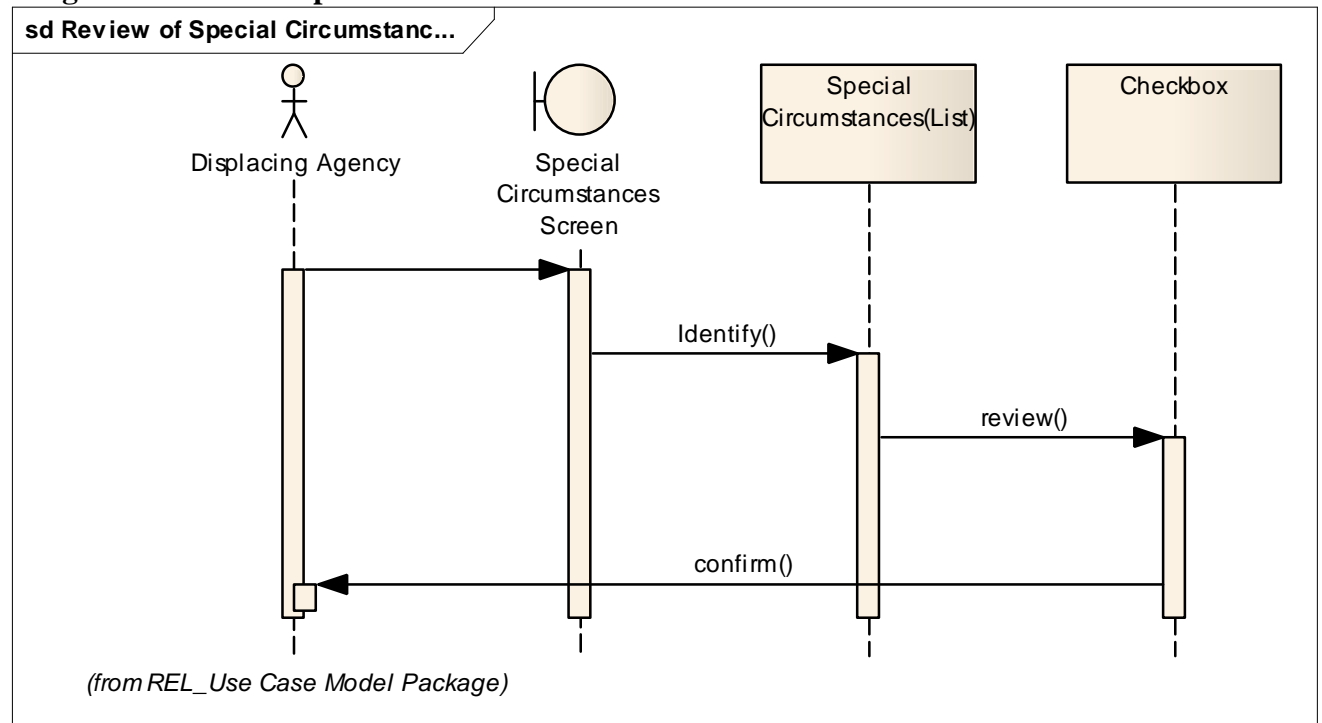
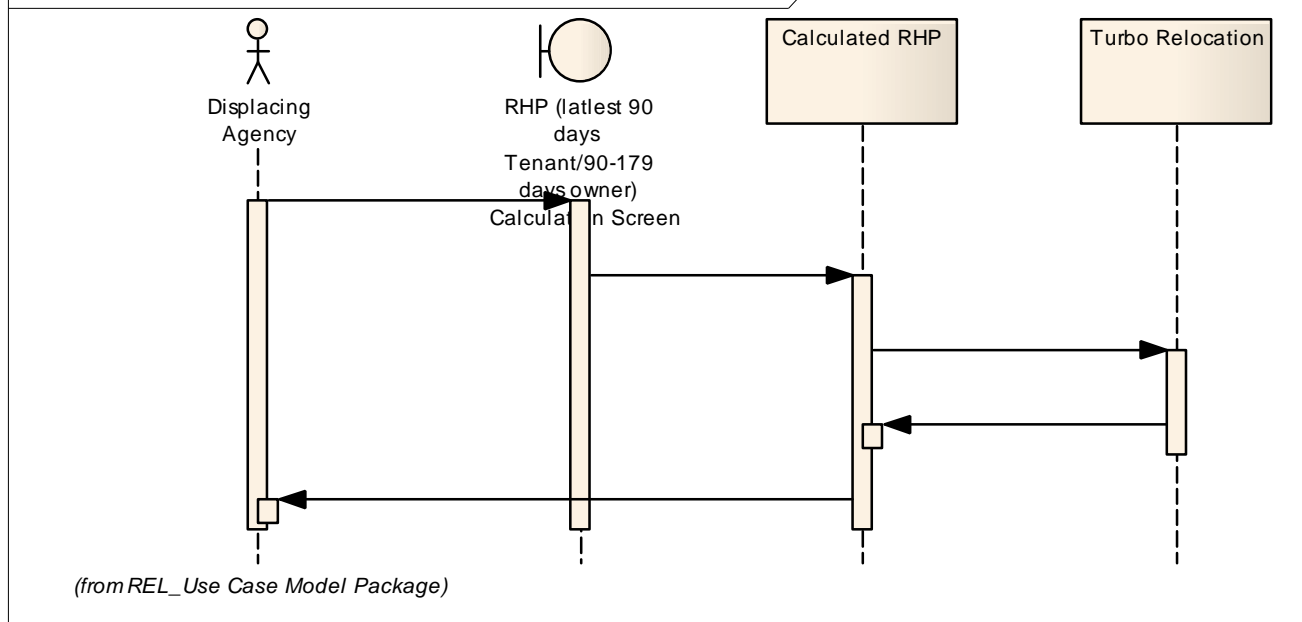
Diagram: Respond to appeal**Diagram: Review of Special Circumstances**

Diagram: RHP with Home Owner for 90-179-days or Tenants for at Least 90 Days

sd RHP with Home Owner for 90-179-days or Tenants for at Least 90 Days

**Diagram: RHP with Home Owner for at Least 180 Days**

sd RHP with Home Owner for at Least 180 Da...

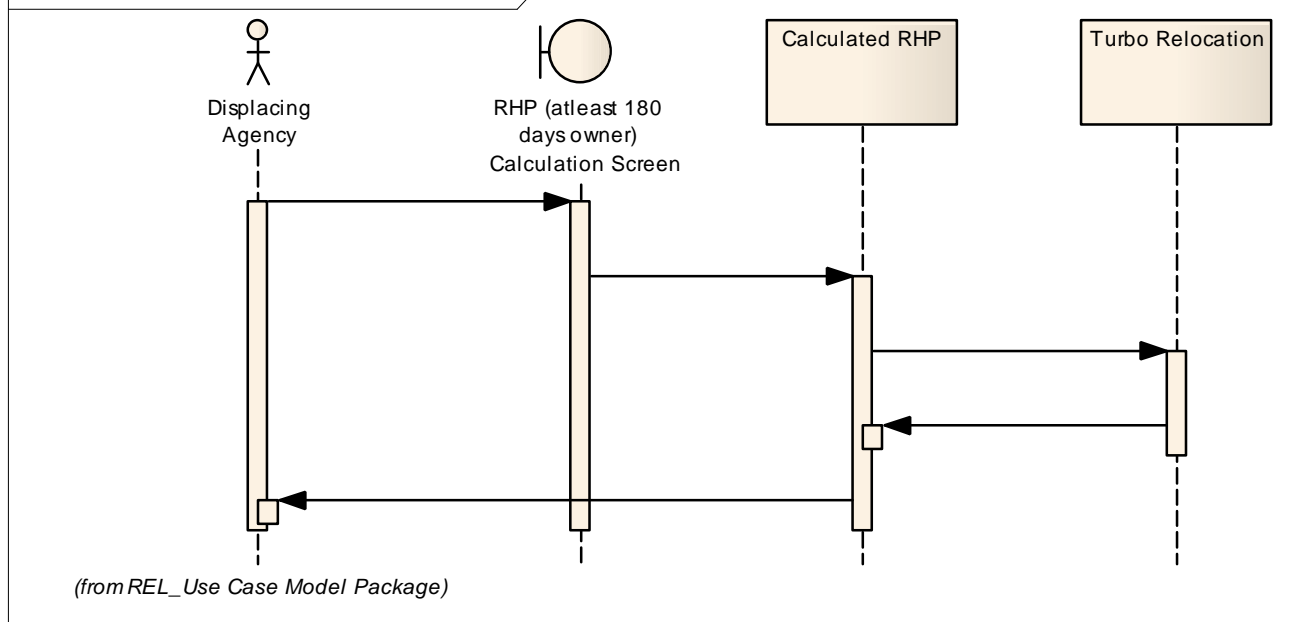


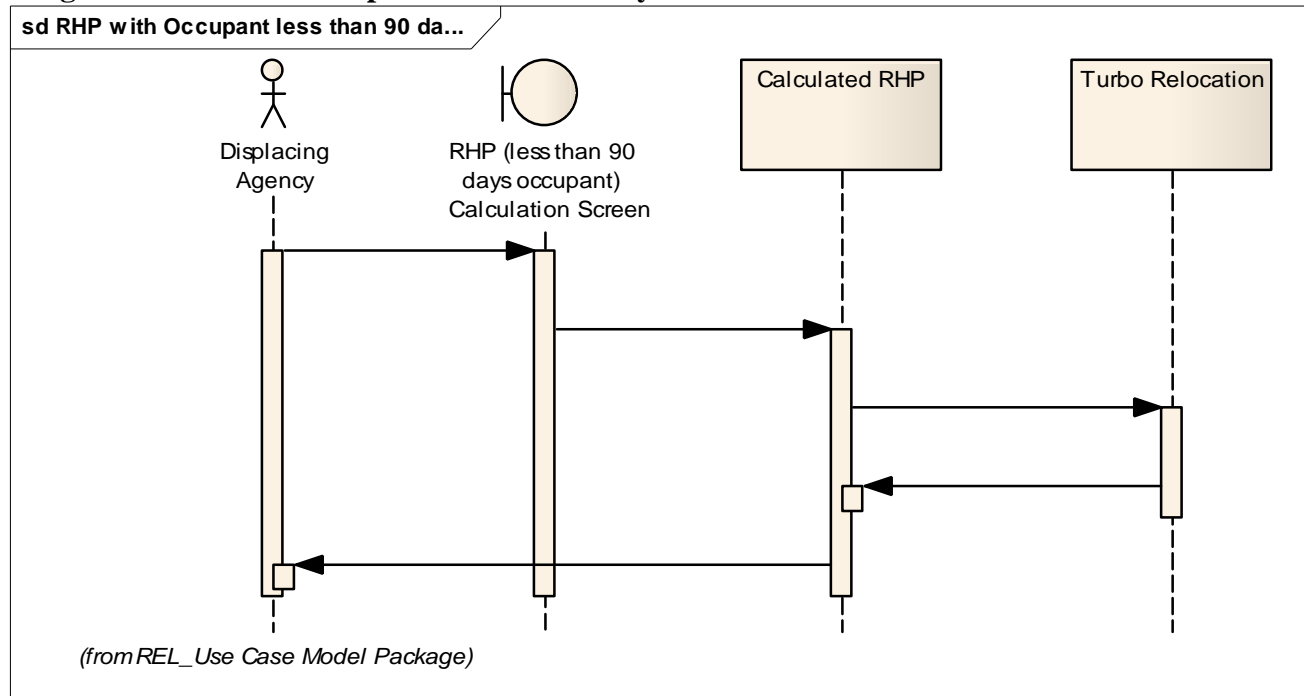
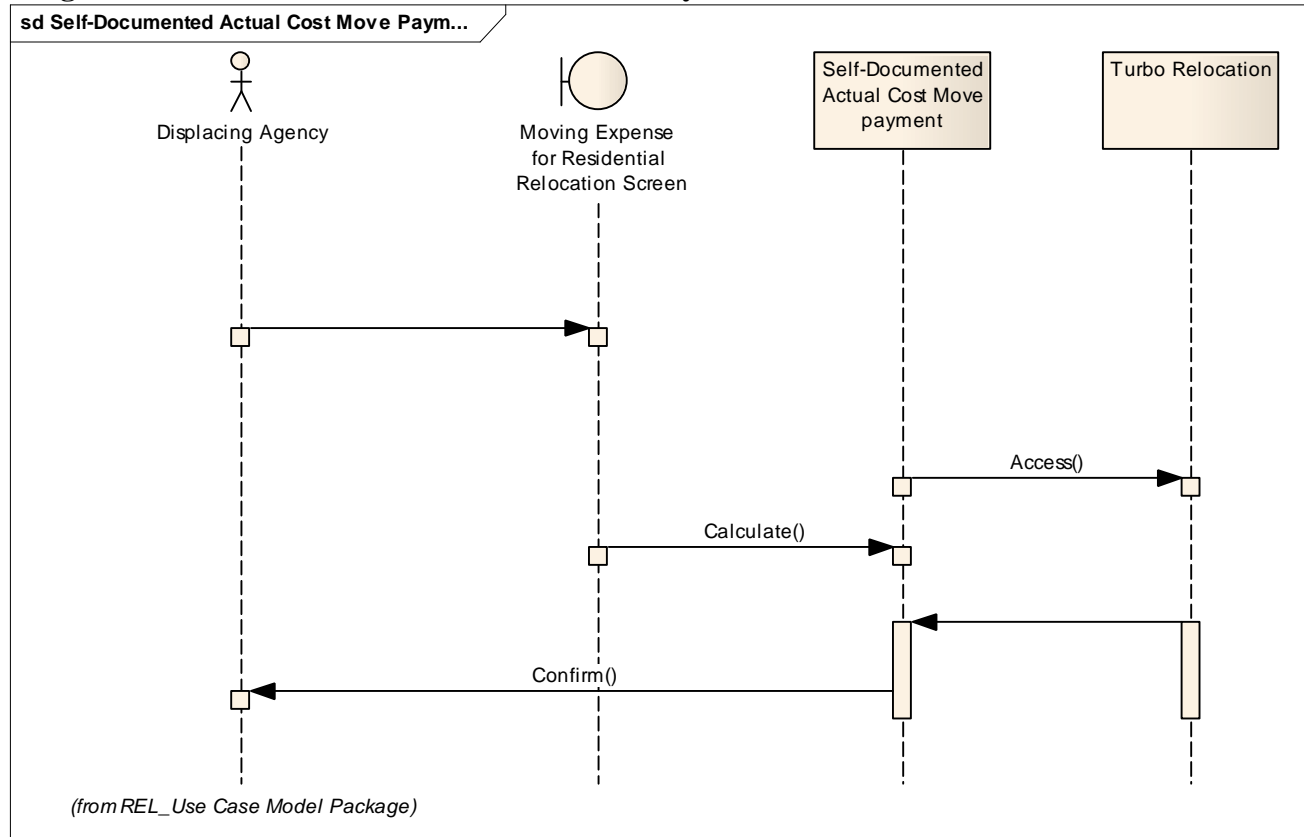
Diagram: RHP with Occupant less than 90 days**Diagram: Self-Documented Actual Cost Move Payment**

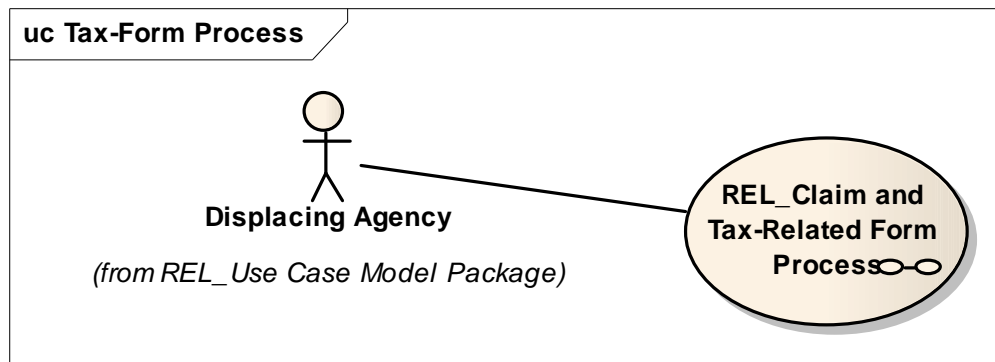
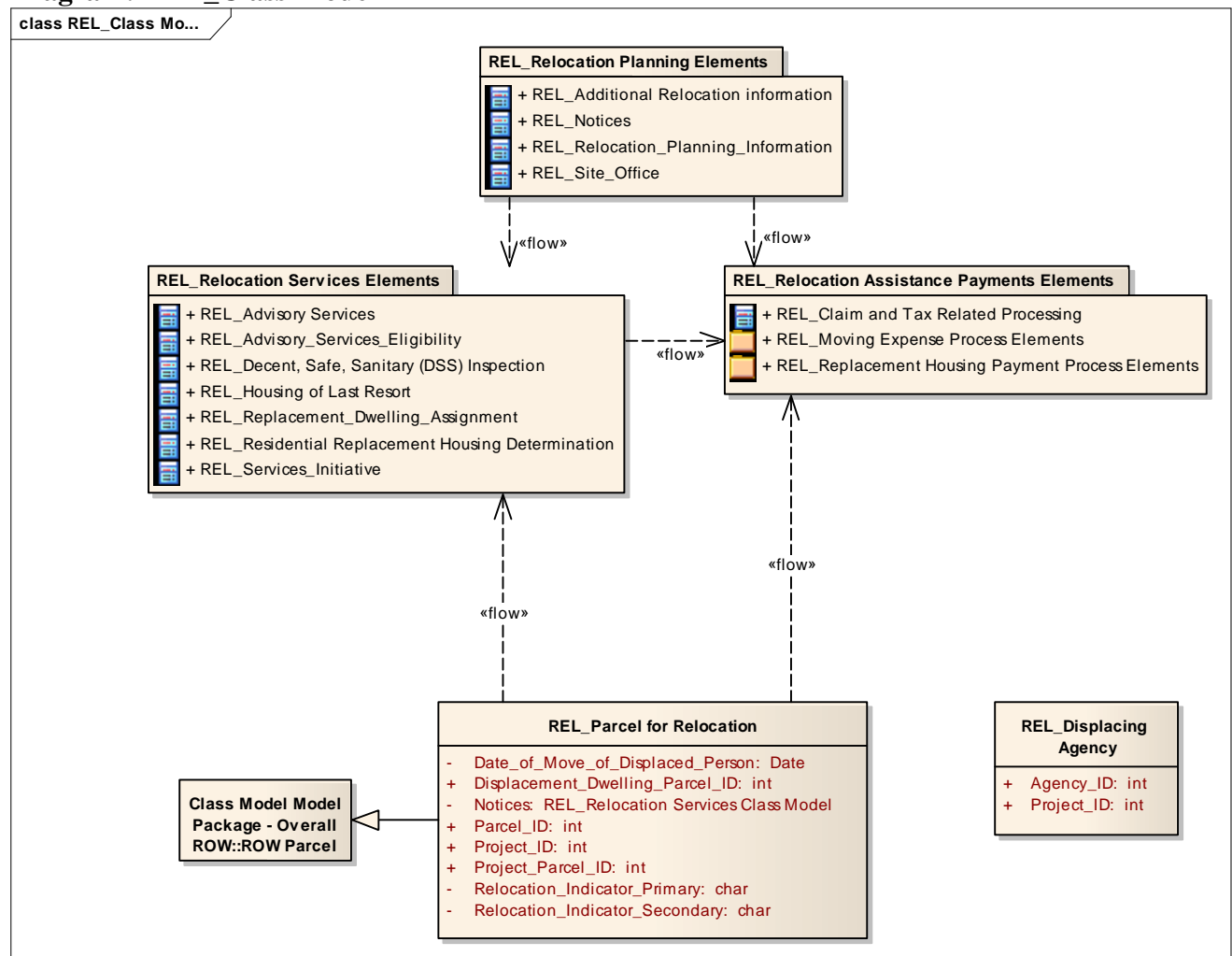
Diagram: Tax-Form Process**Diagram: REL_Class Model**

Diagram: REL_Relocation Planning Class Model

class REL_Relocation Planning Class Mo...

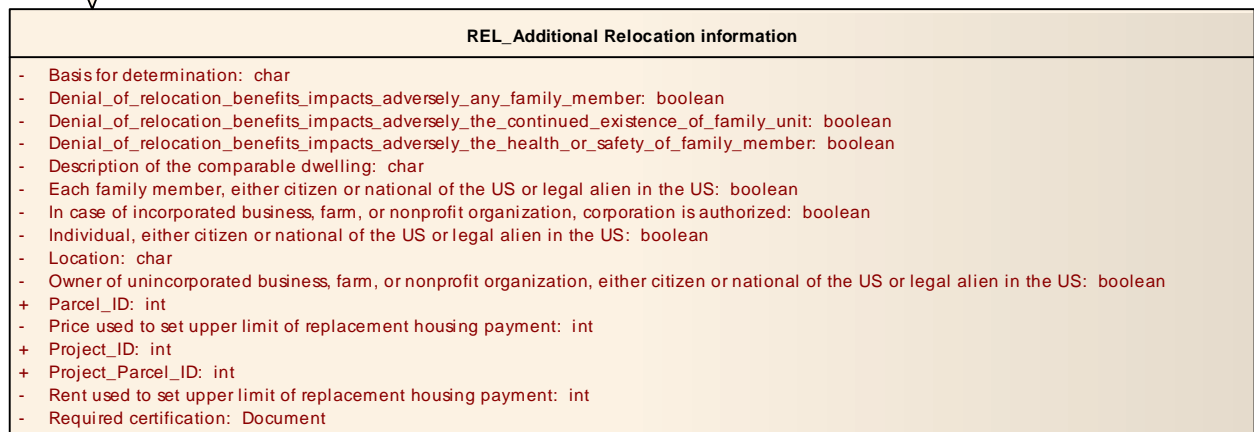
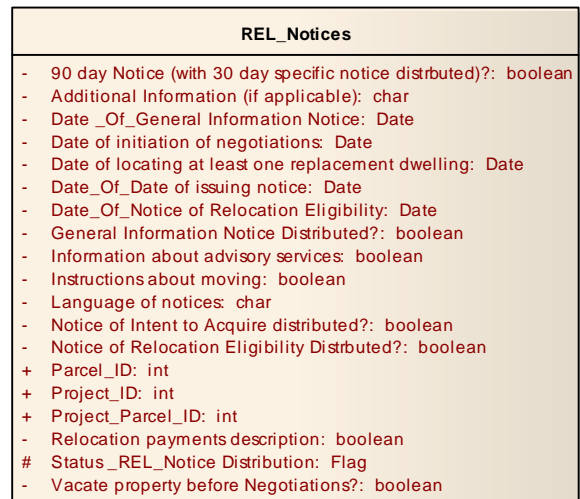
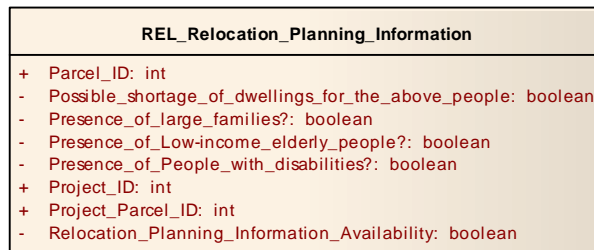
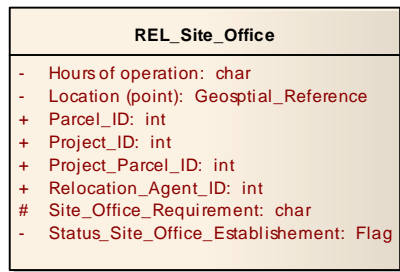


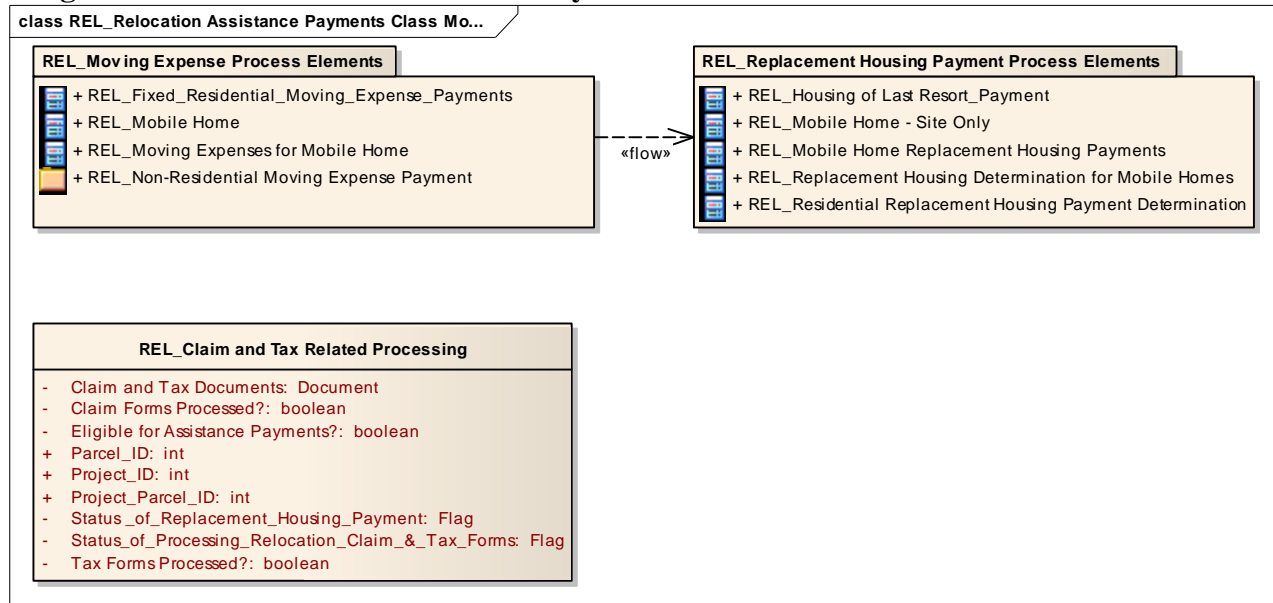
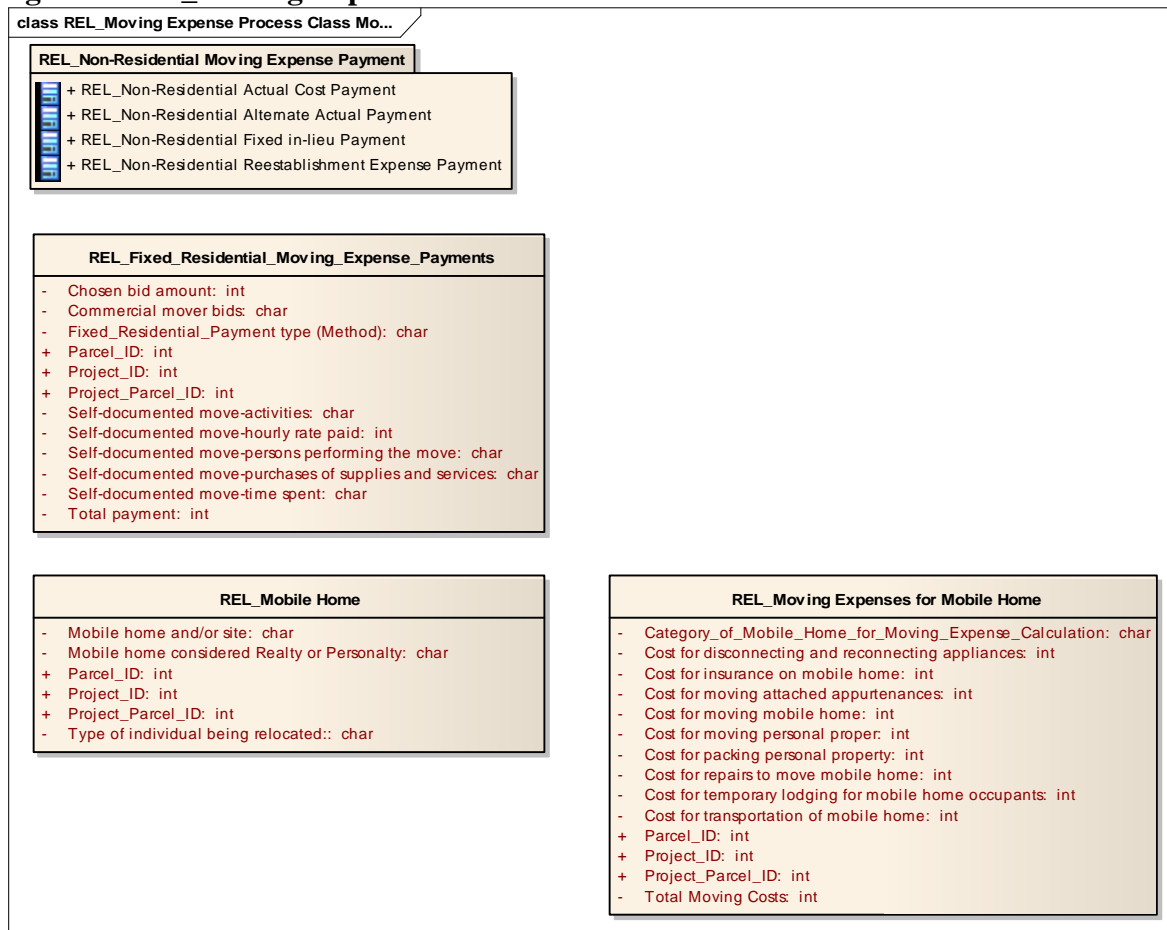
Diagram: REL_Relocation Assistance Payments Class Model**Diagram: REL_Moving Expense Process Class Model**

Diagram: REL_Non-Residential Moving Expense Payment

class REL_Non-Residential Moving Expense Paym...

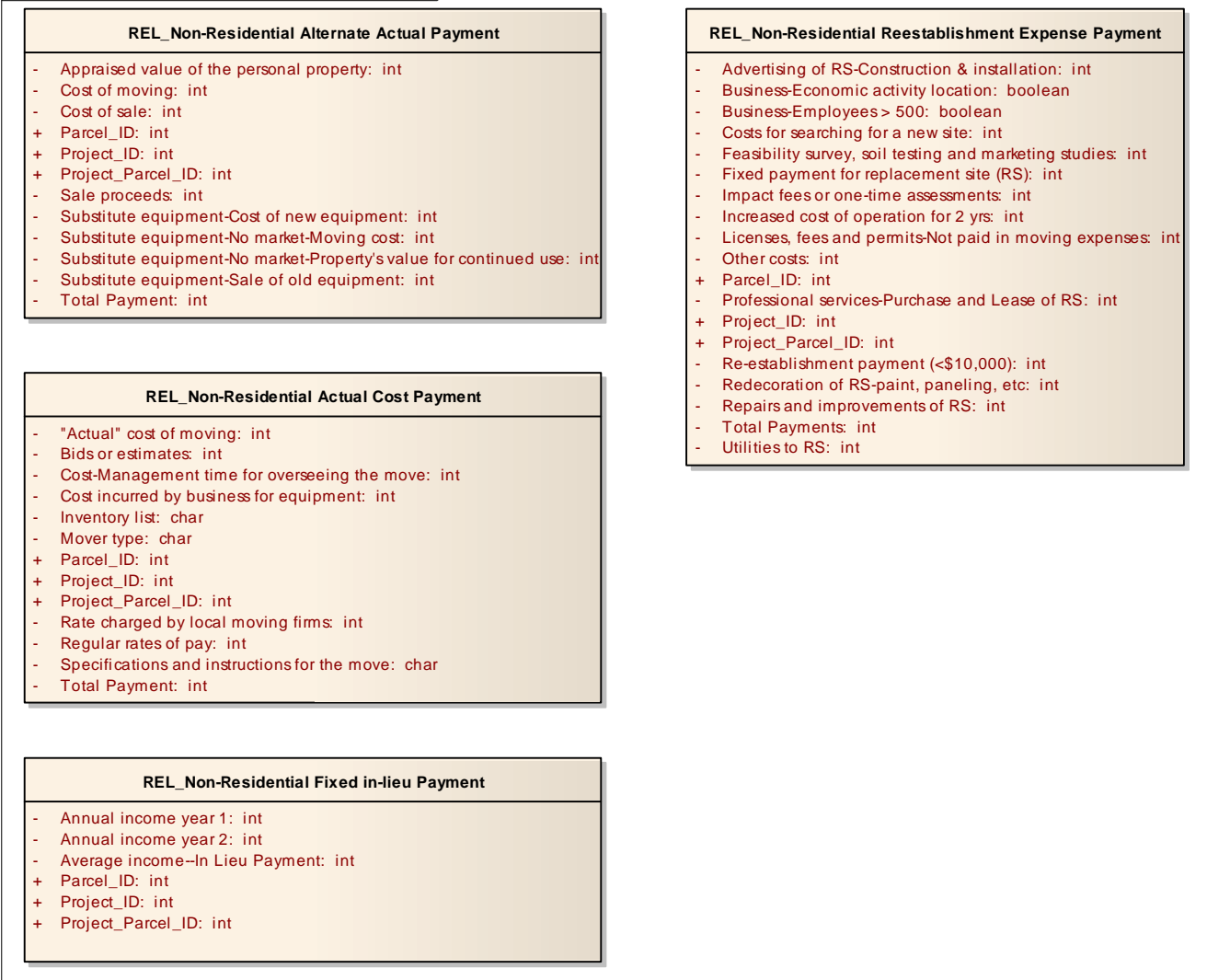


Diagram: REL Replacement Housing Payment Process Class Model

class REL Replacement Housing Payment Process Class Mo...

REL_Residential Replacement Housing Payment Determination

- Actual rent-Displacement dwelling: int
- Comparable Replacement Housing Available?: boolean
- Date of purchase or rent and occupancy of replacement dwelling: Date
- Difference: int
- Down payment assistance: int
- Incidental expenses: int
- Incidental expenses description: char
- Income of displaced person: int
- Insurance received: int
- Market rent-Displacement dwelling: int
- Mortgage interest differential: int
- + Parcel_ID: int
- Price differential: int
- + Project_ID: int
- + Project_Parcel_ID: int
- Rent-Replacement dwelling: int
- Rental Assistance payment (<\$250): int
- Replacement dwelling cost(s): int
- + Replacement dwelling ID: int
- Replacement housing category(s): char
- Resident type (Time of stay, ownership): char
- Special circumstances description: char
- Status_of_any_Replacement_Housing_Payment_Appeal(s): Flag
- Total RHP: int

REL_Housing of Last Resort_Payment

- HLR_Payment_Transaction: Transaction_Document
- + Parcel_ID: int
- + Project_ID: int
- Total Cost of HRL: int
- Written agreement: Document

REL Replacement Housing Determination for Mobile Homes

- Assistance type: char
- Location of replacement site: Geospatial_Reference
- Ownership or Occupancy tenure: char
- + Parcel_ID: int
- + Project_ID: int
- + Project_Parcel_ID: int
- Site available: boolean
- Type of Replacement housing: Site and mobile home/Mobile Home only/ Site only: char

REL_Mobile Home - Site Only

- + Parcel_ID: int
- + Parcel_Project_ID: int
- Payment for site only: int
- + Project_ID: int

REL_Mobile Home Replacement Housing Payments

- Acquisition price of displaced dwelling and site: int
- Acquisition price of displaced mobile home: int
- Acquisition price of displaced mobile home site: int
- Actual cost of replacement property: int
- Cost of comparable conventional dwelling: int
- Cost of comparable mobile home: int
- Cost of comparable mobile home site: int
- Cost of comparable replacement property: int
- Cost of repairs/modifications: int
- Difference - rent - mobile home: int
- Difference - rent - mobile home site: int
- DS & S mobile home purchased: int
- Market price displacement MH site: int
- Market rent-Displacement mobile home site: int
- Moving cost of mobile home: int
- + Parcel_ID: int
- Price differential offer- mobile home: int
- Price differential offer-mobile home site: int
- + Project_ID: int
- + Project_Parcel_ID: int
- Related expenses: int
- Rent of comparable mobile home site: int
- Replacement site: int
- Salvage trade-in value - MH: int
- Set-up charges: int
- Site improvements: int
- Total price differential payment: int
- Total RHP payment - MH (<\$22,500): int
- Total to purchase MH and site: int
- Value of displaced mobile home: int

Diagram: REL Relocation Services Class Model

class REL_Relocation Services Class Mo...

REL_Advisory_Services_Eligibility

- Eligibility category: char
- Eligibility Description: char
- + Parcel_ID: int
- + Project_ID: int
- + Project_Parcel_ID: int

REL_Services_Initiative

- Eligibility for Each Type of Payments Determined: boolean
- Information_made_Available (Services, Available Payments and Eligibility Requirements): char
- + Parcel_ID: int
- + Project_ID: int
- + Project_Parcel_ID: int
- Status Personal Interview: boolean
- Status_Determination_of_Occupant_Needs: Flag

REL_Advisory Services

- Agencies providing services: char
- Application or claim forms: Document
- Current listings: char
- Federal & state housing programs: char
- Other social services: char
- + Parcel_ID: int
- + Project_ID: int
- + Project_Parcel_ID: int
- + Relocation agent ID: int
- Status: Advisory service(s) provided: boolean
- Transportation services: char

REL_Replacement_Dwelling_Assignment

- DSS Inspection 2: REL_Decent, Safe, Sanitary (DSS) Inspection
- DSS Inspection1: REL_Decent, Safe, Sanitary (DSS) Inspection
- DSS_Inspection_Result_Notification: boolean
- DSS_Inspection_Report_2: Document
- First_DSS_Report: Document
- + Parcel_ID: int
- + Project_ID: int
- + Project_Parcel_ID: int
- Replacement_Dwelling_Selected?: boolean
- Status_Of_DSS Inspection I: Flag
- Status_Of_DSS Inspection II: Flag

REL_Residential Replacement Housing Determination

- Access to employment: char
- Access to public & commercial facilities: char
- Adverse environmental conditions: boolean
- Comparable Dwelling Notification: Document
- Currently available: boolean
- Location of replacement dwelling: Geospatial_Reference
- Number of comparable dwellings offered: int
- Other needs: char
- + Parcel_ID: int
- Physical condition of replacement dwelling: char
- + Project_ID: int
- + Project_Parcel_ID: int
- + Replacement dwelling ID: int
- Size of replacement dwelling: char
- Typical residential site: boolean
- Utility and cost of replacement dwelling: char

REL_Decent, Safe, Sanitary (DSS) Inspection

- ADA Accessible: boolean
- Adequate in size: boolean
- Bathroom: boolean
- DSS Inspection: Document
- DSS_Inspection_Complete: boolean
- Electrical System: boolean
- Heating System: boolean
- Kitchen: boolean
- Local housing/occupancy code compliance: boolean
- + Parcel_ID: int
- + Parcel_Project_ID: int
- Potable Water: boolean
- + Project_ID: int
- + Replacement dwelling ID: int
- Structurally sound: boolean

REL_Housing of Last Resort

- Assignment_of_Last_Resort_Housing: char
- Housing of Last Resort Applicable?: boolean
- Method for providing housing of last resort: char
- + Parcel_ID: int
- + Project_ID: int
- + Project_Parcel_ID: int
- Reason for Housing of Last Resort: char

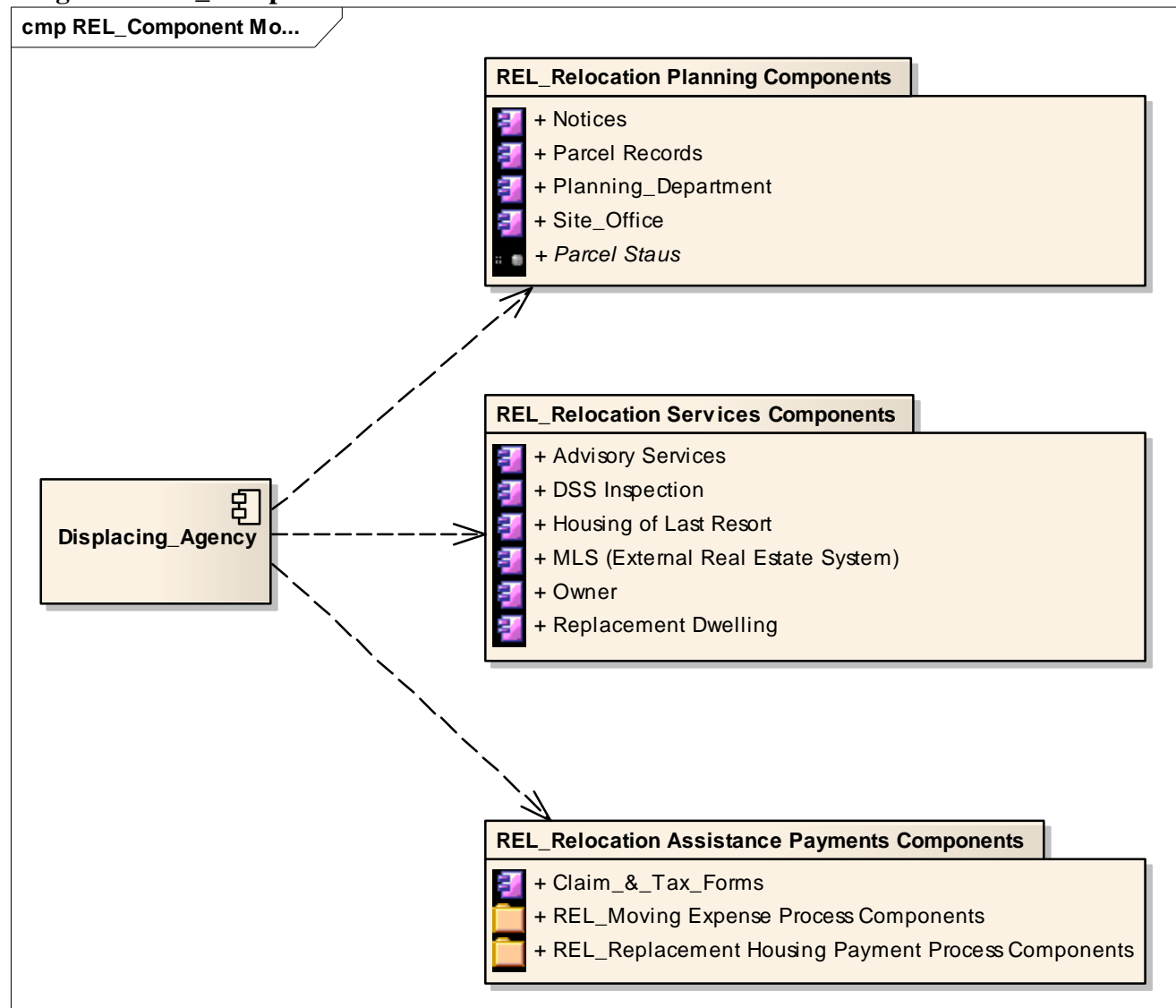
Diagram: REL_Component Model

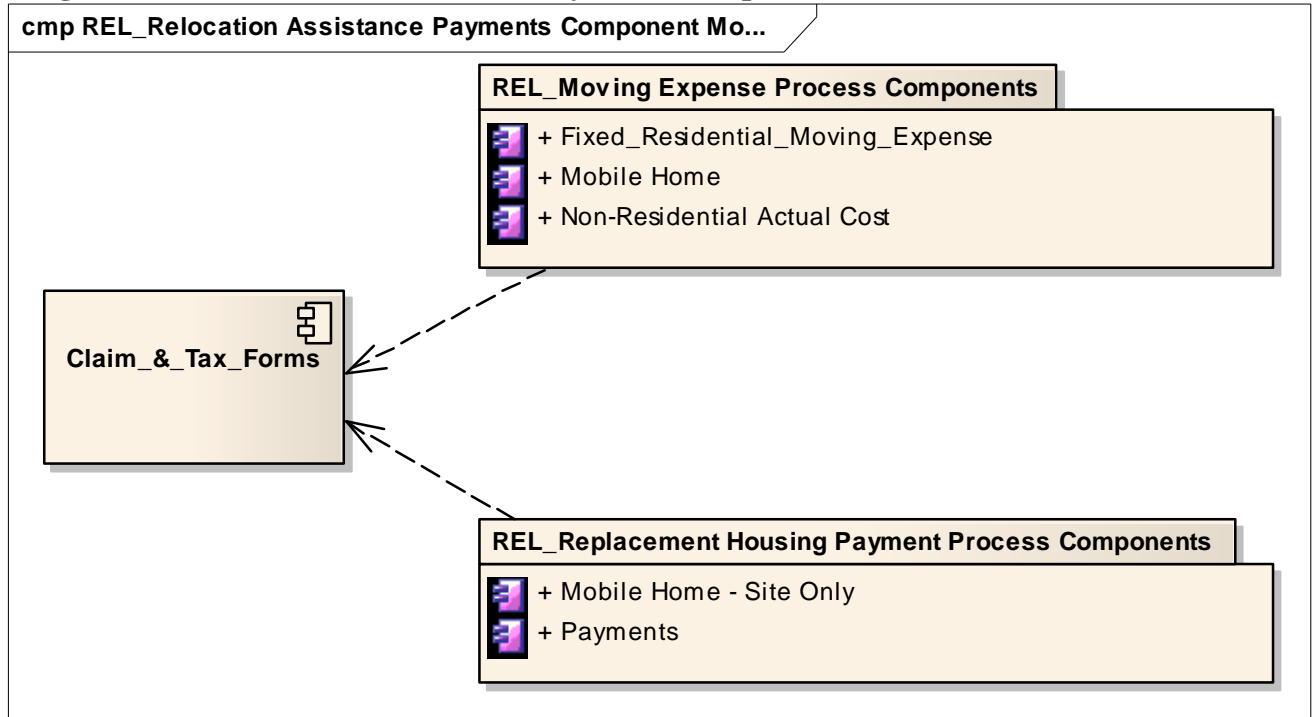
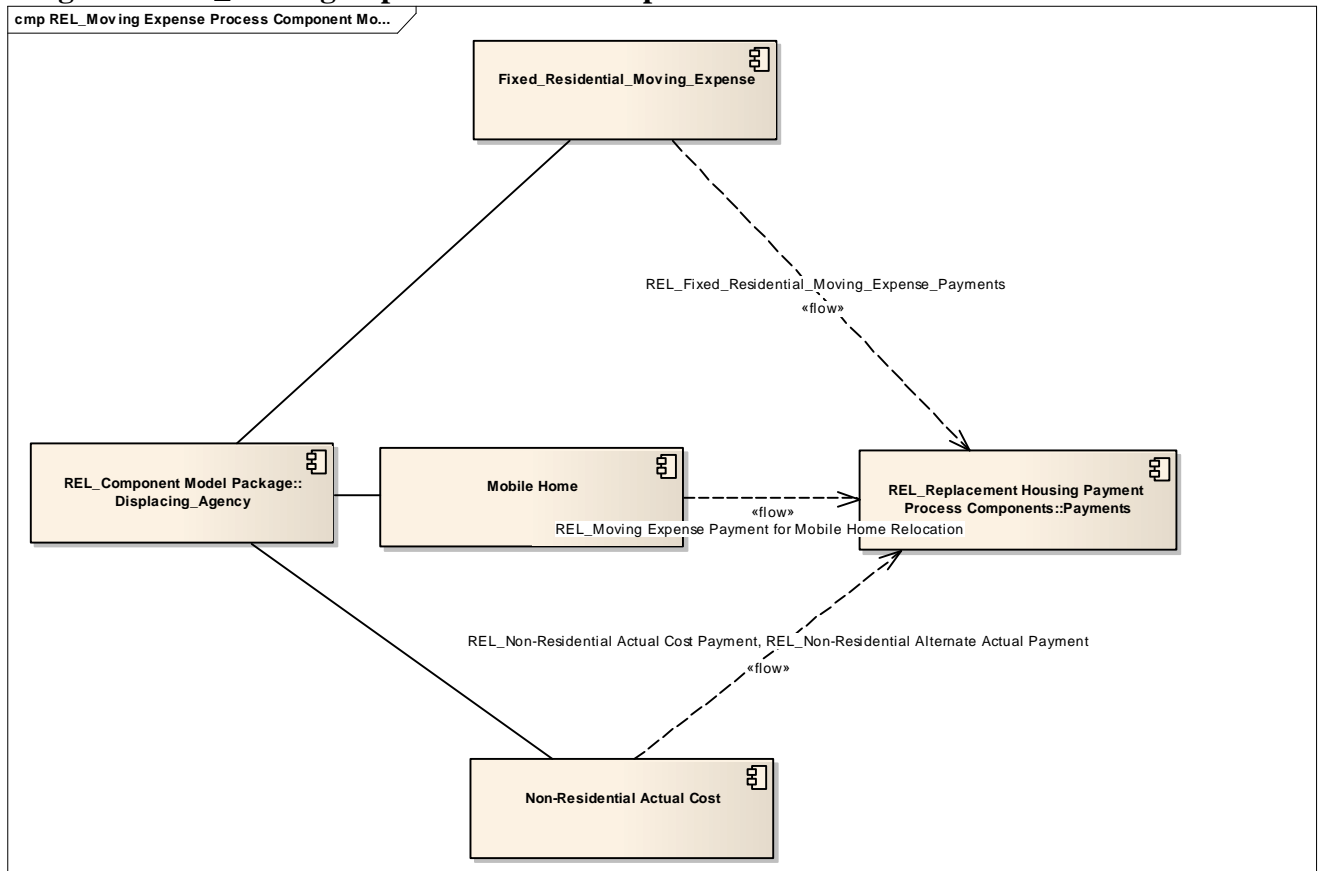
Diagram: REL_Relocation Assistance Payments Component Model**Diagram: REL_Moving Expense Process Component Model**

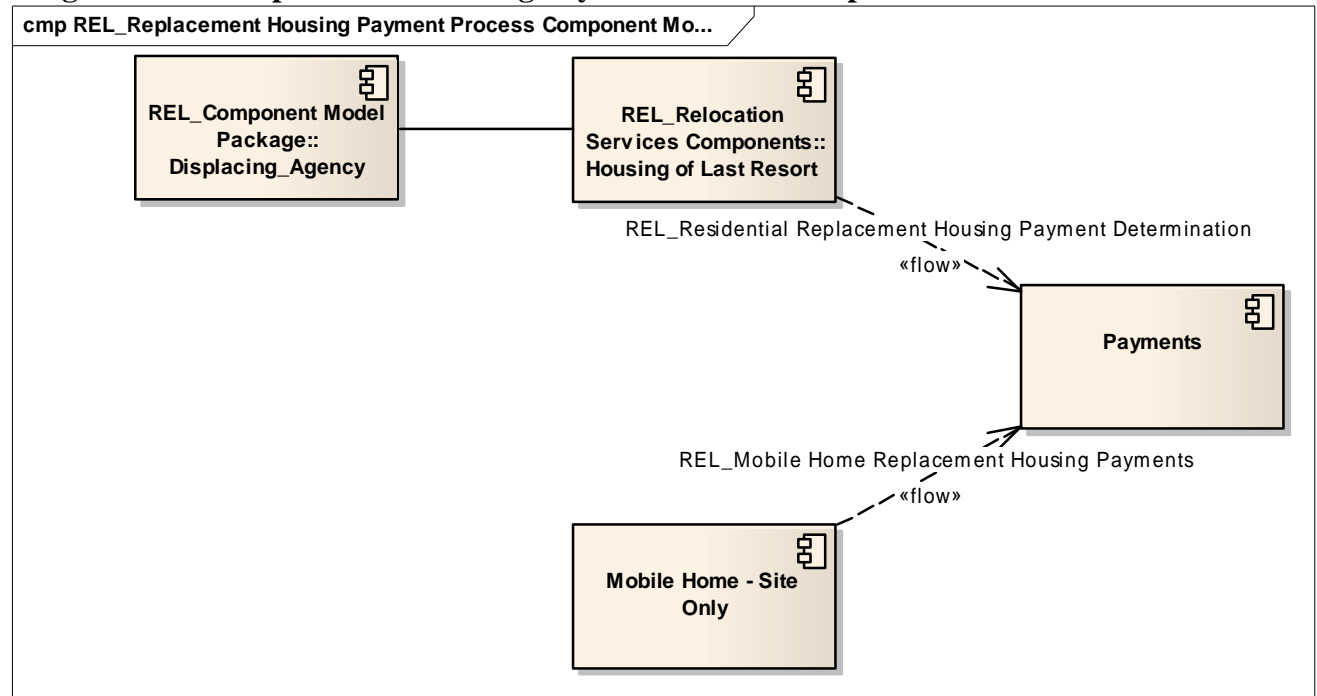
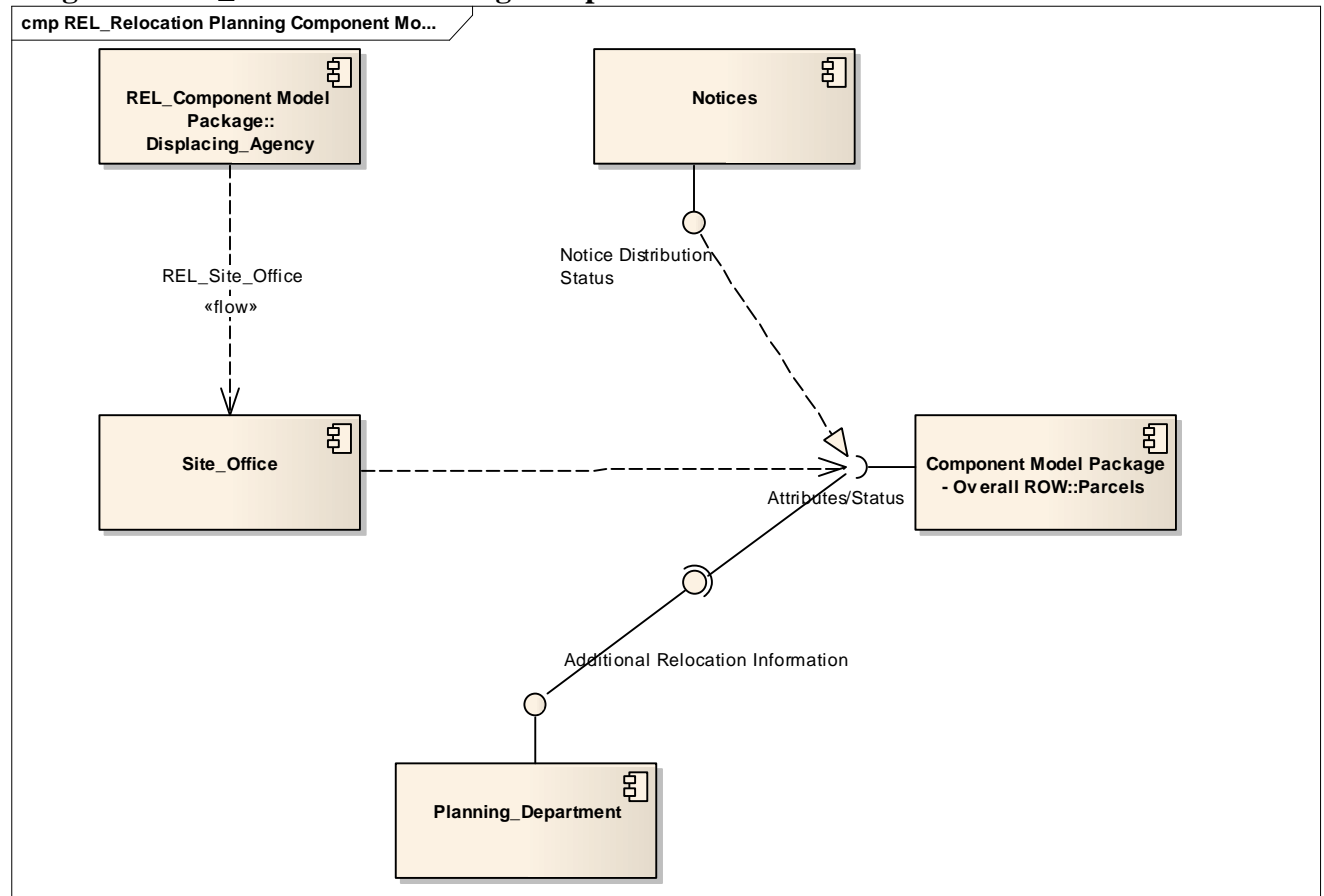
Diagram: REL_Replacement Housing Payment Process Component Model**Diagram: REL_Relocation Planning Component Model**

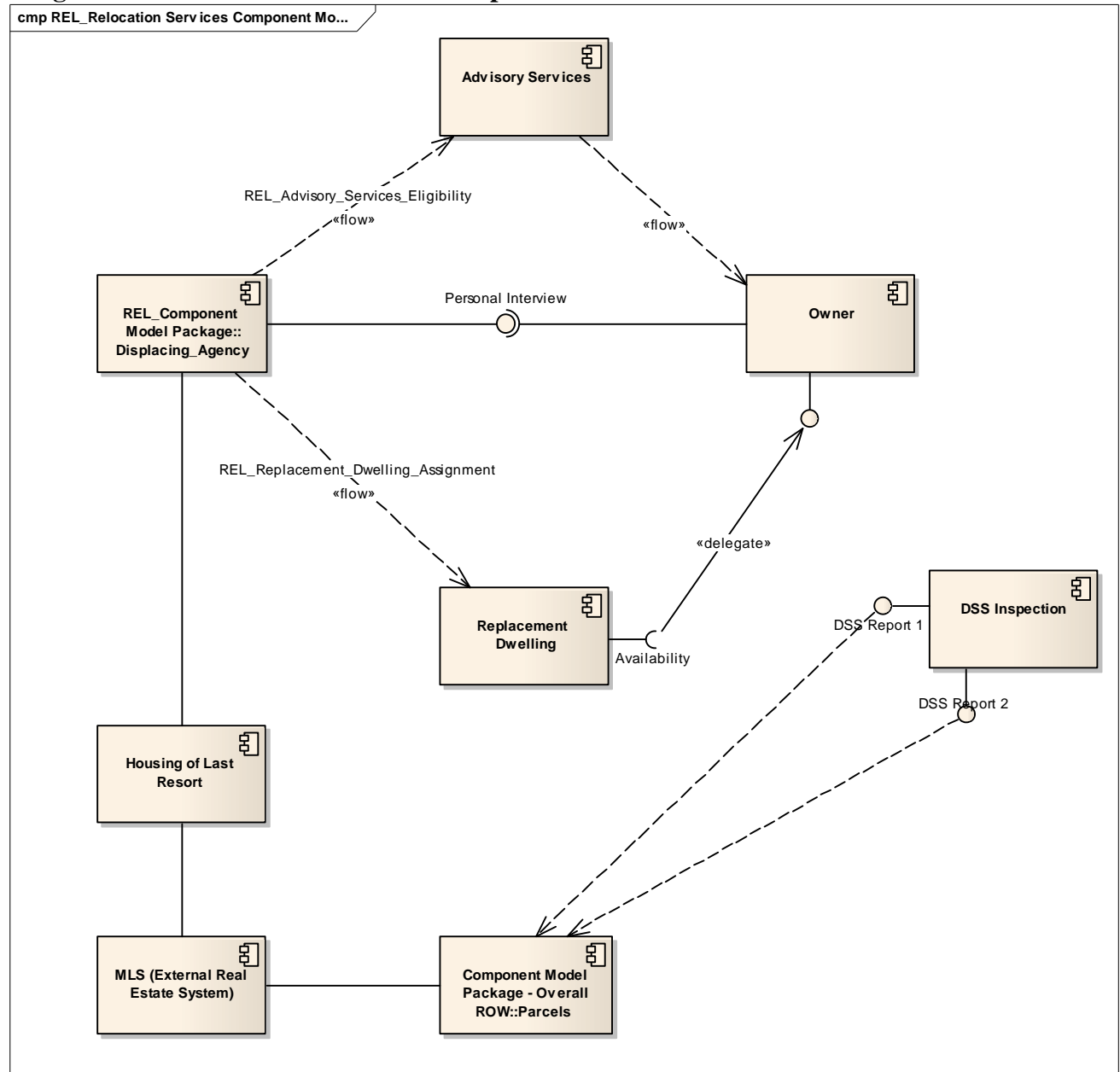
Diagram: REL_Relocation Services Component Model

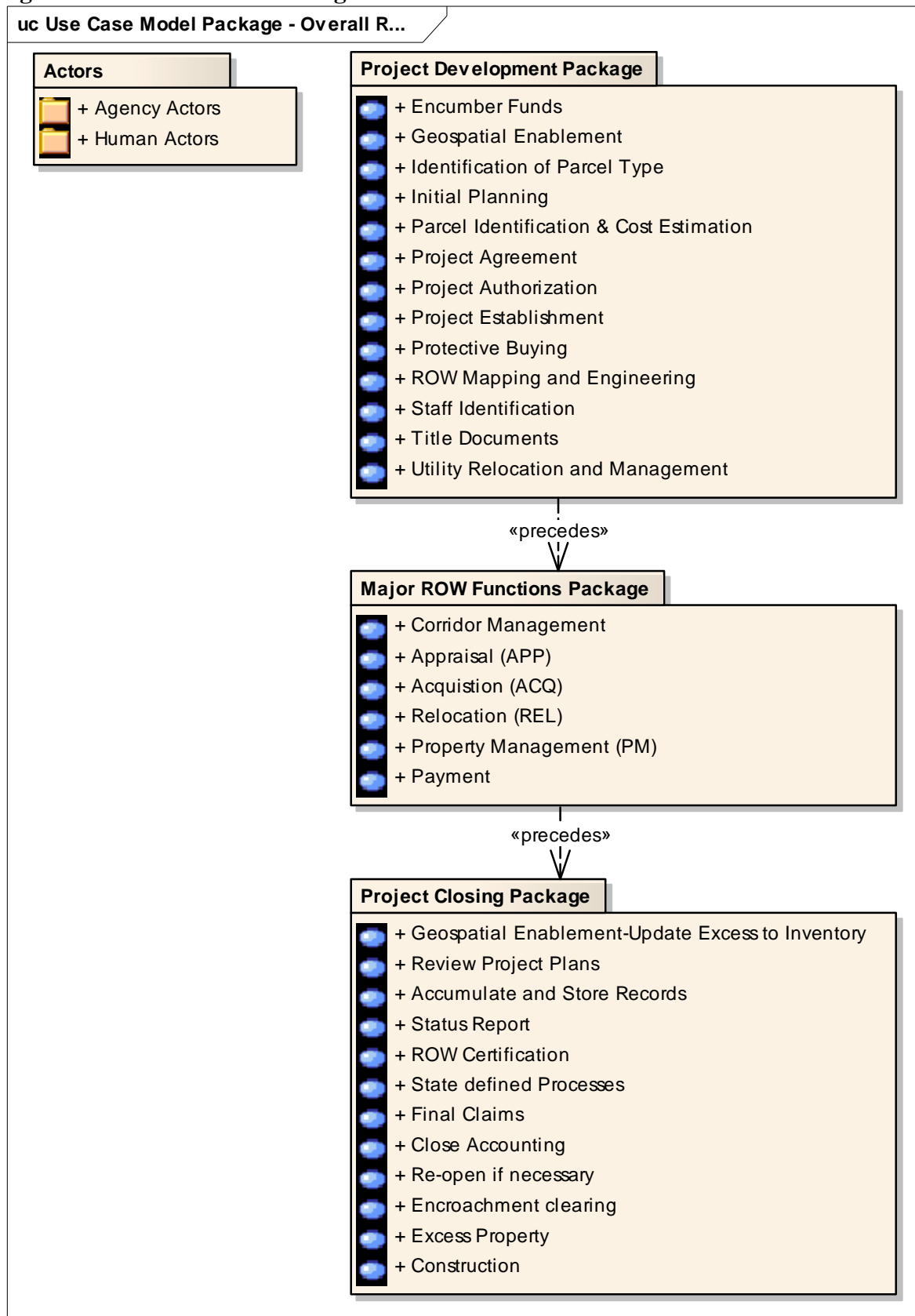
Diagram: Use Case Model Package - Overall ROW

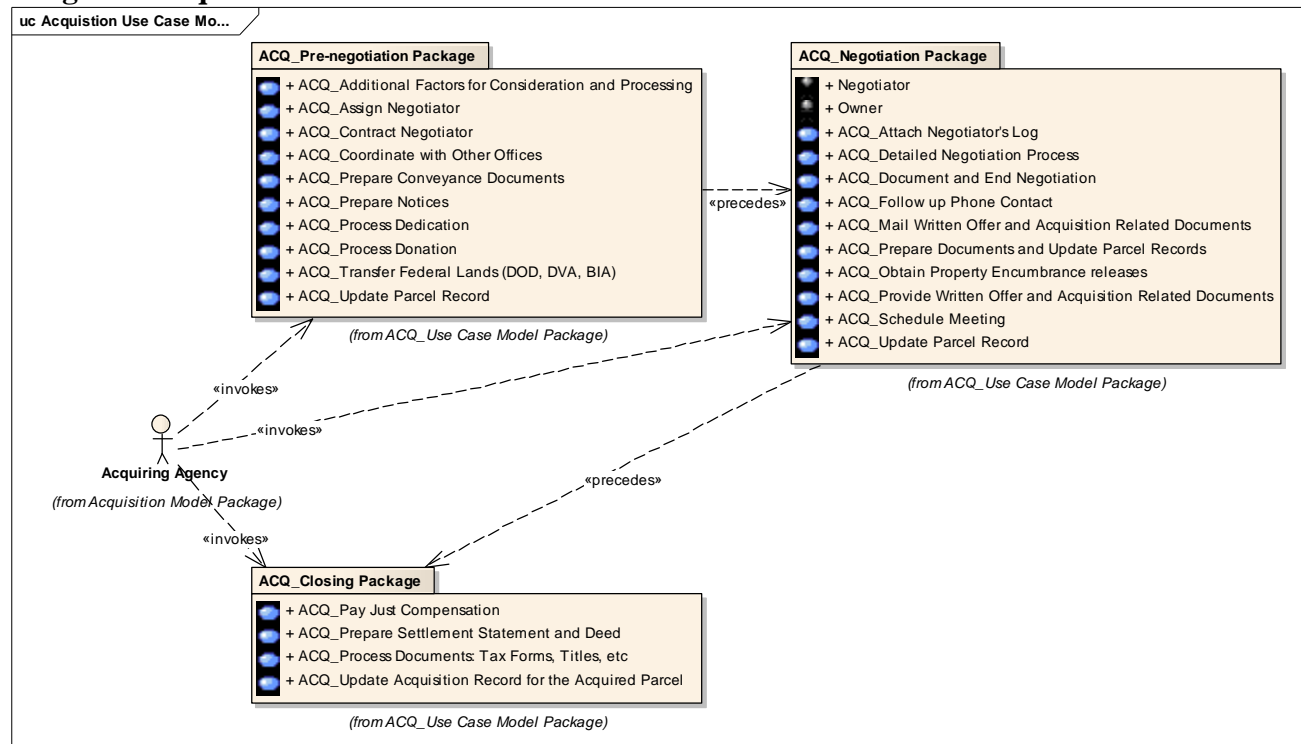
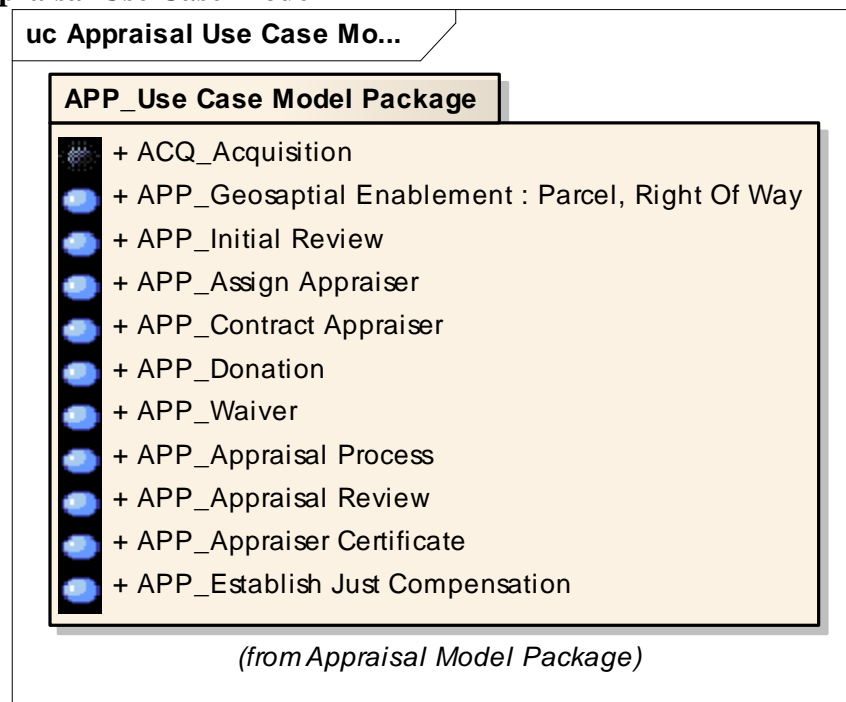
Diagram: Acquisition Use Case Model**Diagram: Appraisal Use Case Model**

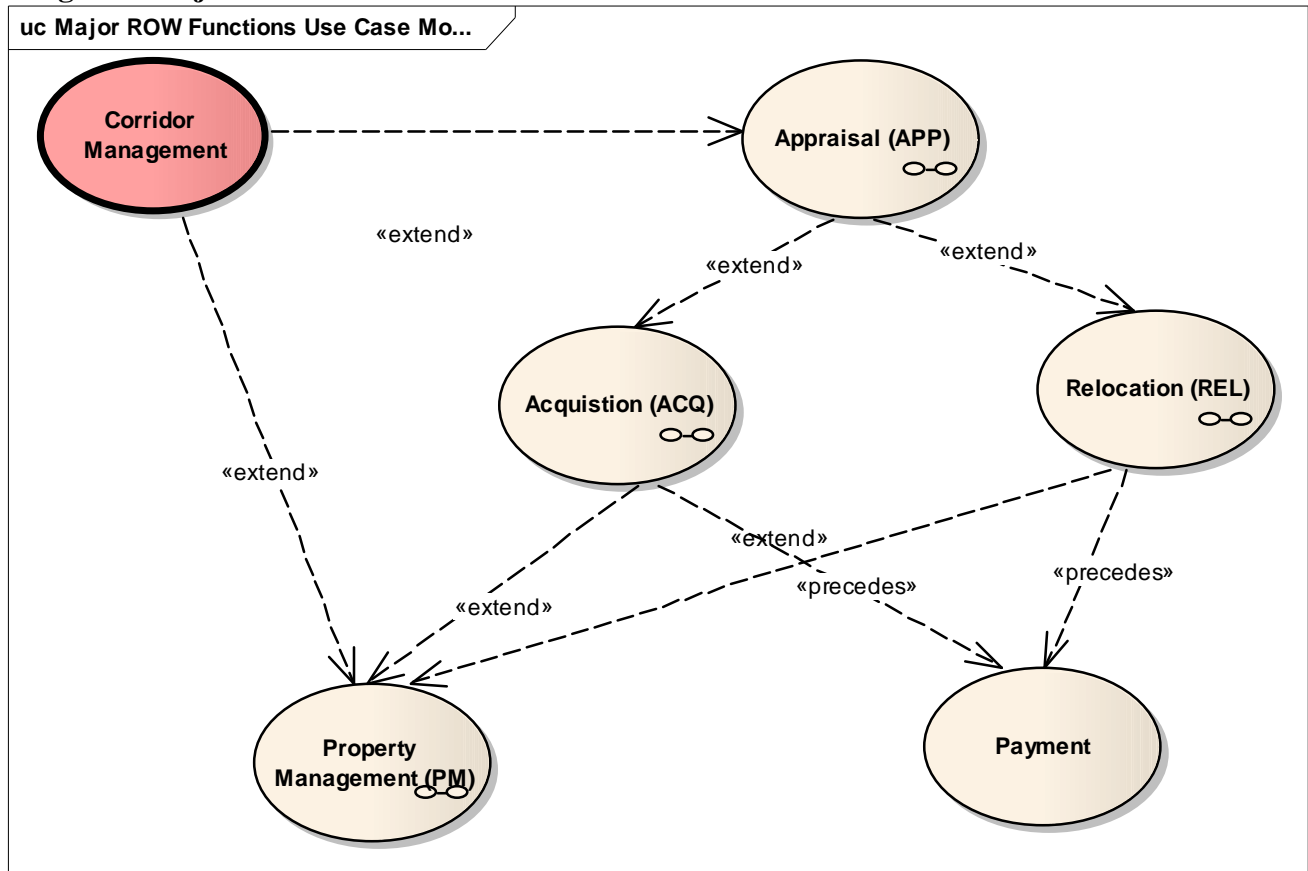
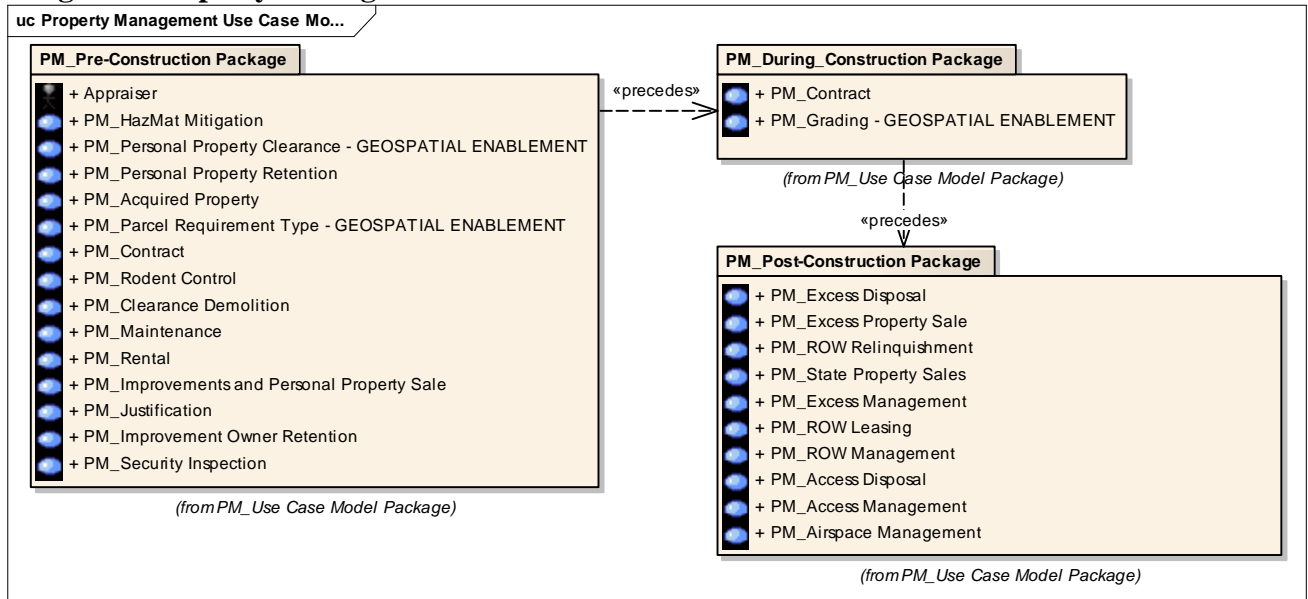
Diagram: Major ROW Functions Use Case Model**Diagram: Property Management Use Case Model**

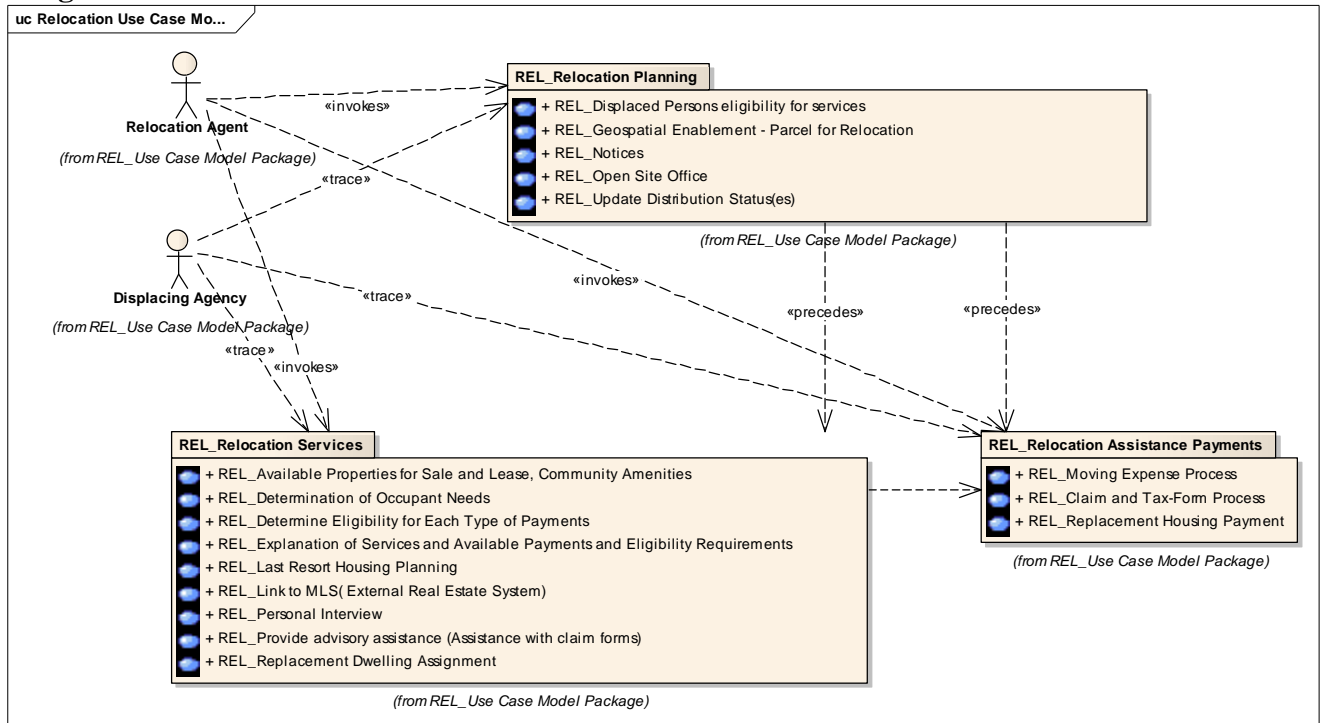
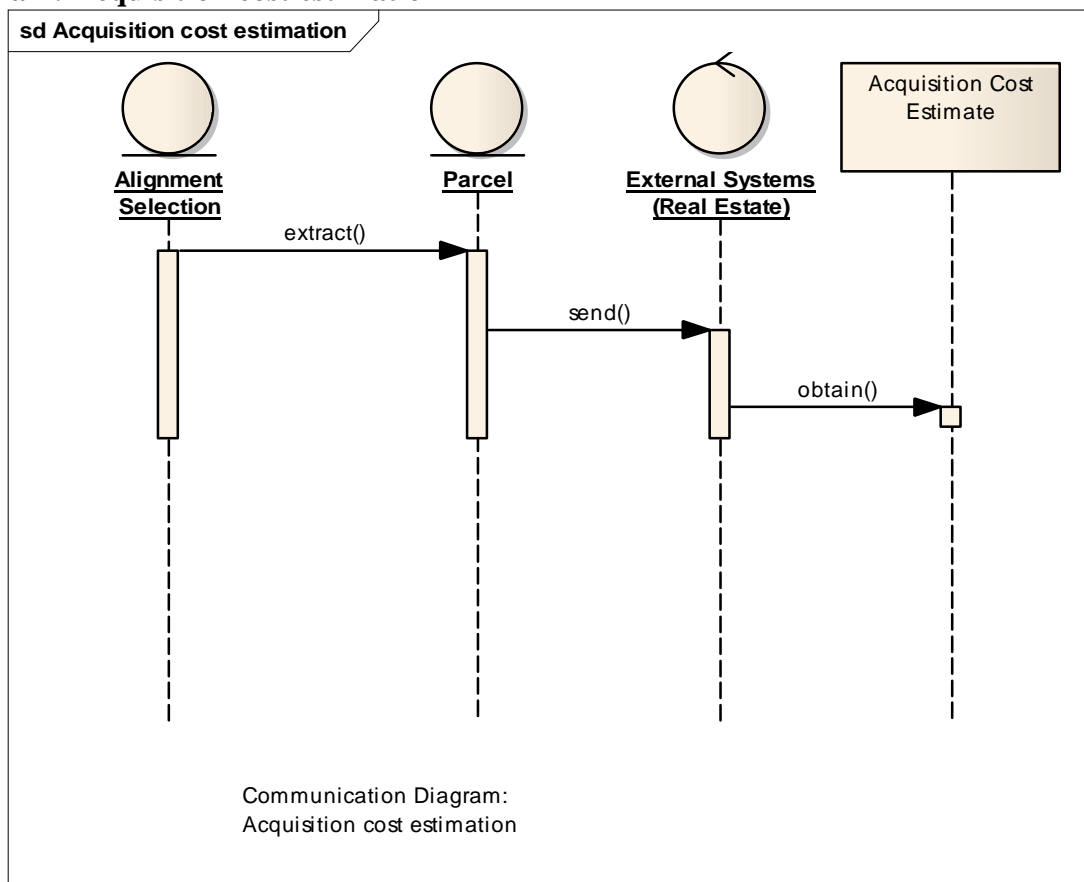
Diagram: Relocation Use Case Model**Diagram: Acquisition cost estimation**

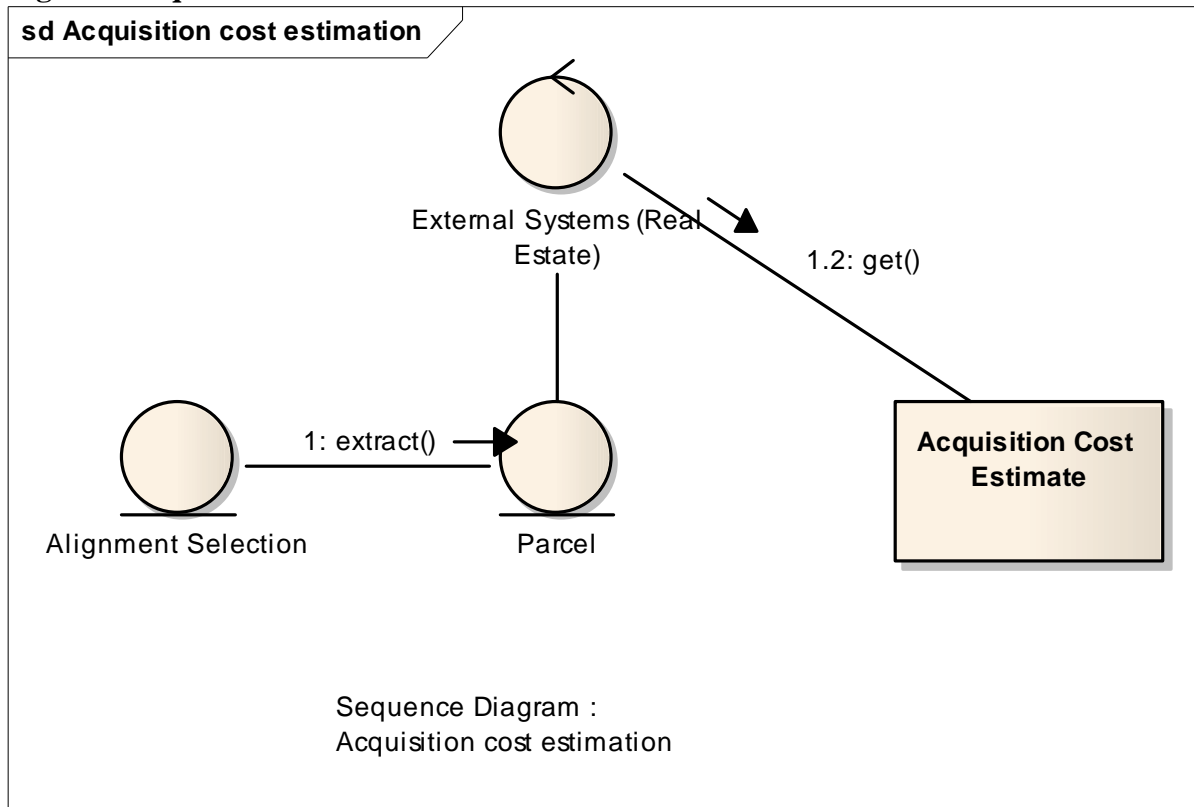
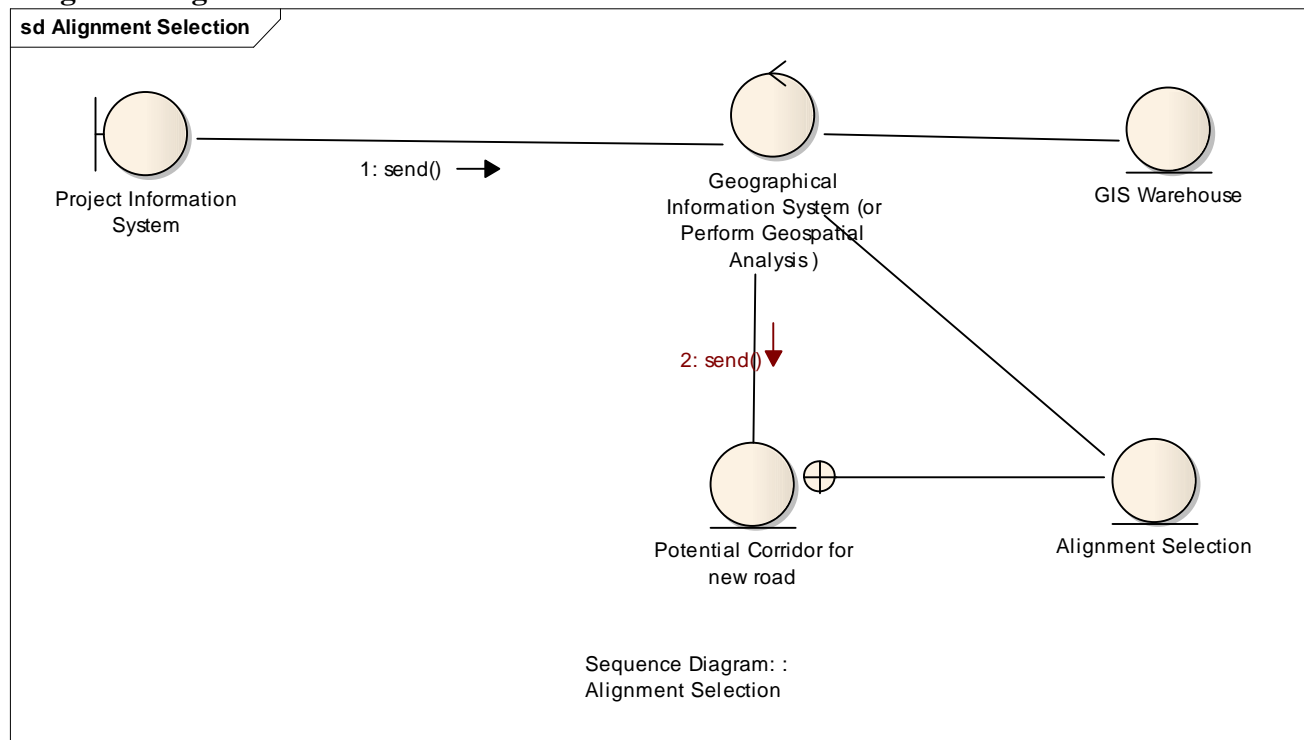
Diagram: Acquisition cost estimation**Diagram: Alignment Selection**

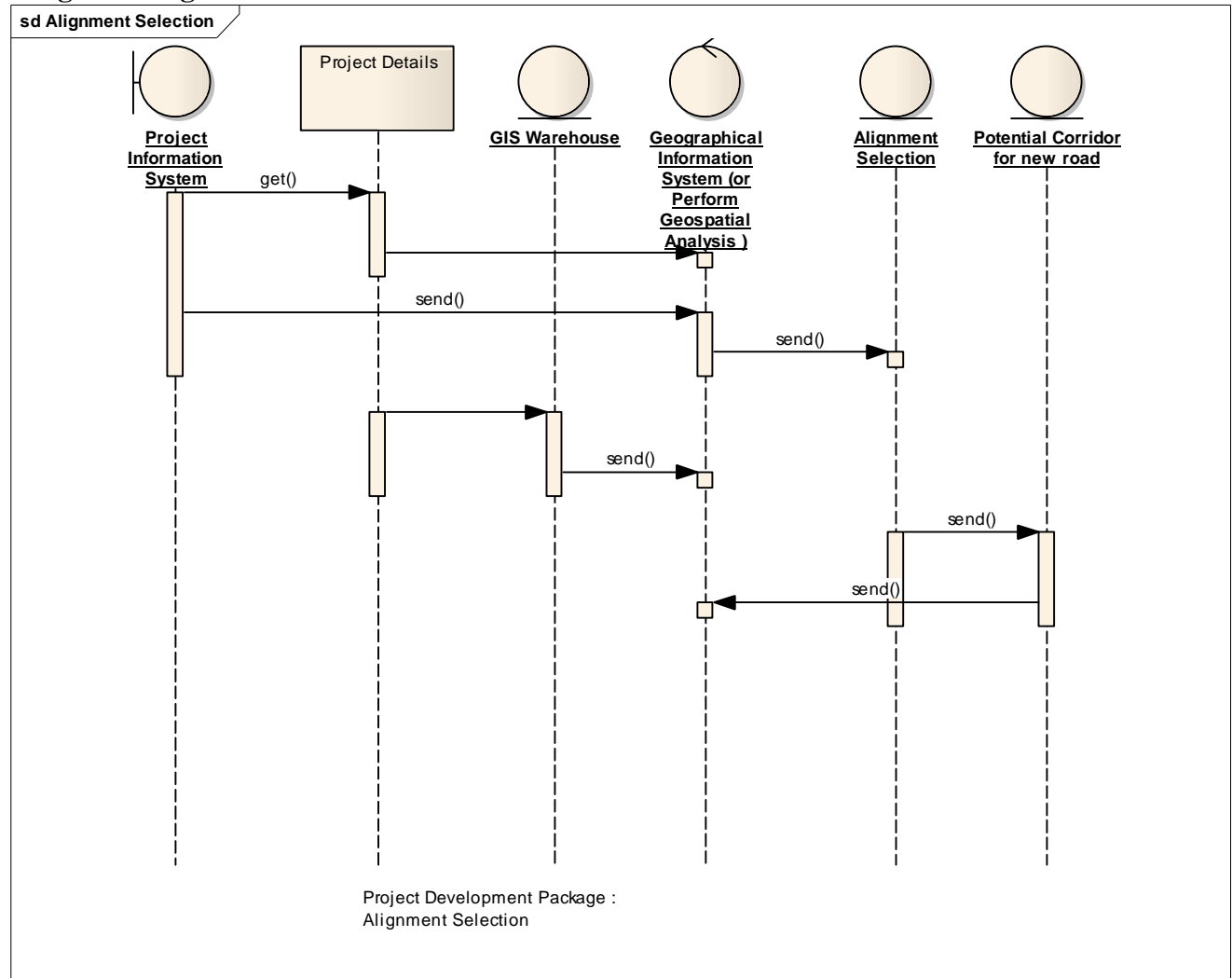
Diagram: Alignment Selection

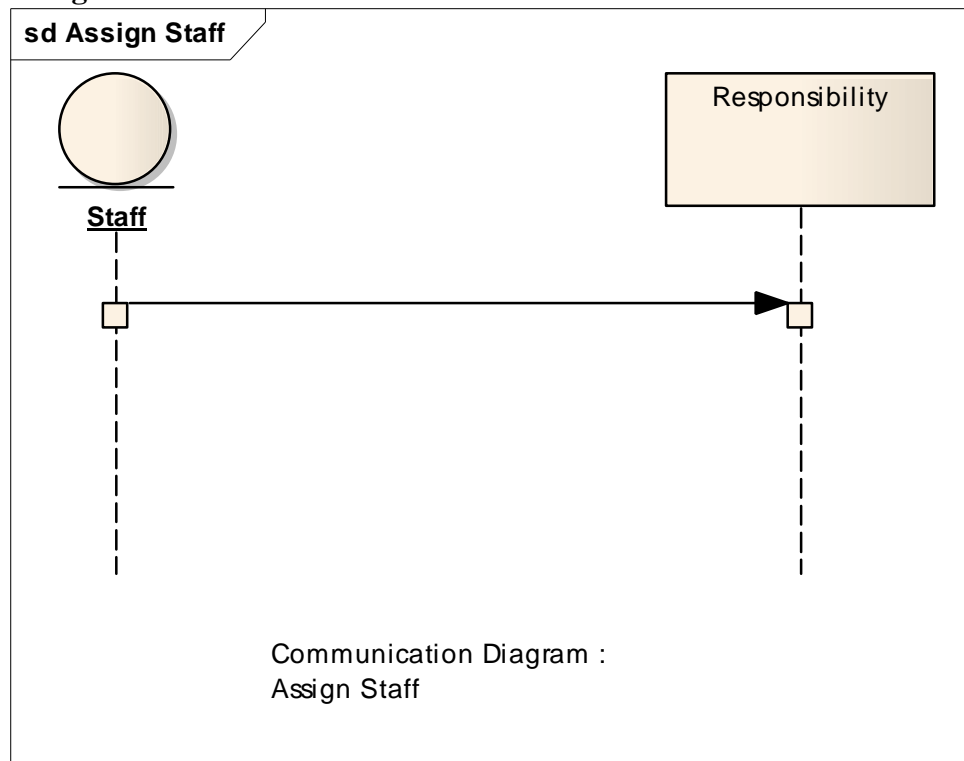
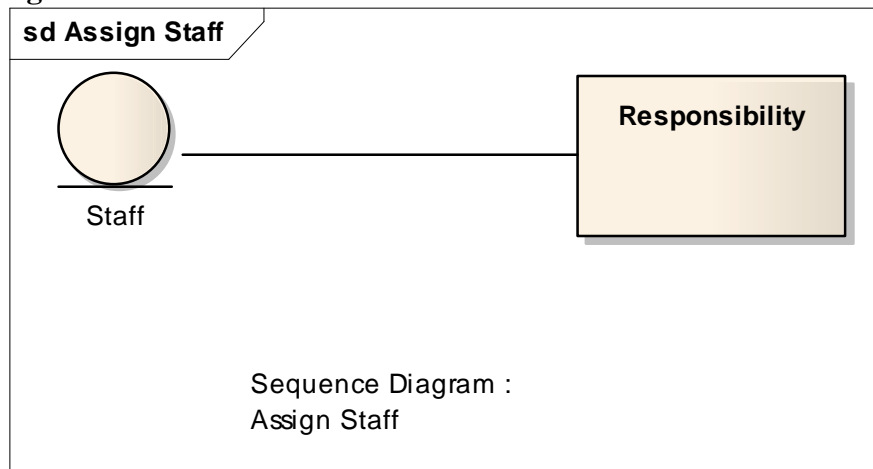
Diagram: Assign Staff**Diagram: Assign Staff**

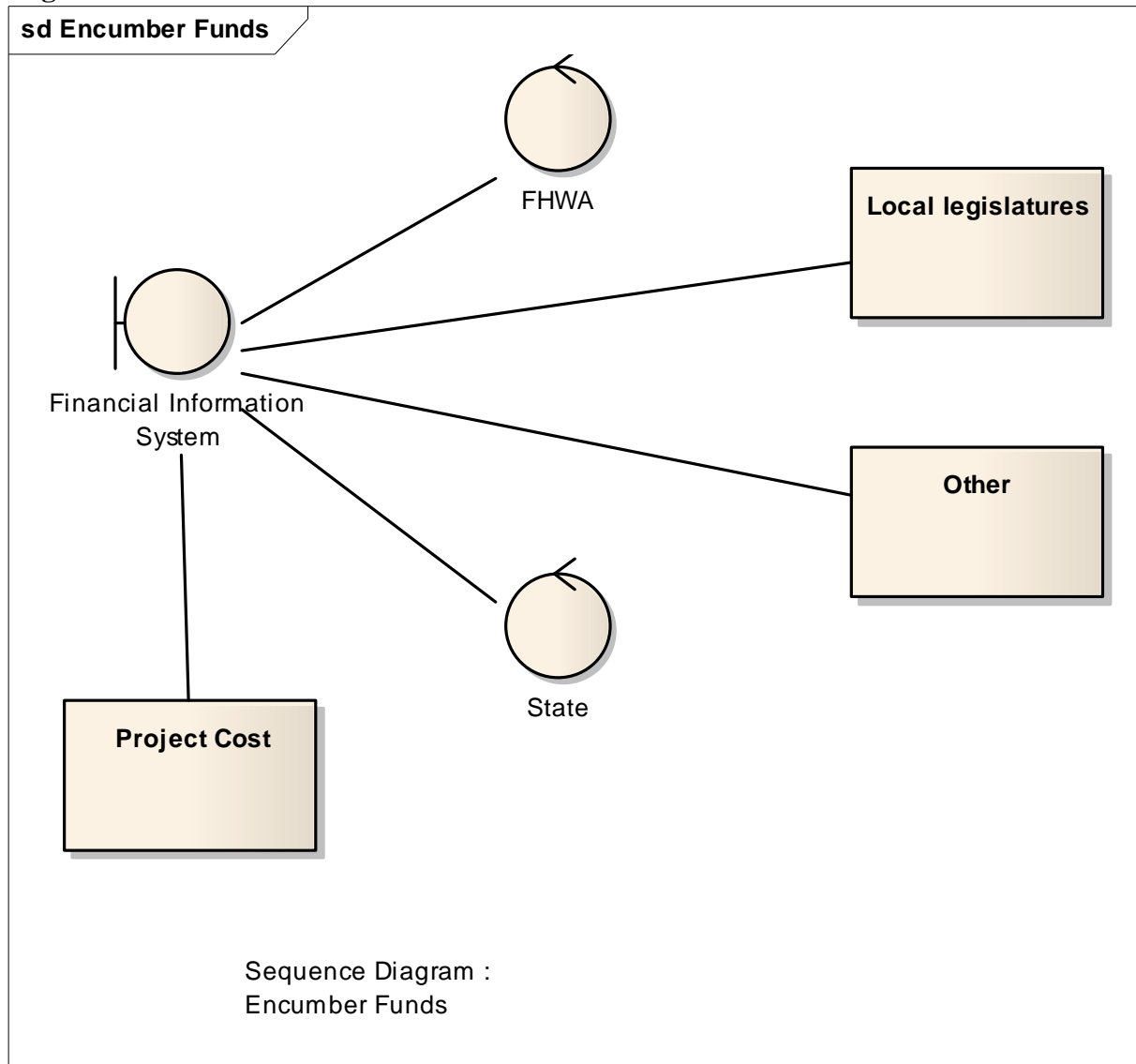
Diagram: Encumber Funds

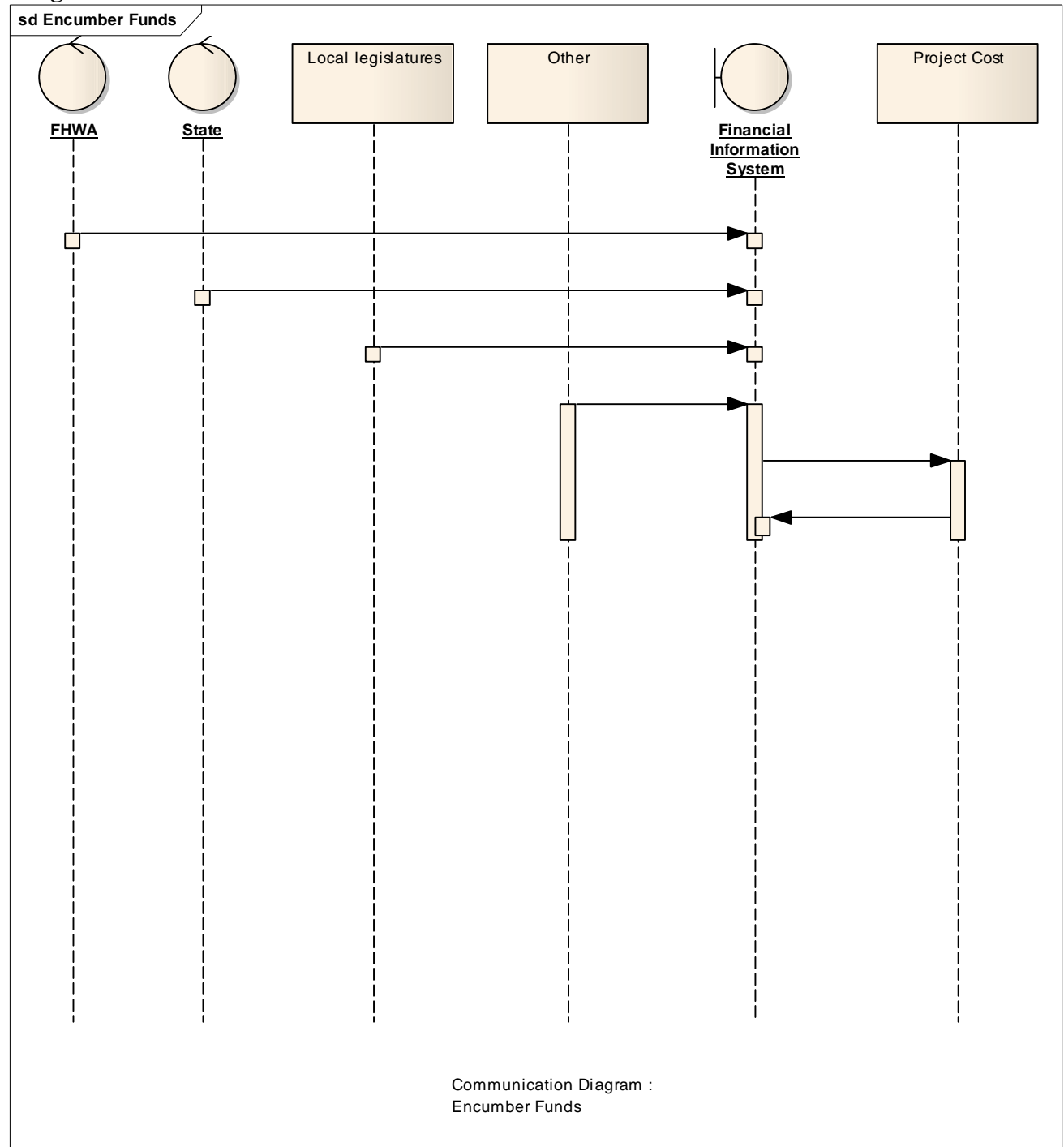
Diagram: Encumber Funds

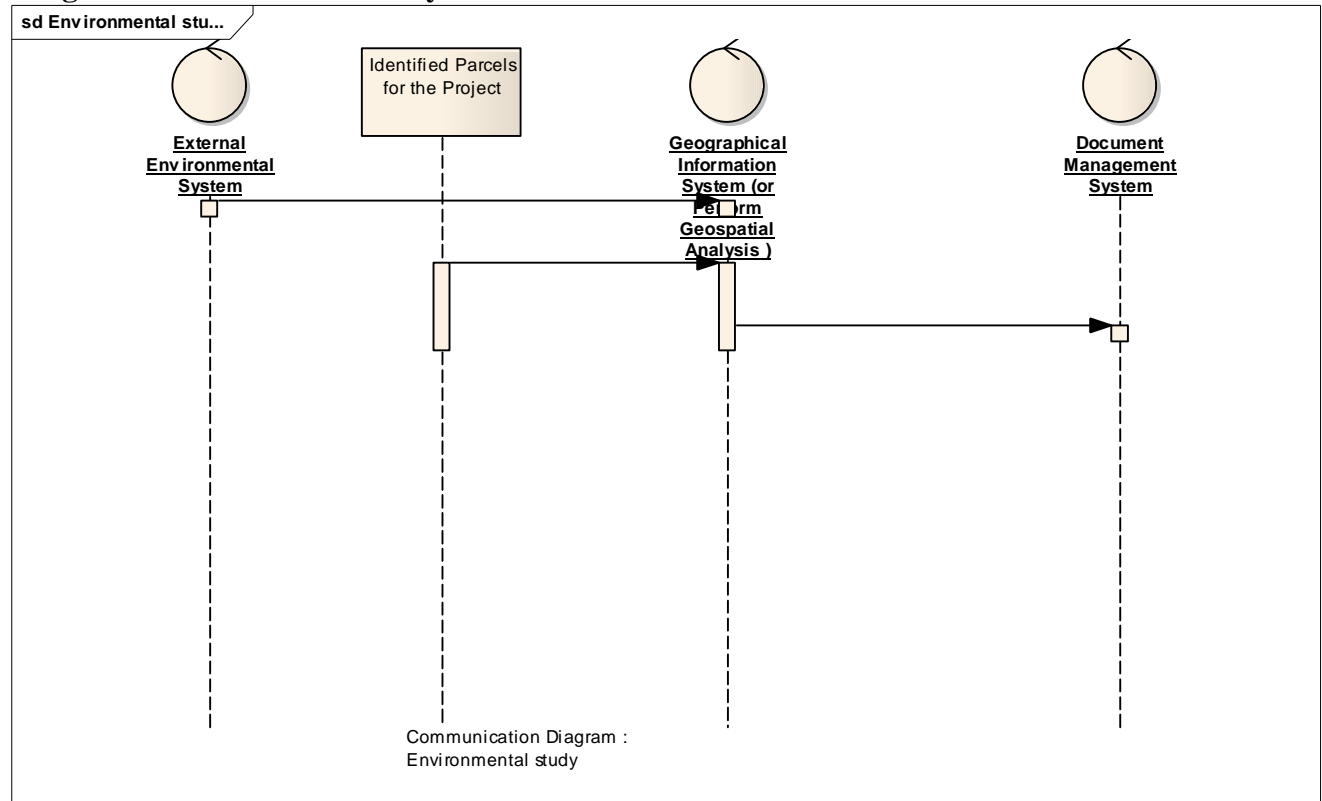
Diagram: Environmental study

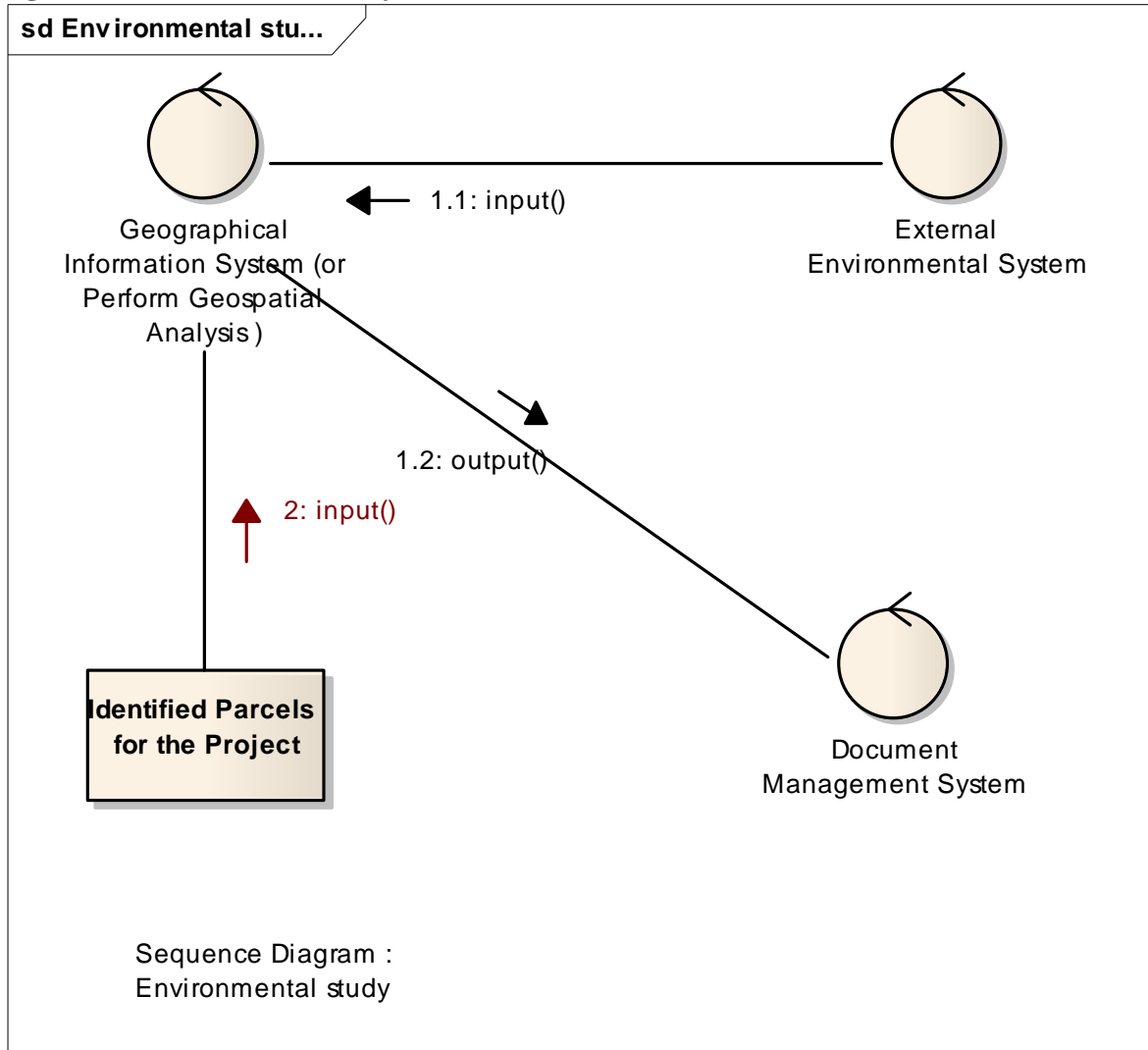
Diagram: Environmental study

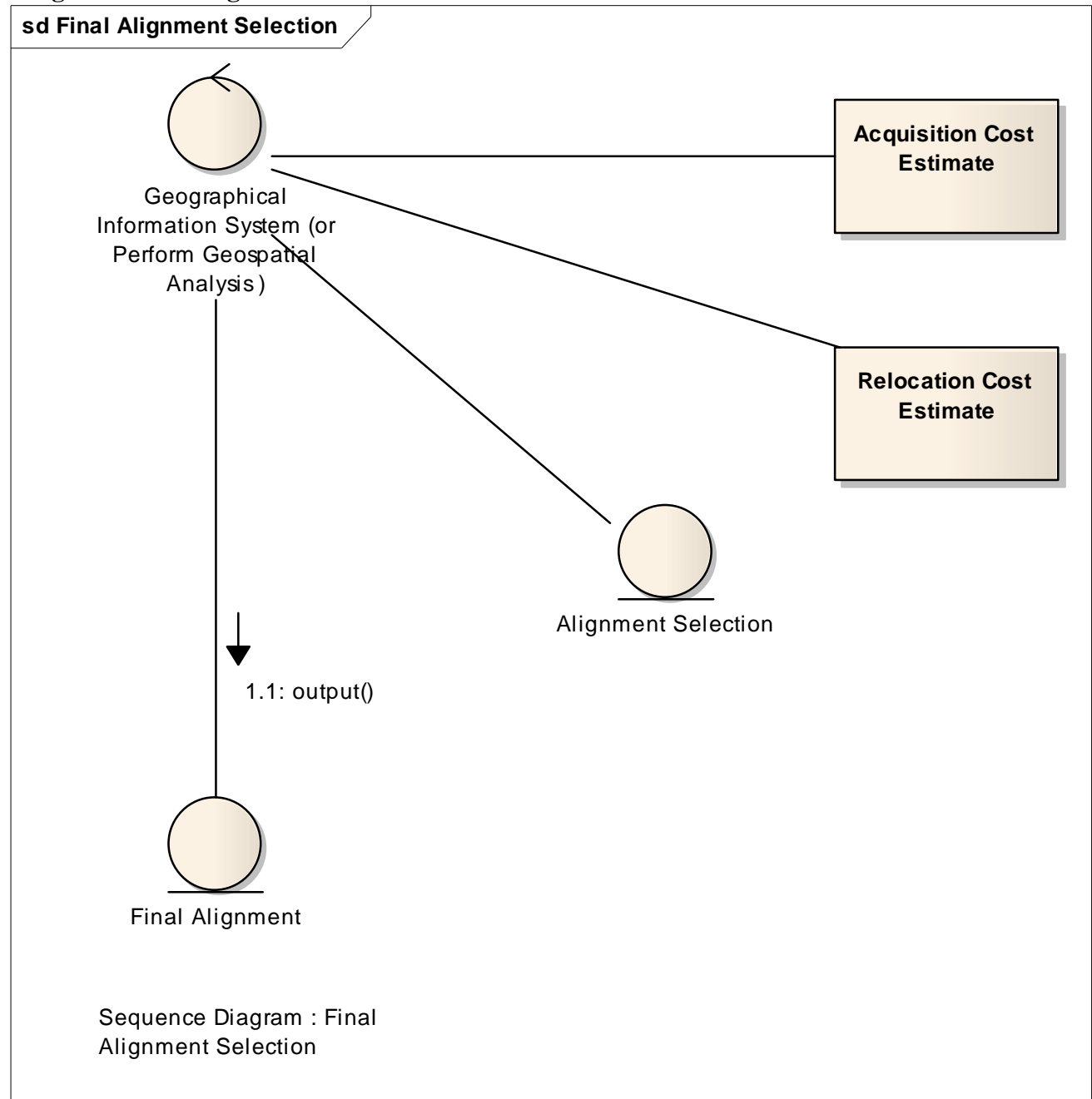
Diagram: Final Alignment Selection

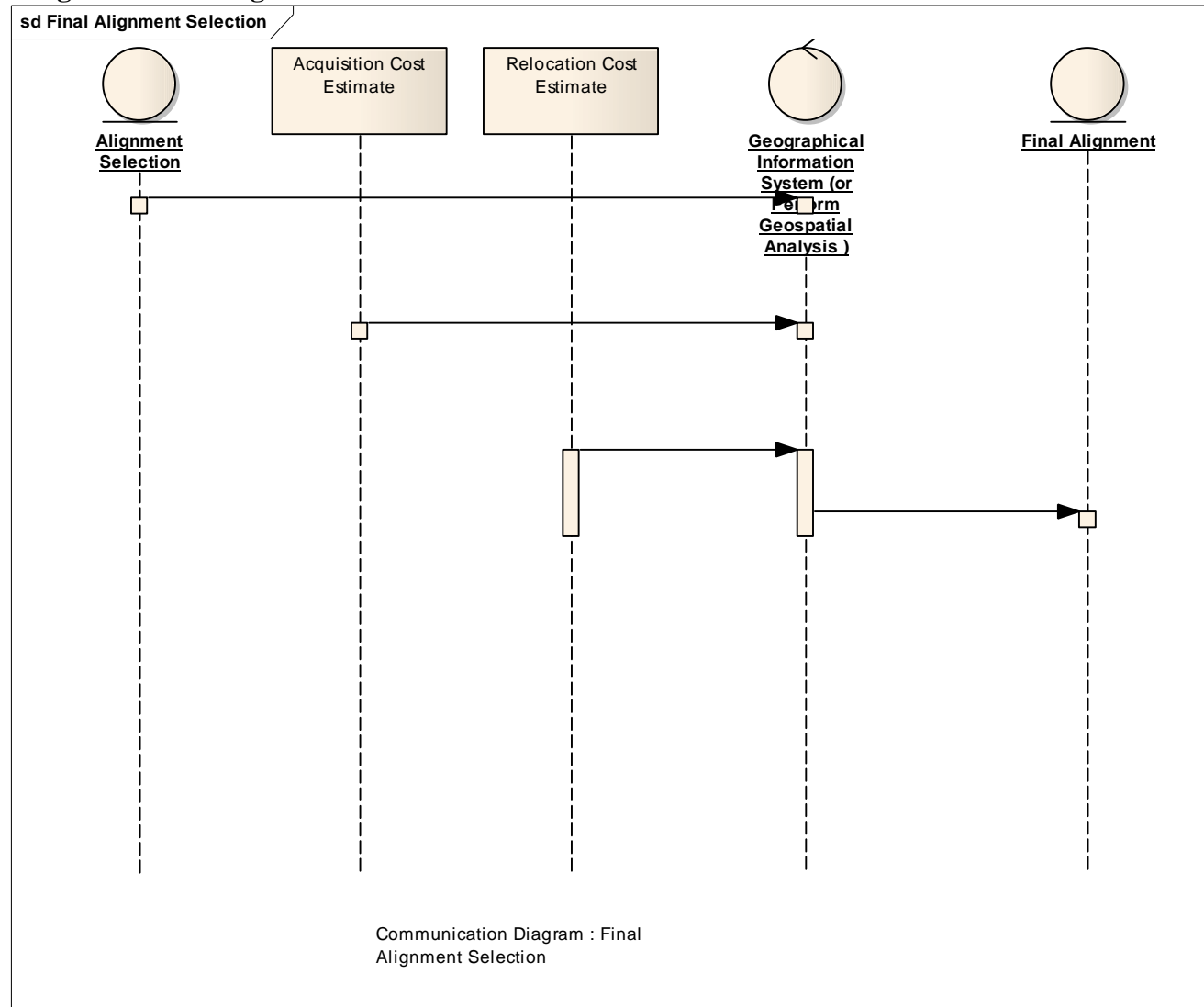
Diagram: Final Alignment Selection

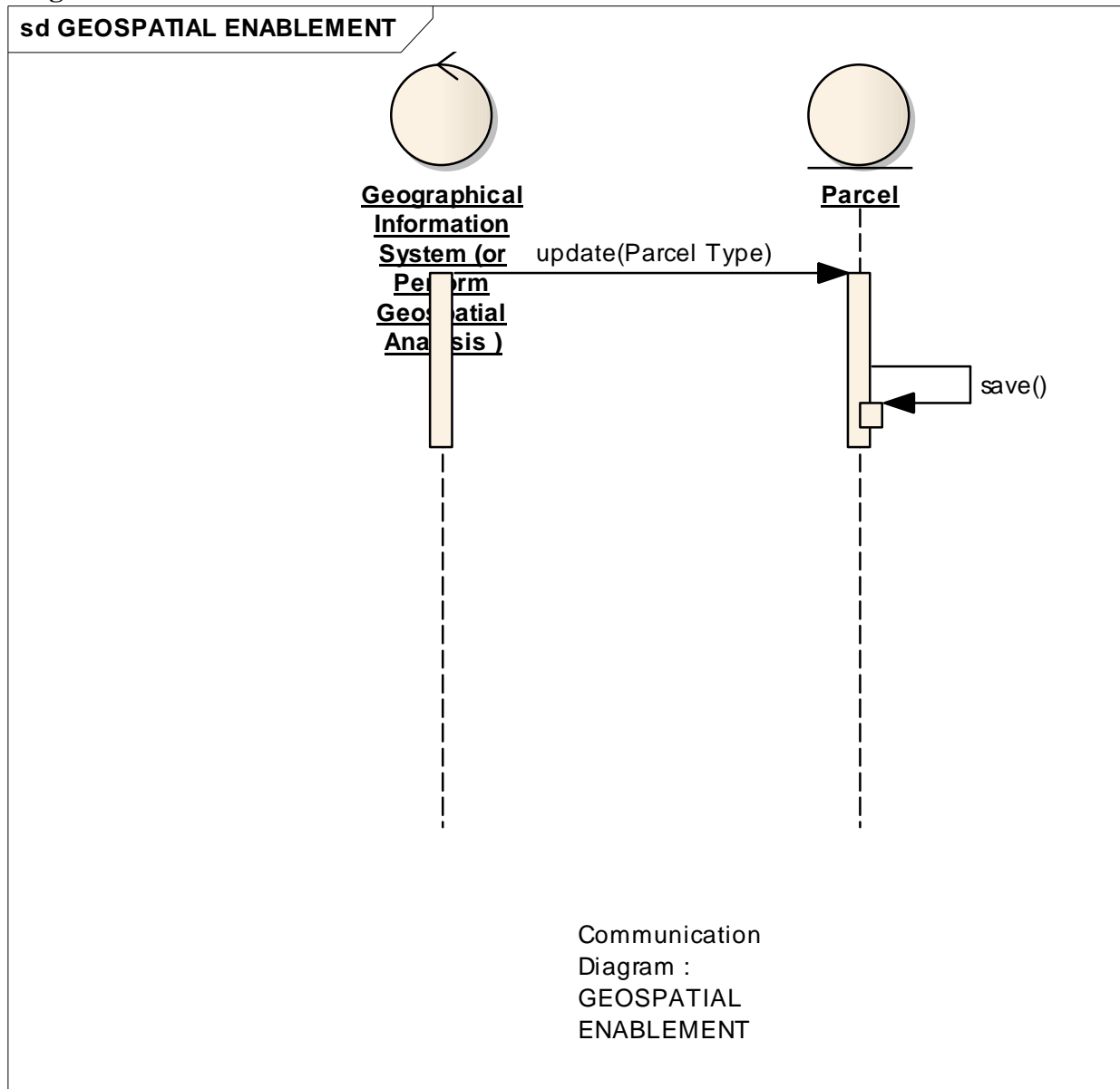
Diagram: GEOSPATIAL ENABLEMENT

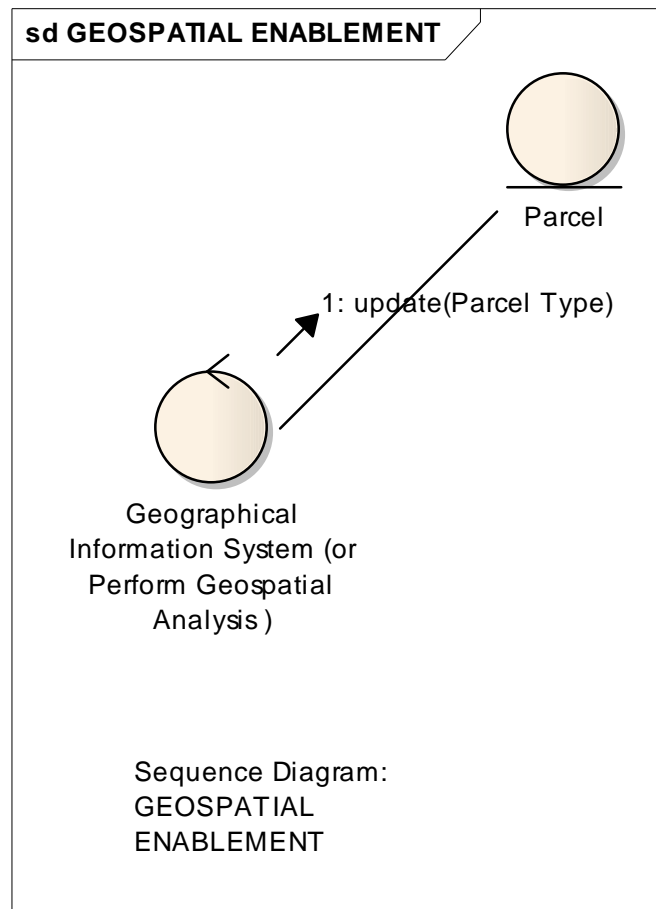
Diagram: GEOSPATIAL ENABLEMENT

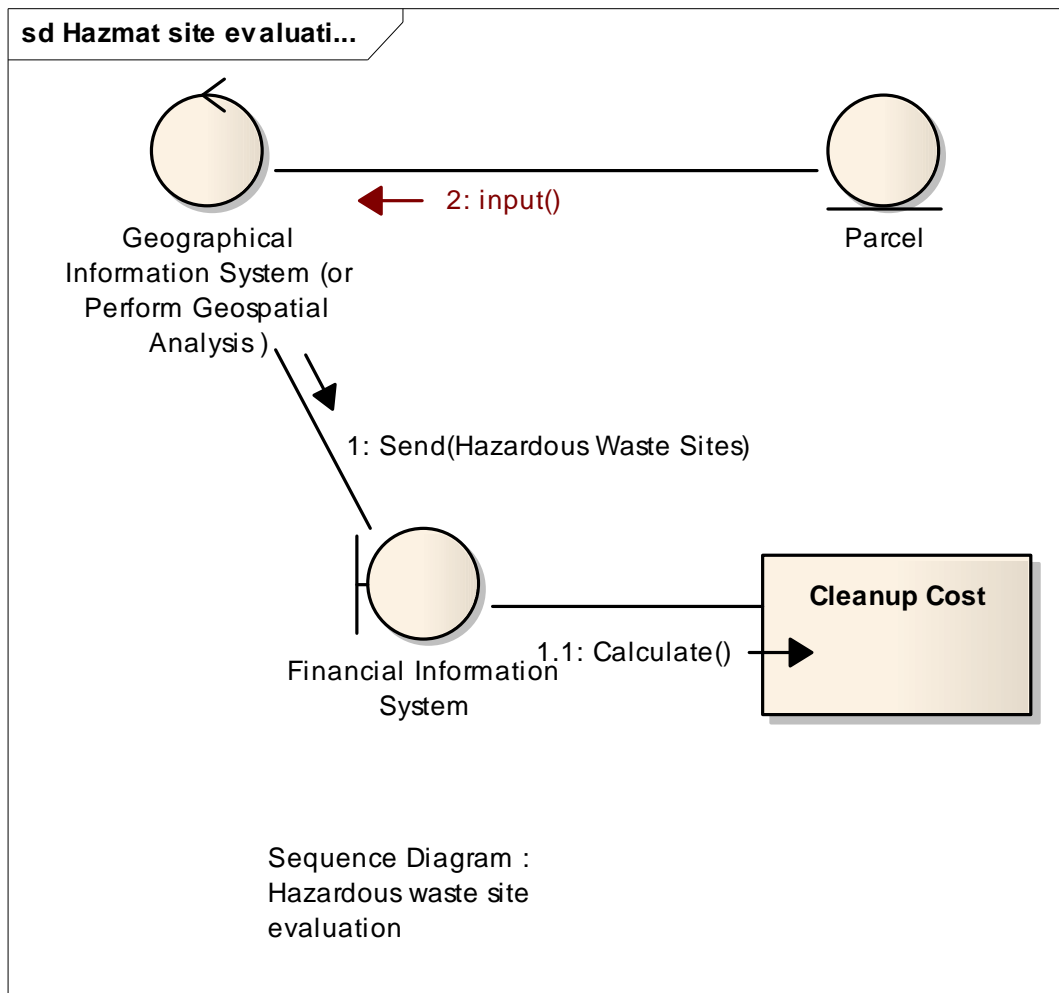
Diagram: Hazmat site evaluation

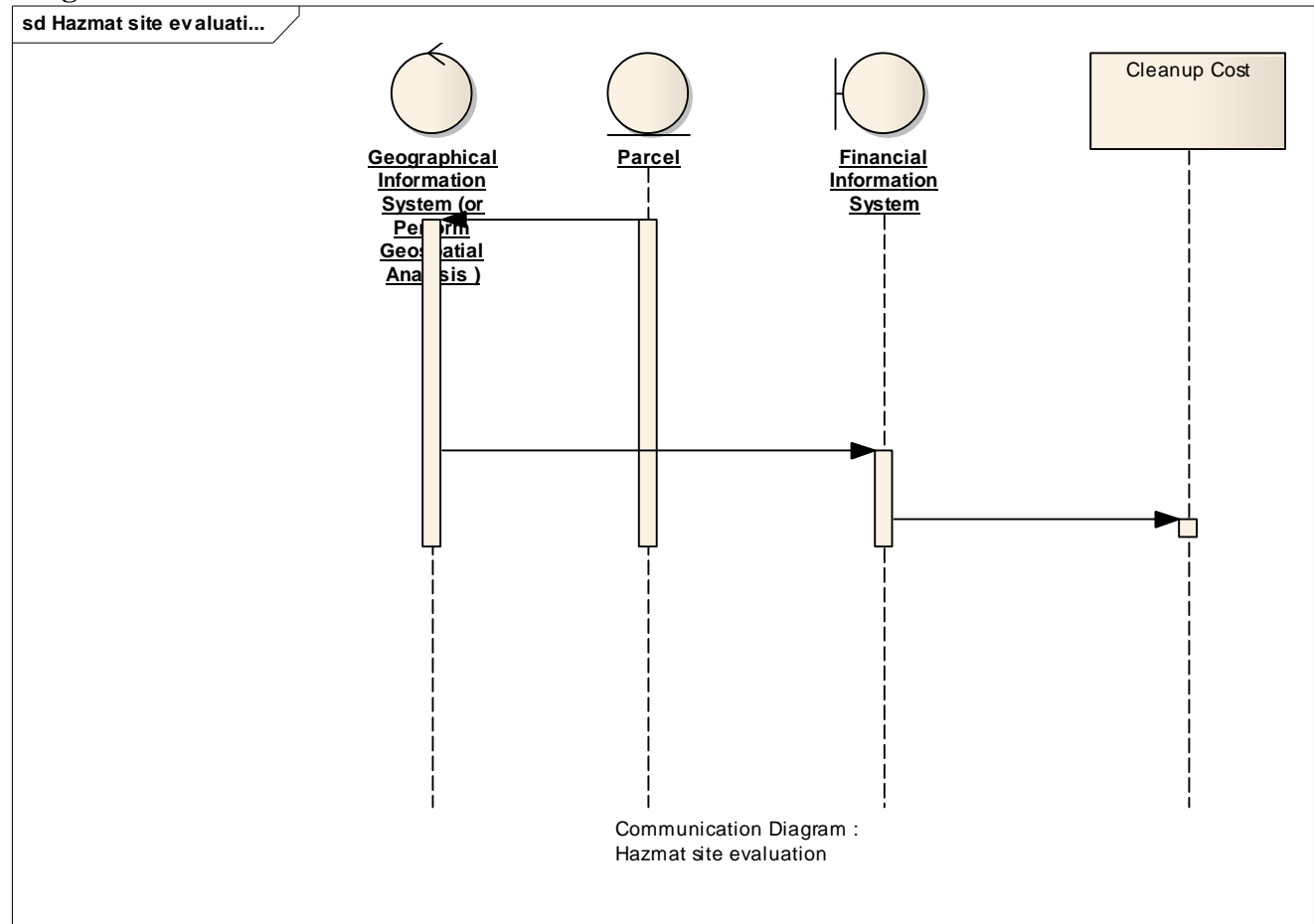
Diagram: Hazmat site evaluation

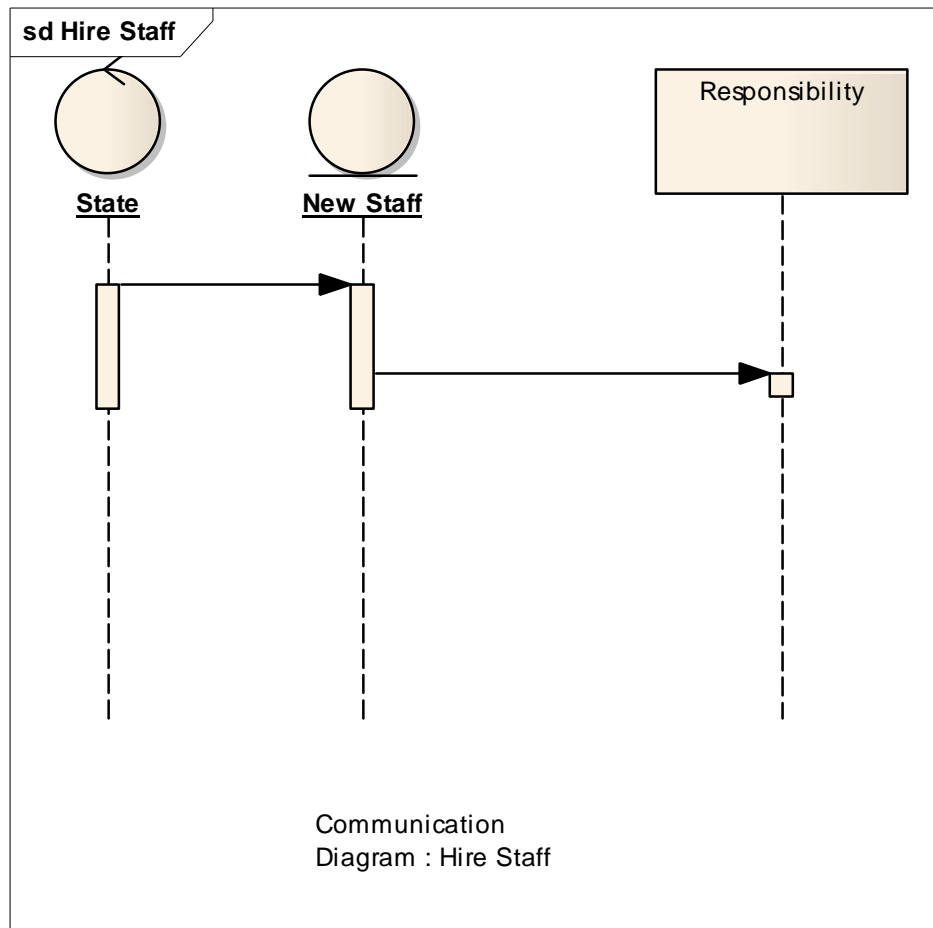
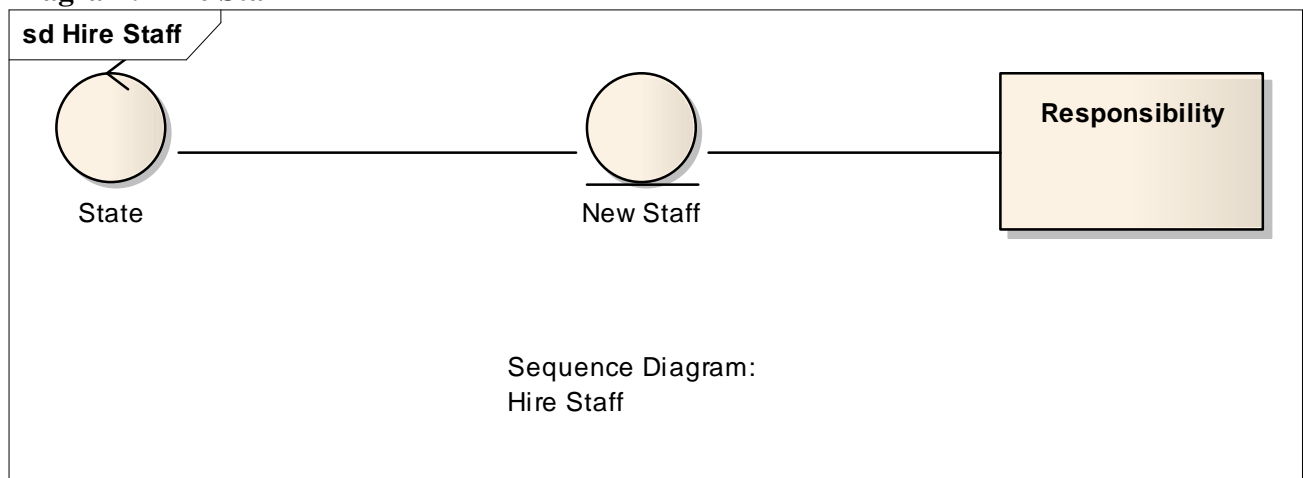
Diagram: Hire Staff**Diagram: Hire Staff**

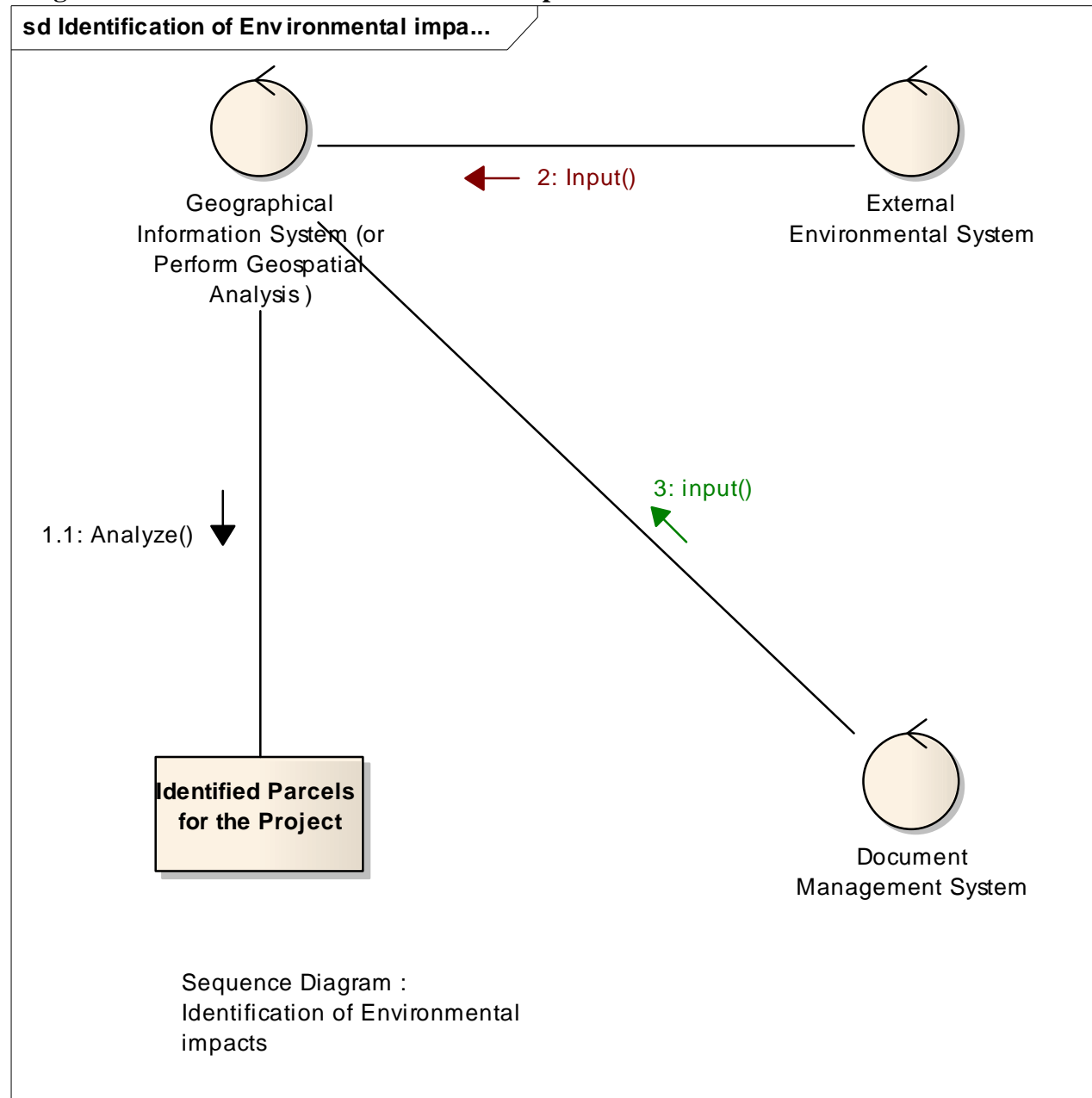
Diagram: Identification of Environmental impacts

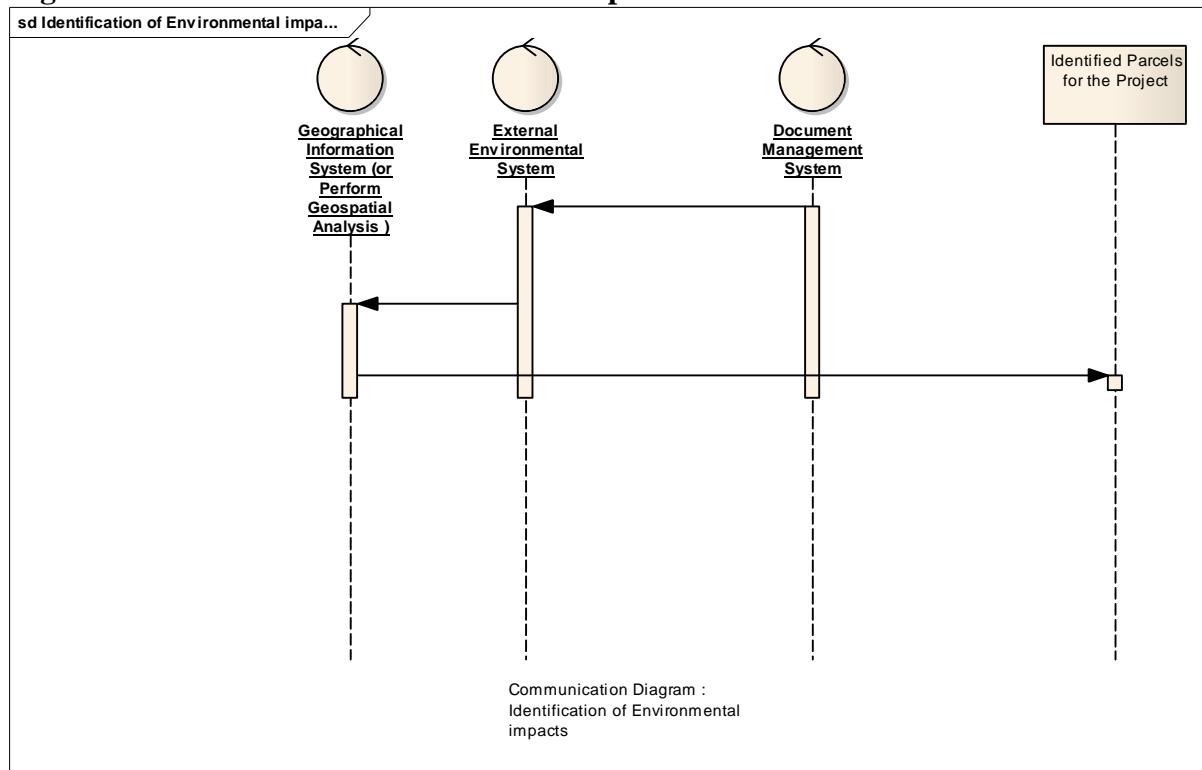
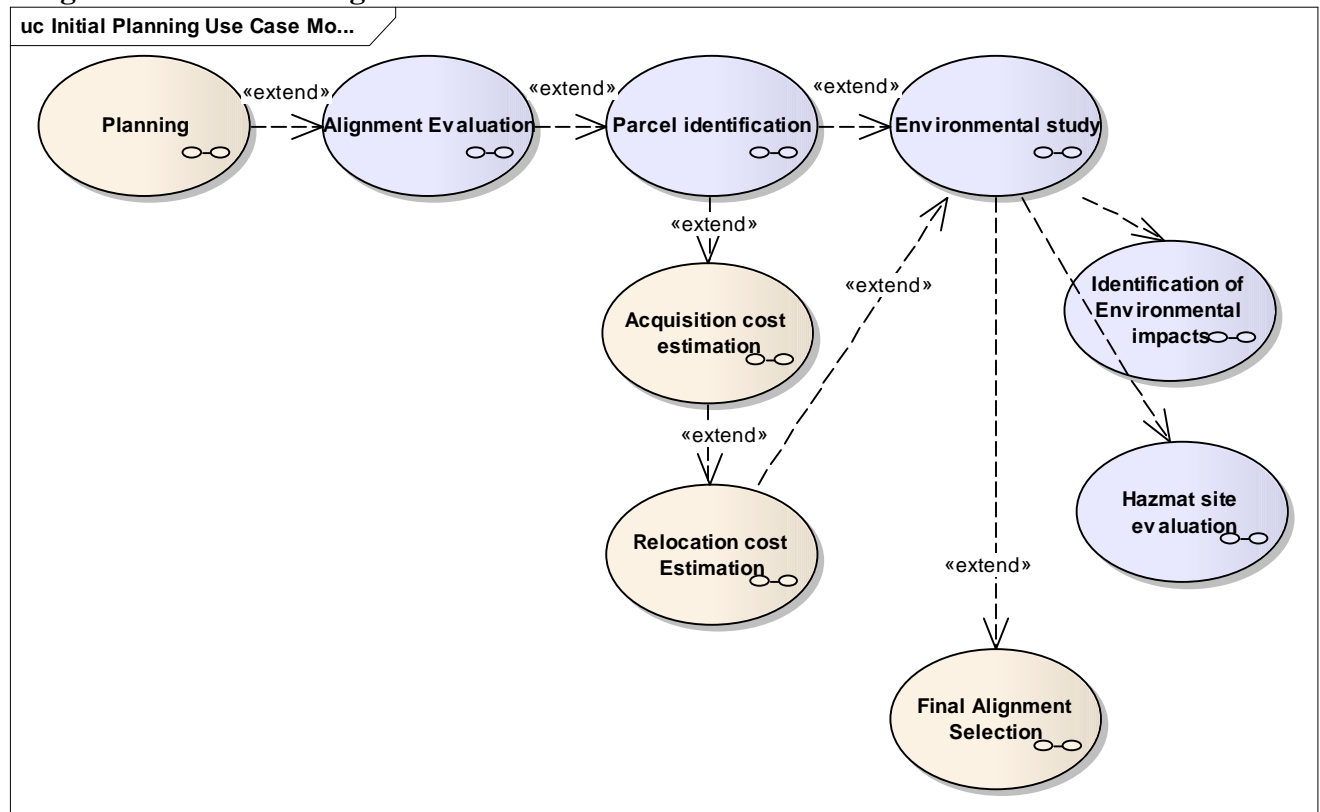
Diagram: Identification of Environmental impacts**Diagram: Initial Planning Use Case Model**

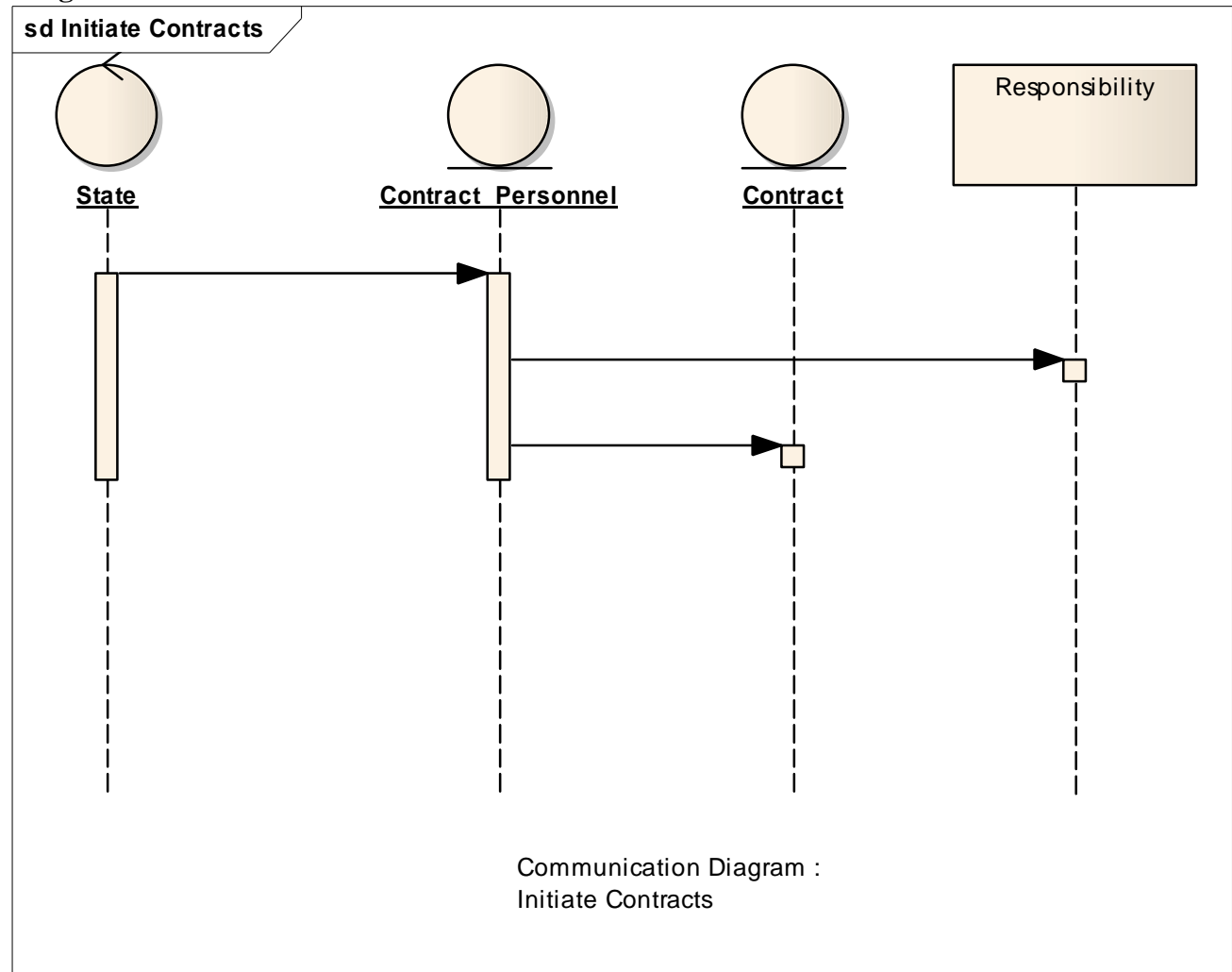
Diagram: Initiate Contracts

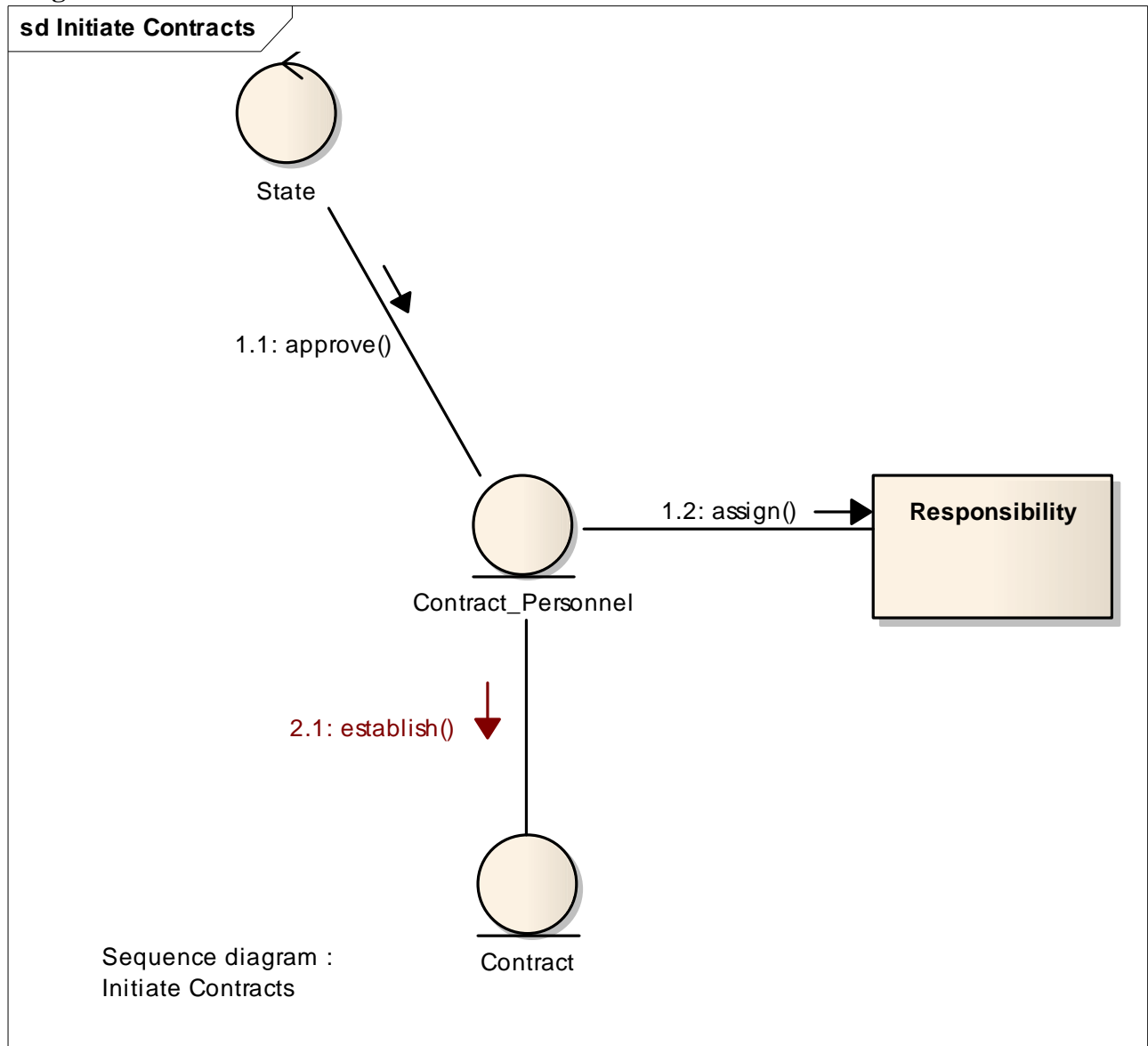
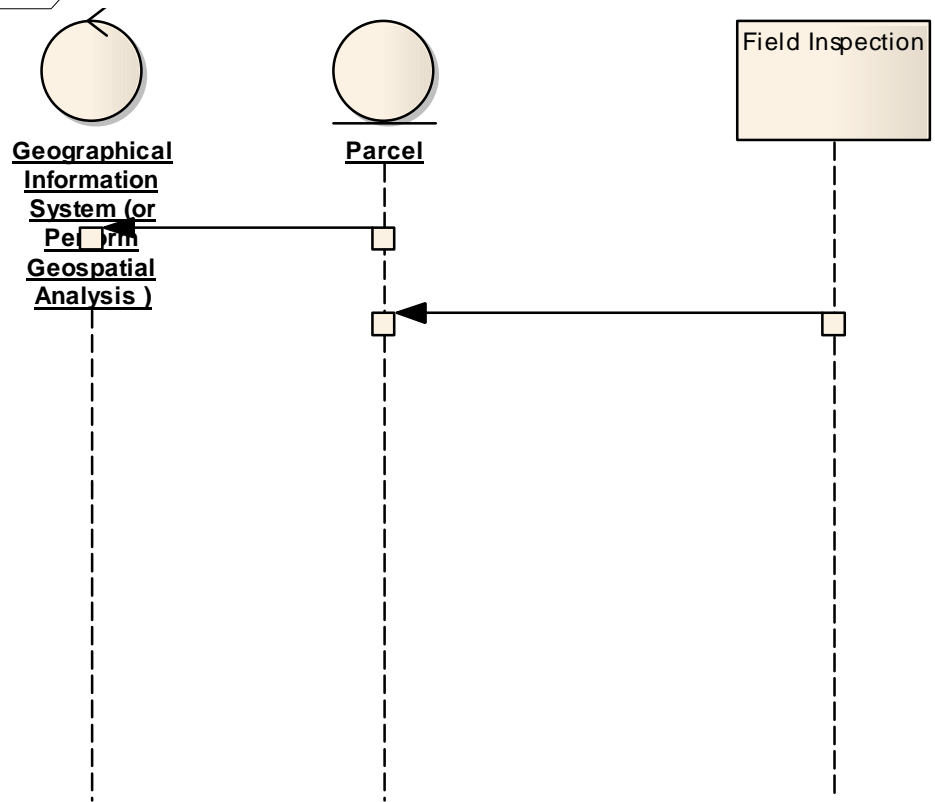
Diagram: Initiate Contracts

Diagram: Parcel Alignment Inspection**sd Parcel Alignment Inspection**

Communication Diagram :
Parcel Alignment Inspection

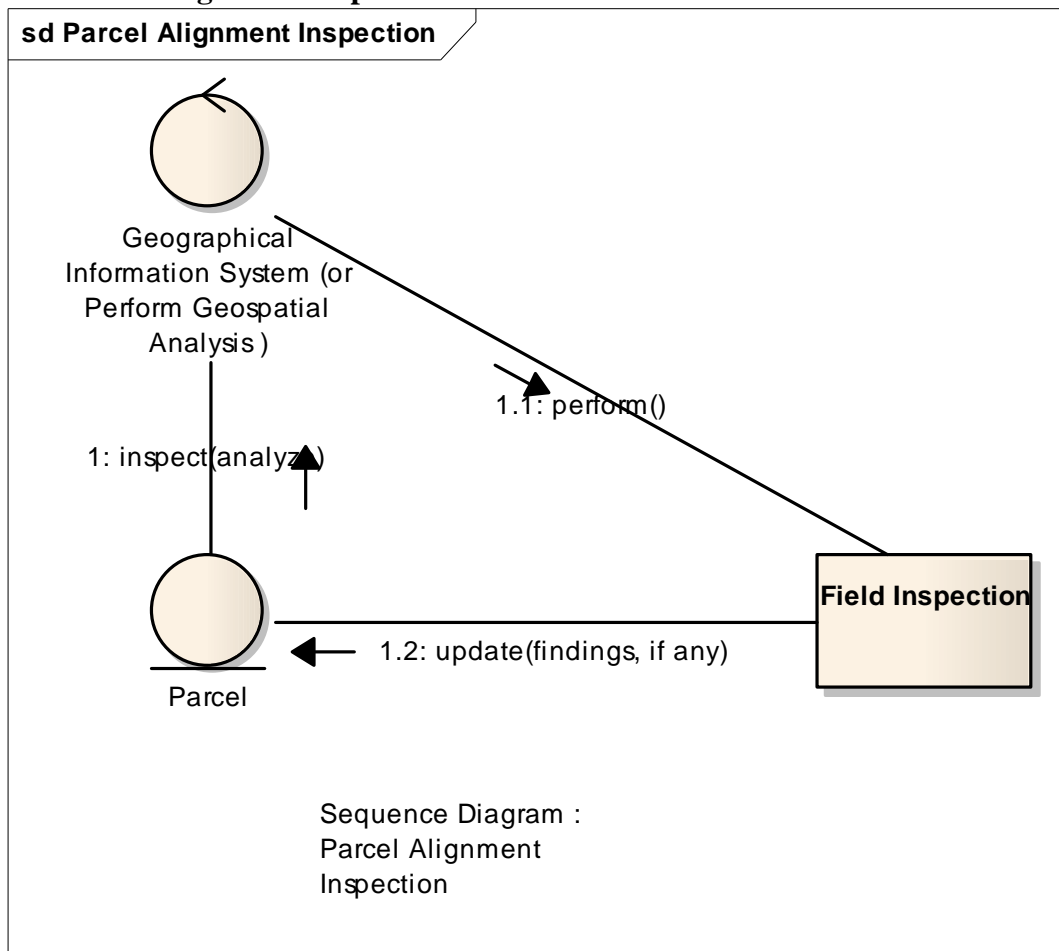
Diagram: Parcel Alignment Inspection

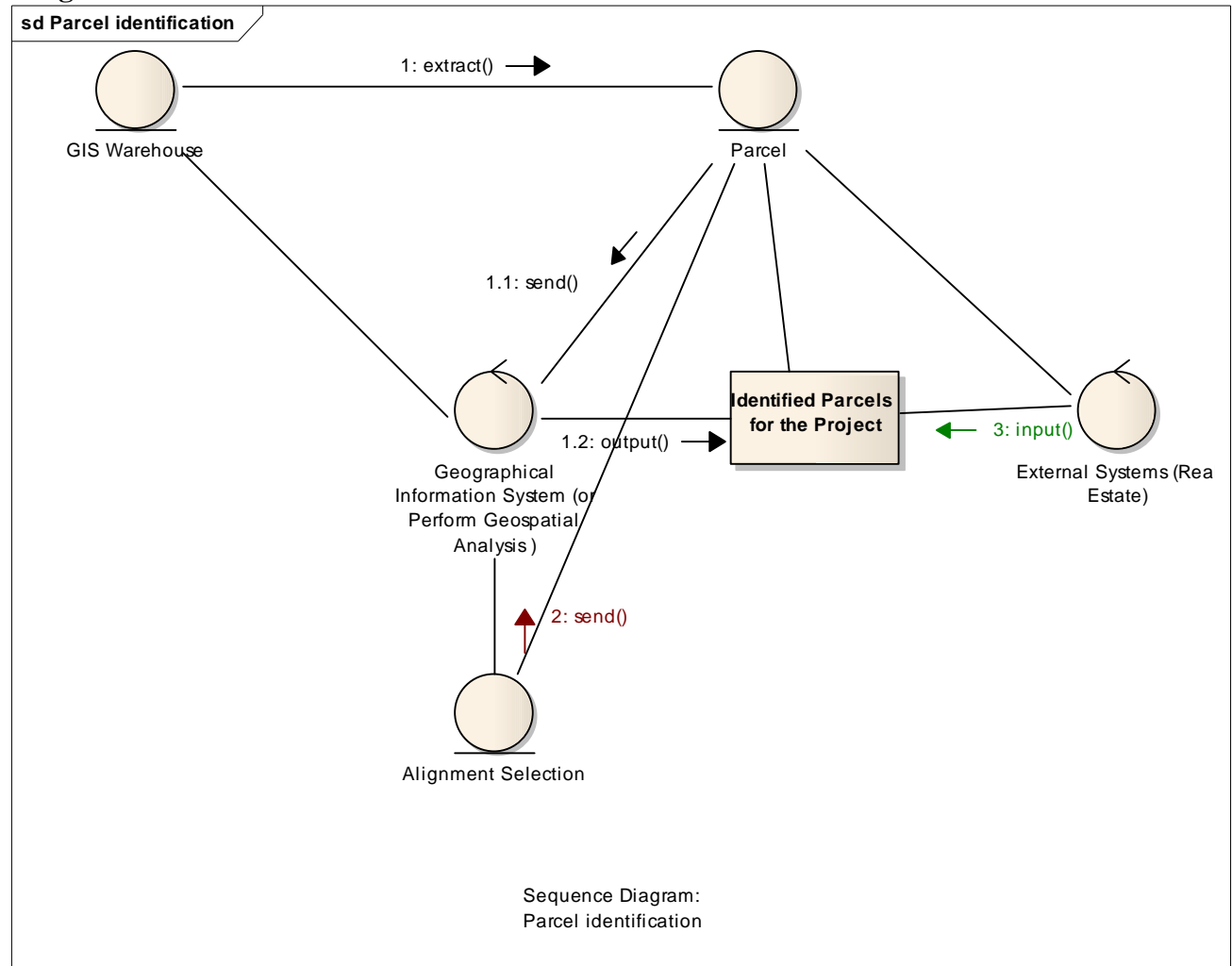
Diagram: Parcel identification

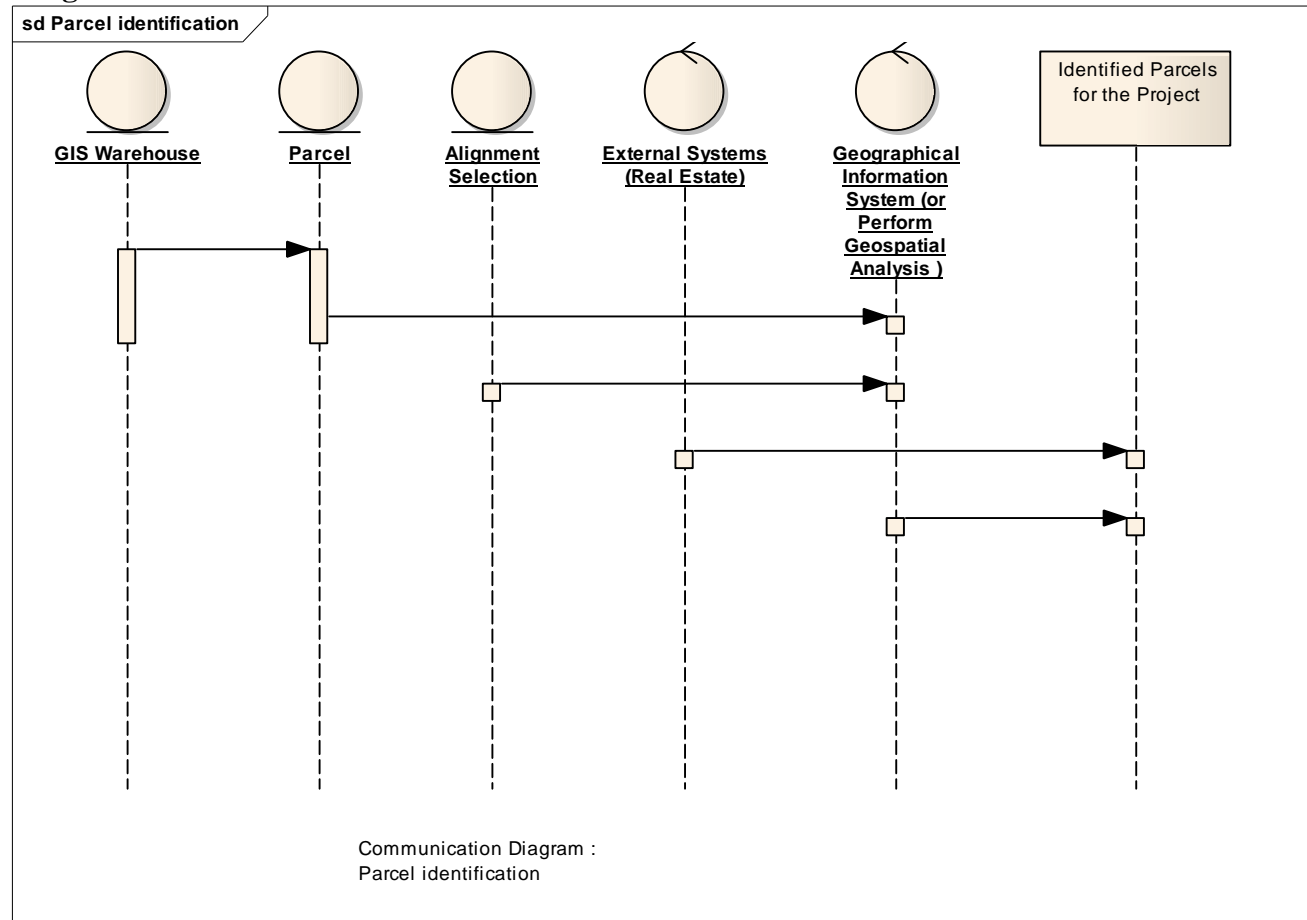
Diagram: Parcel identification

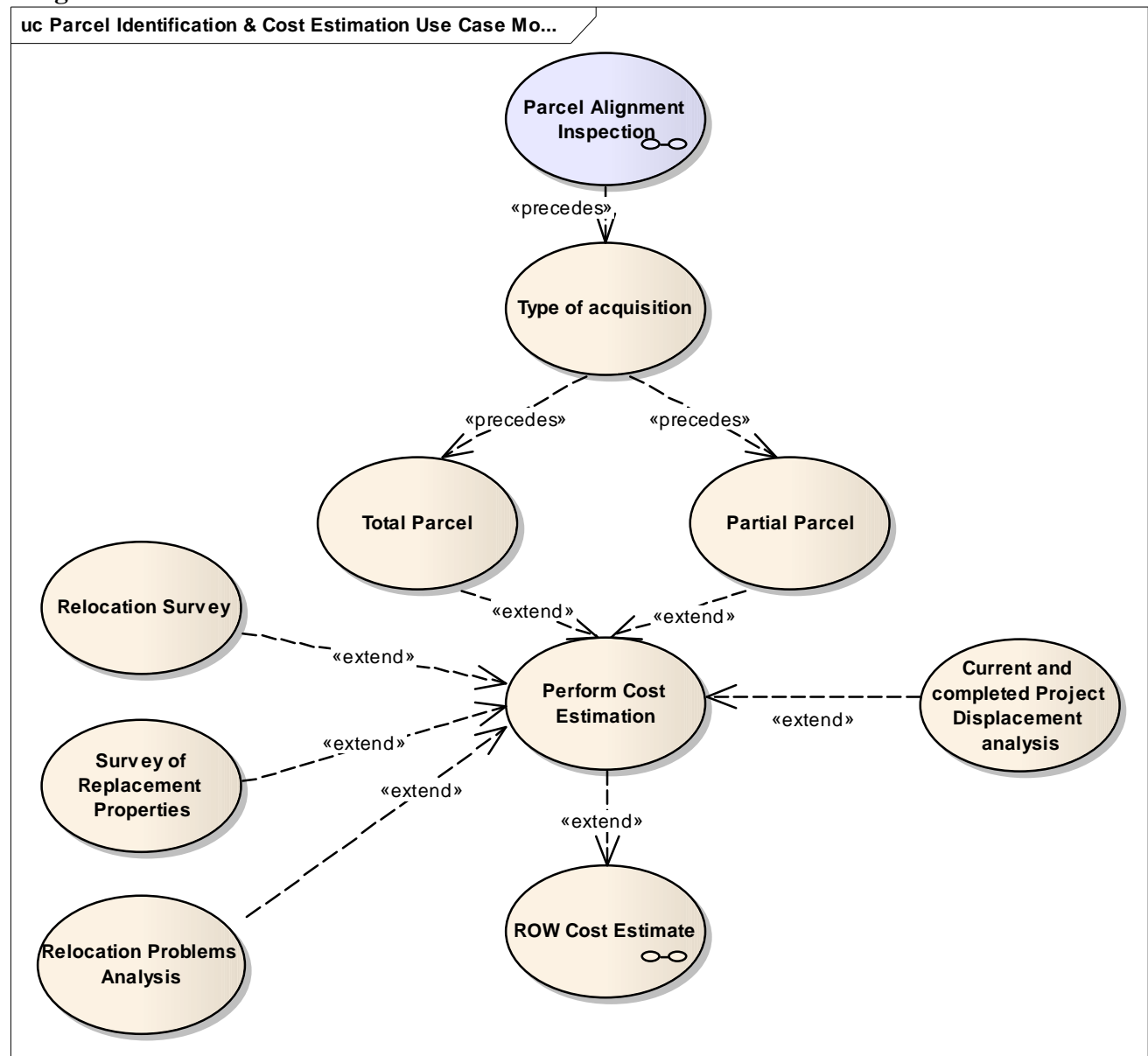
Diagram: Parcel Identification & Cost Estimation Use Case Model

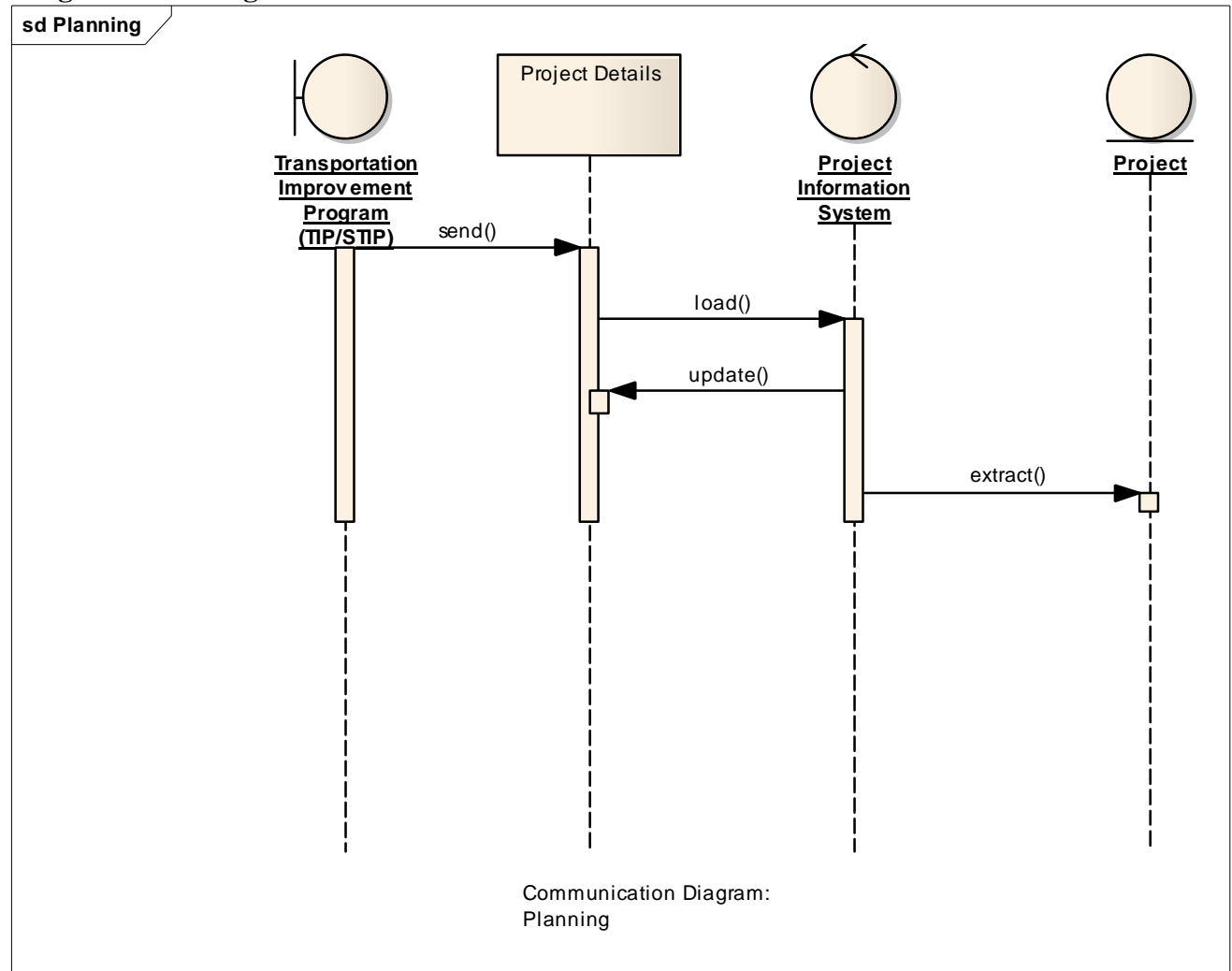
Diagram: Planning

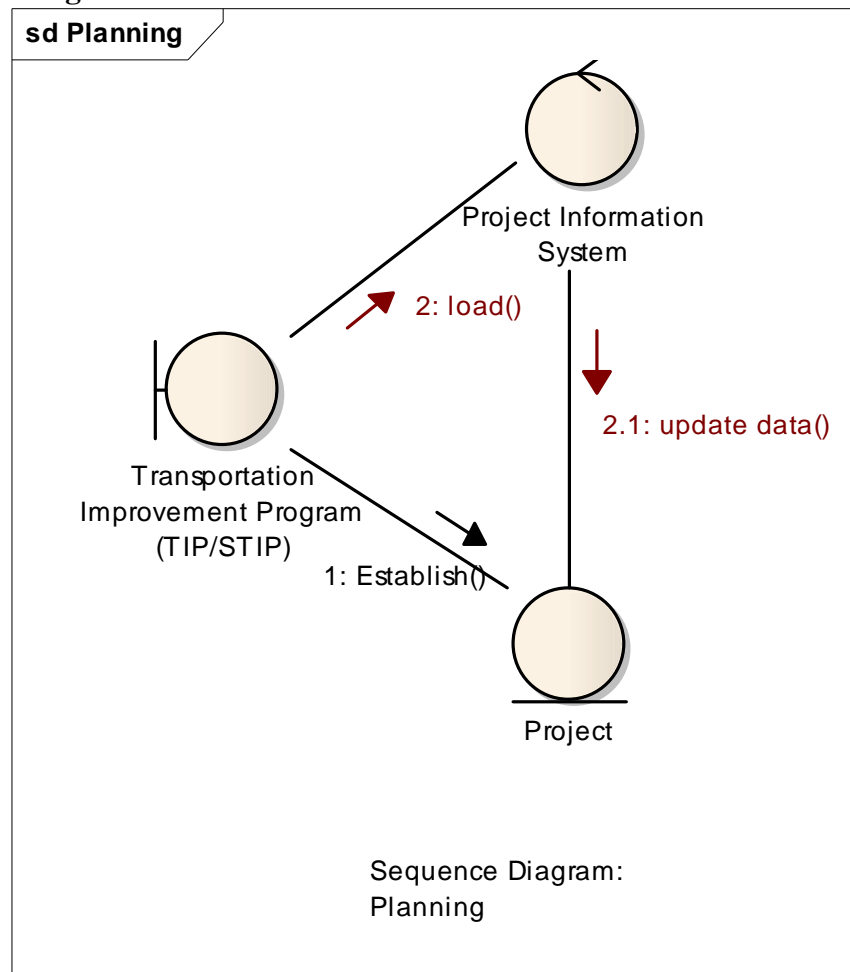
Diagram: Planning

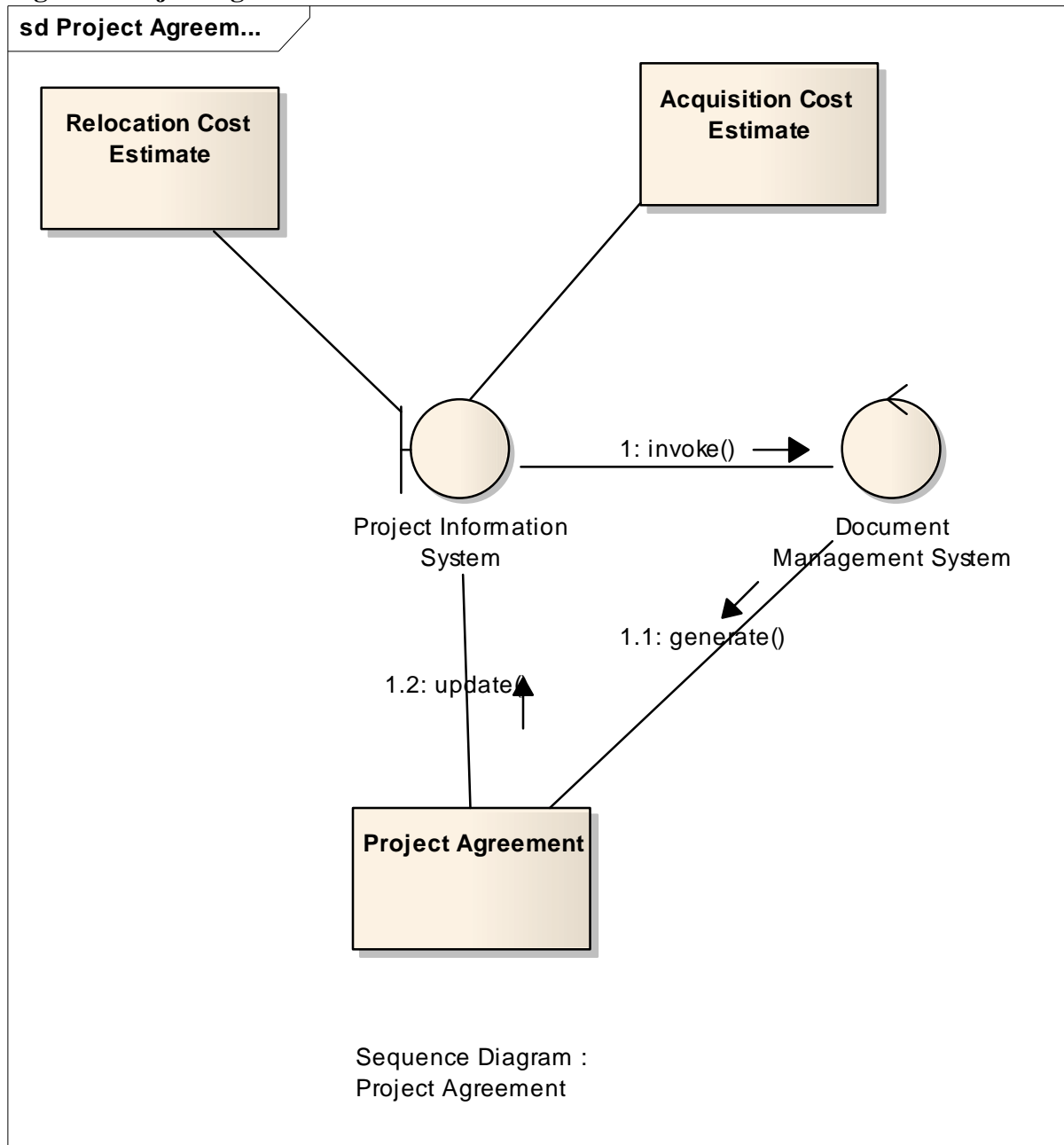
Diagram: Project Agreement

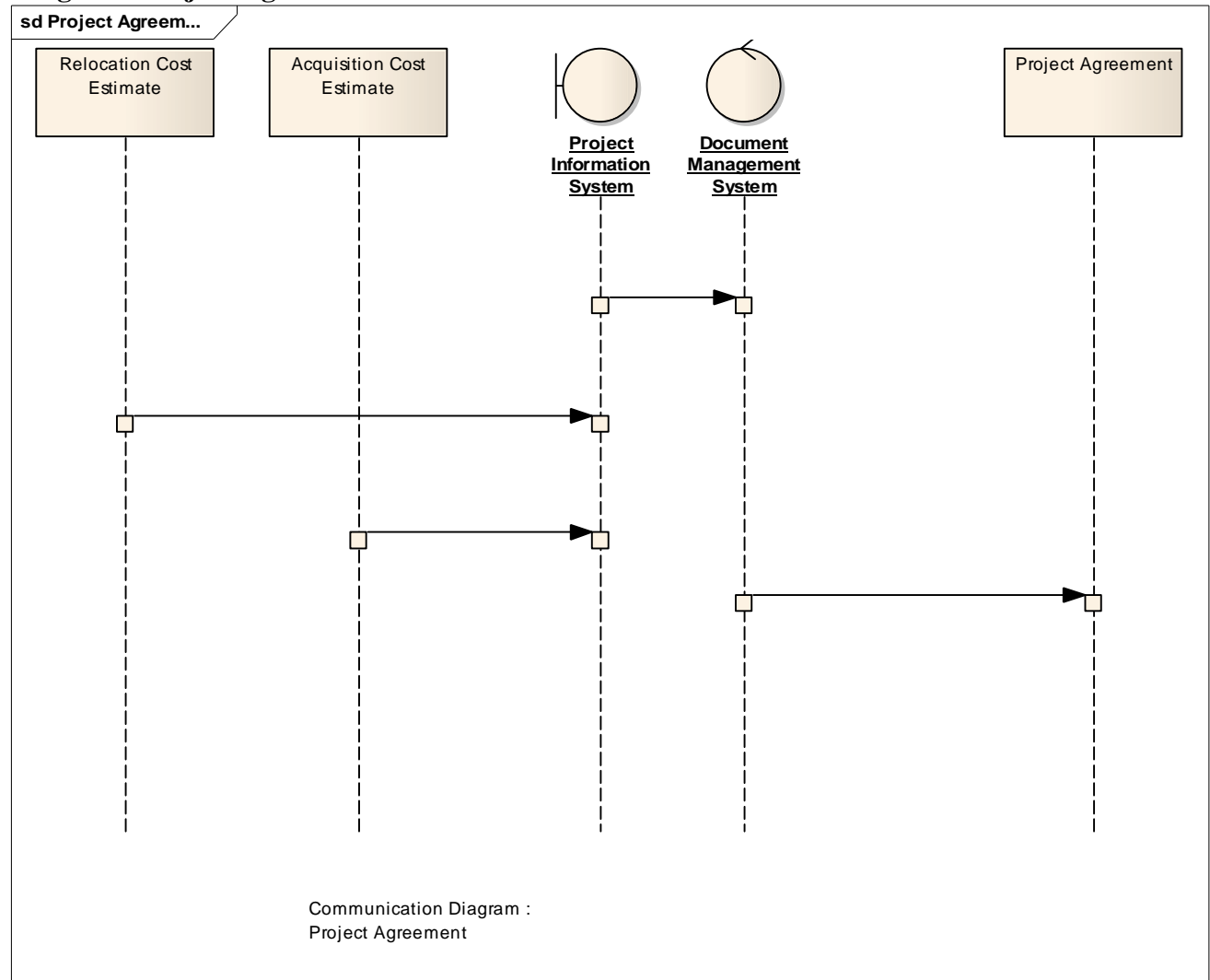
Diagram: Project Agreement

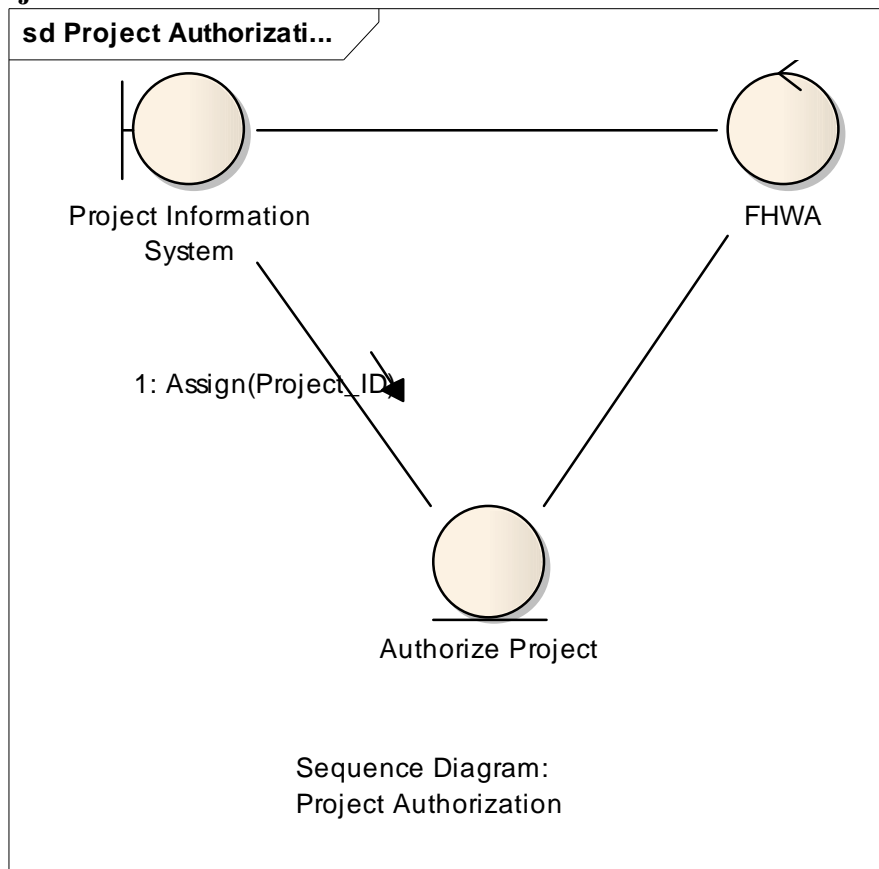
Diagram: Project Authorization

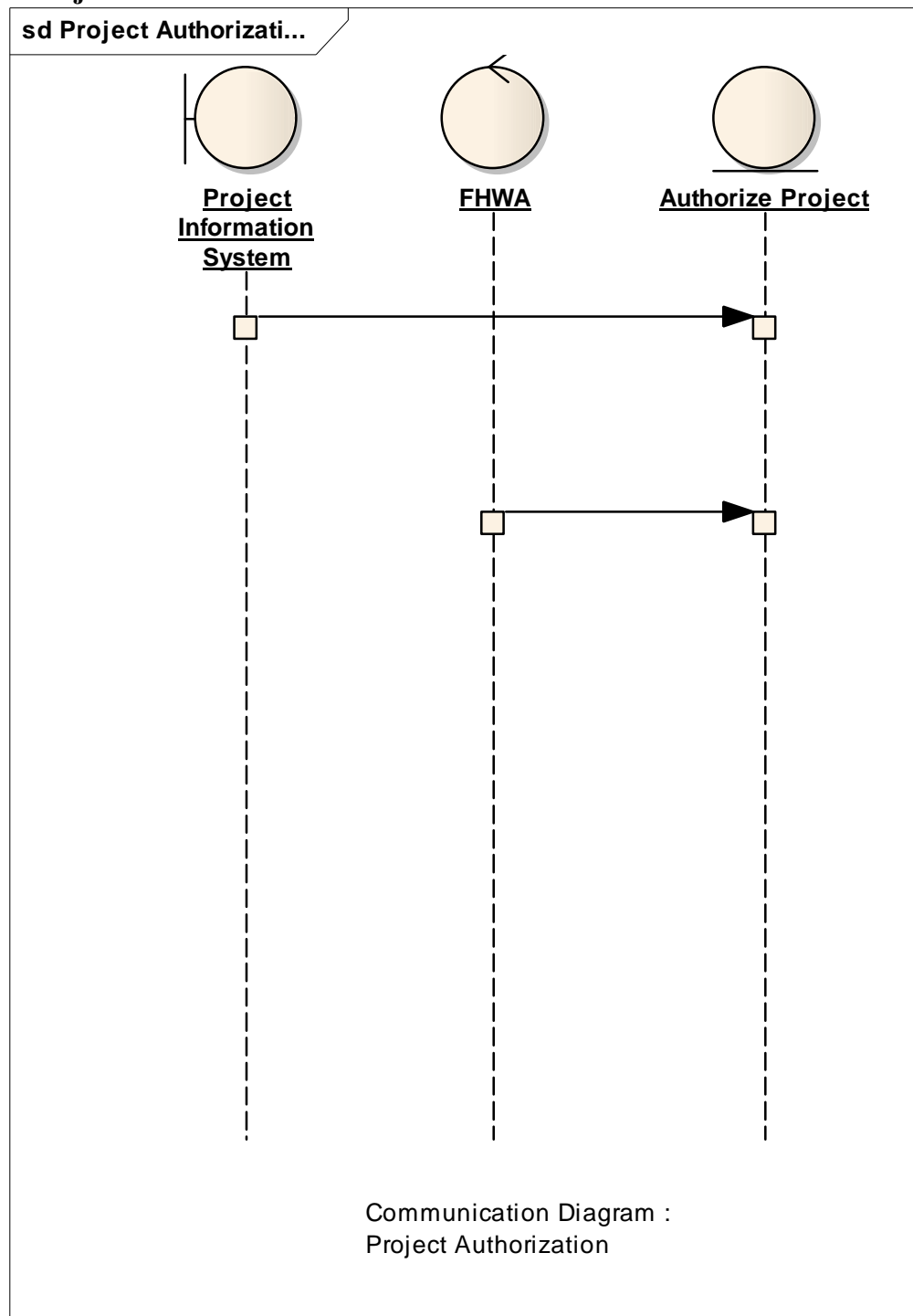
Diagram: Project Authorization

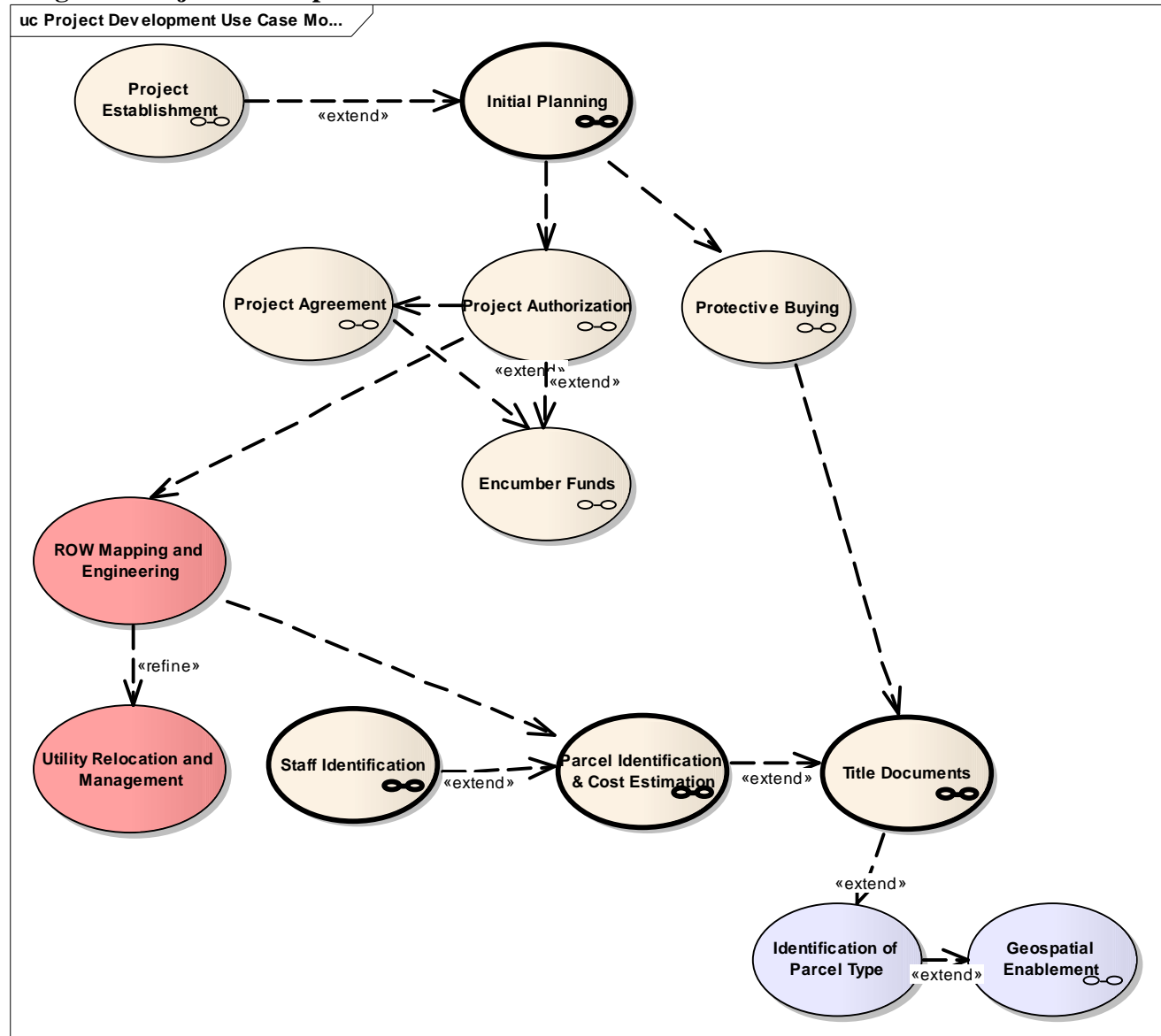
Diagram: Project Development Use Case Model

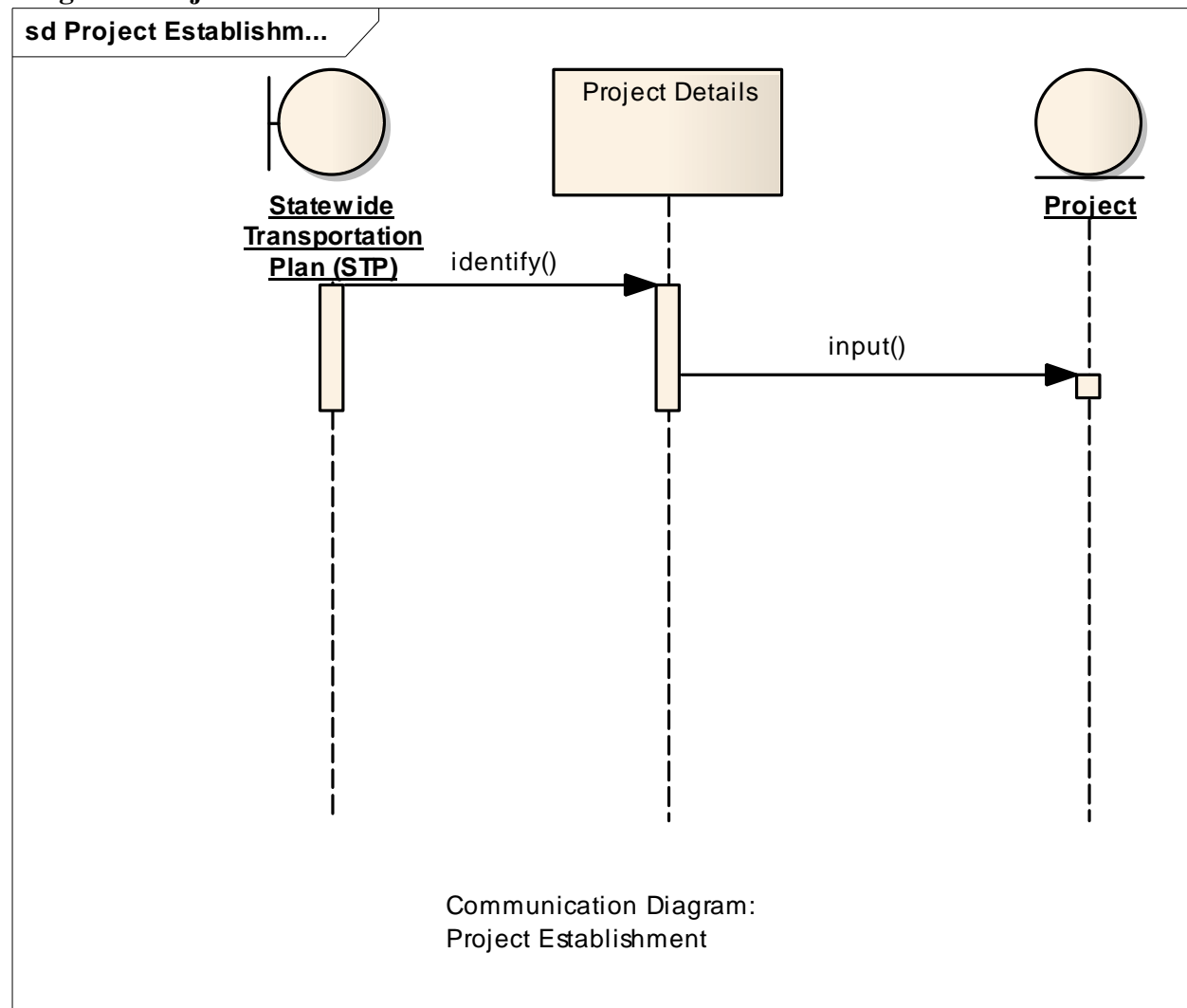
Diagram: Project Establishment

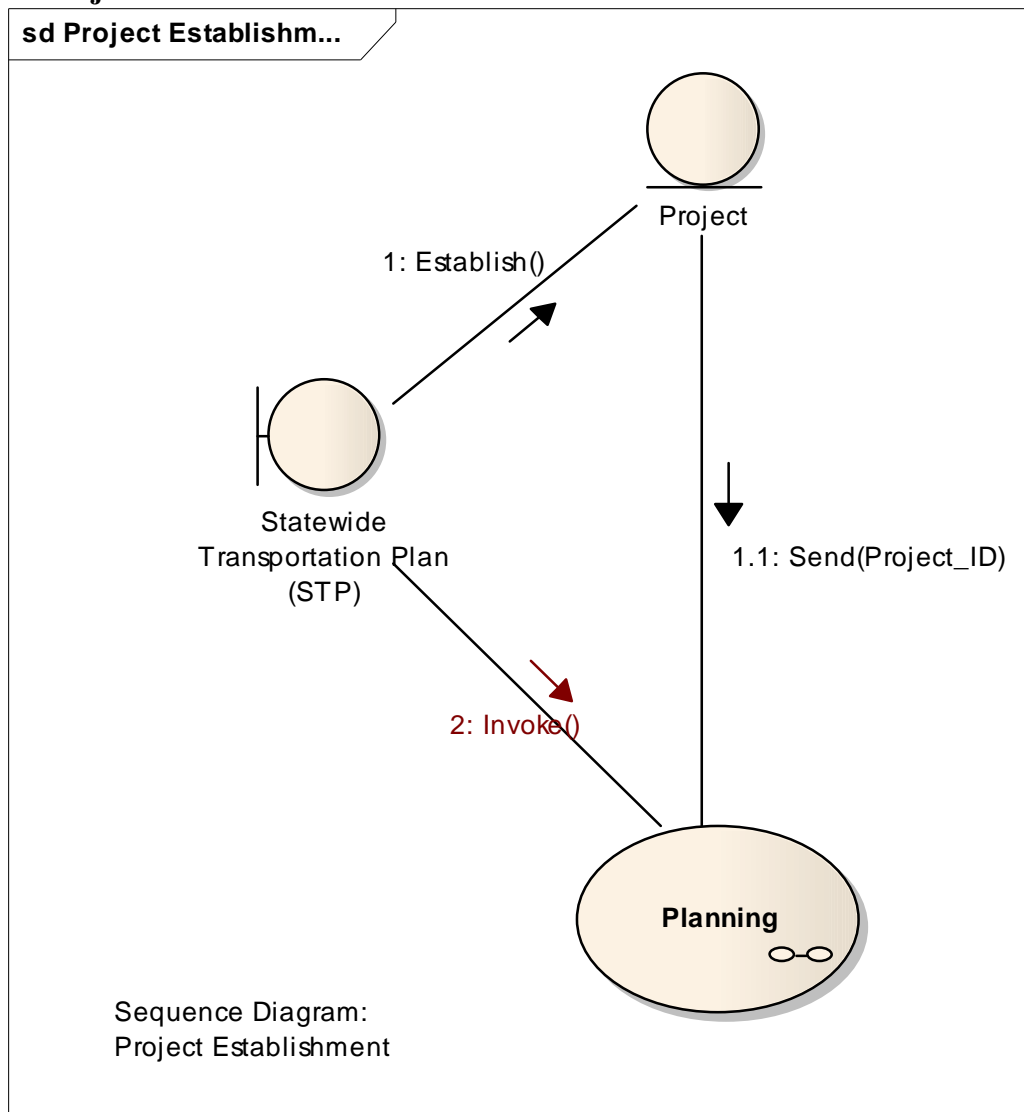
Diagram: Project Establishment

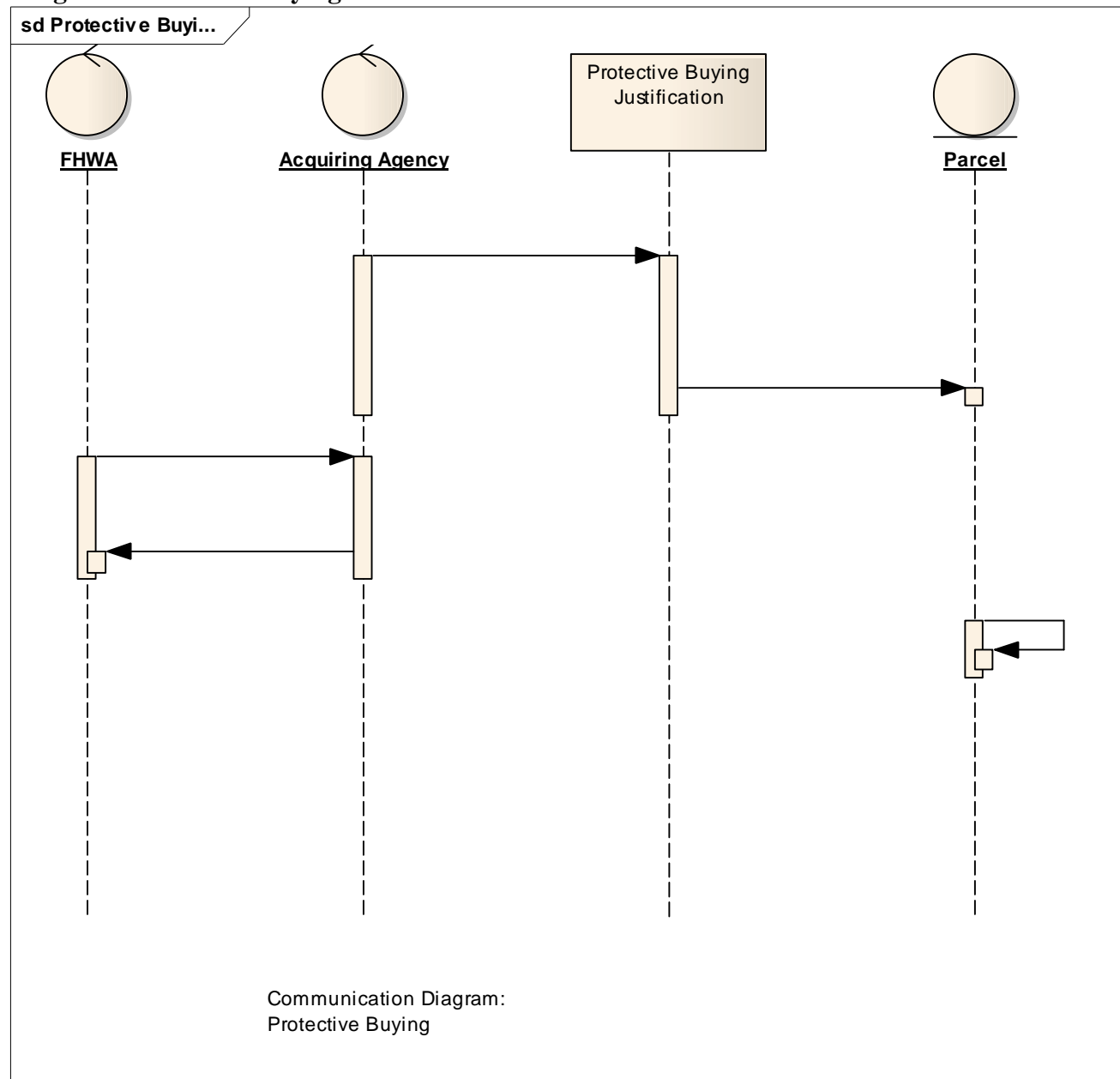
Diagram: Protective Buying

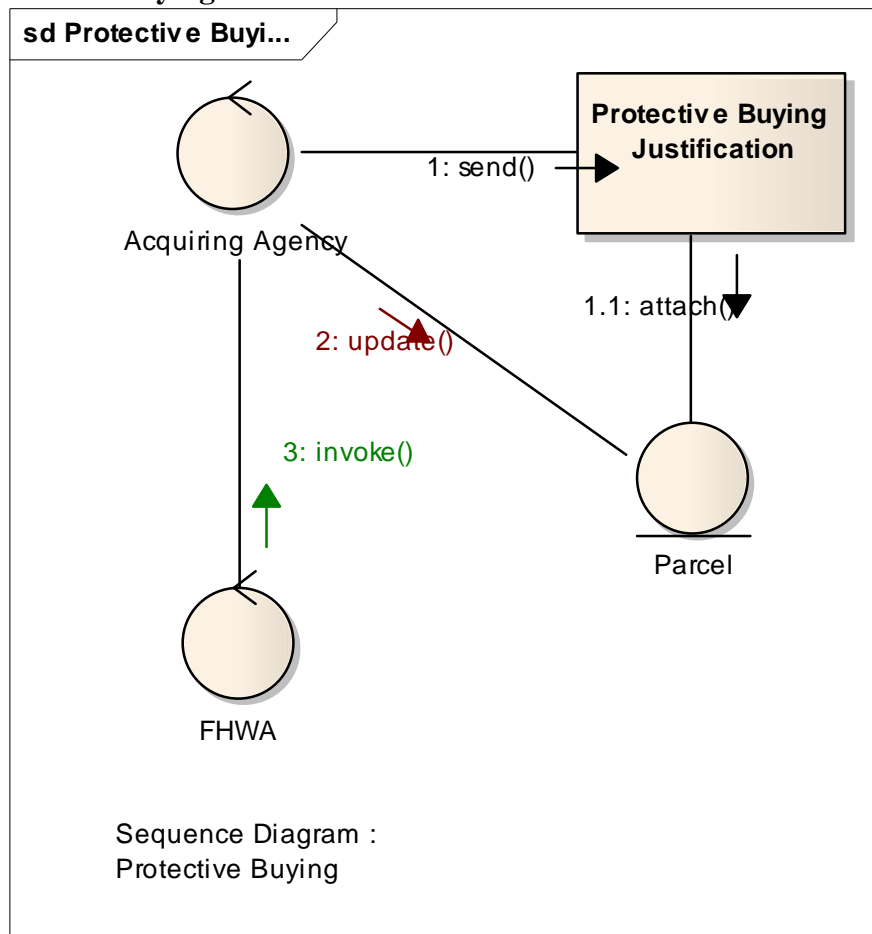
Diagram: Protective Buying

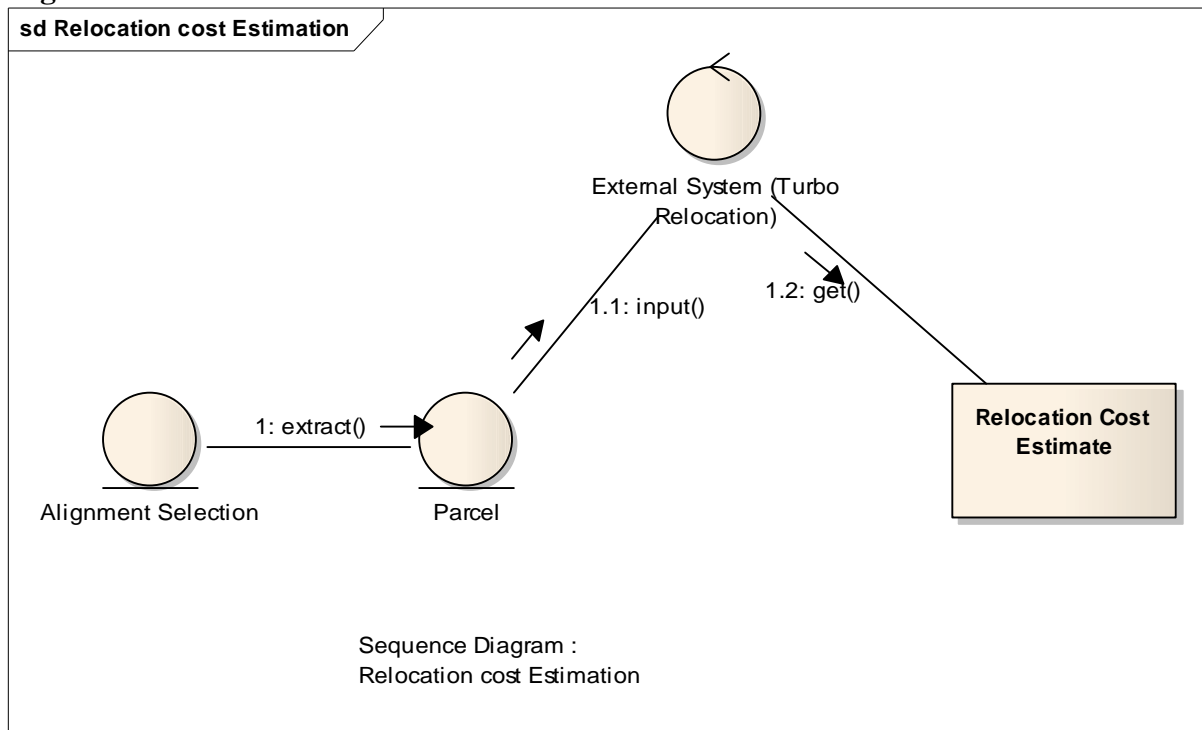
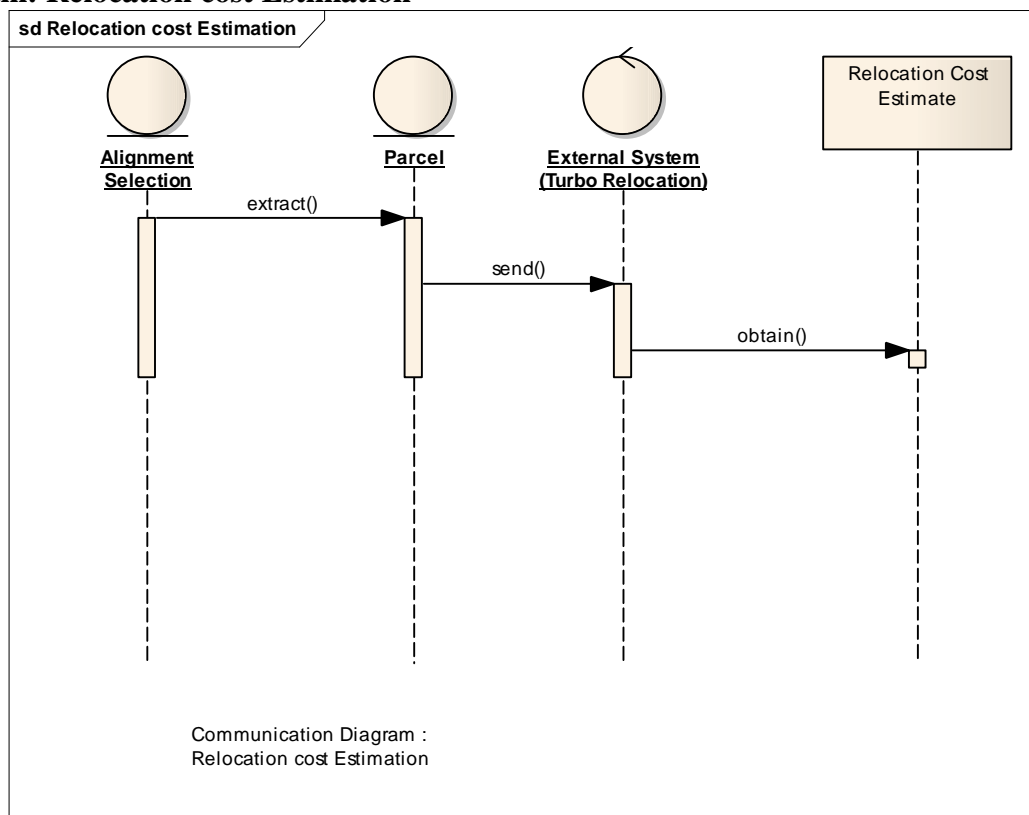
Diagram: Relocation cost Estimation**Diagram: Relocation cost Estimation**

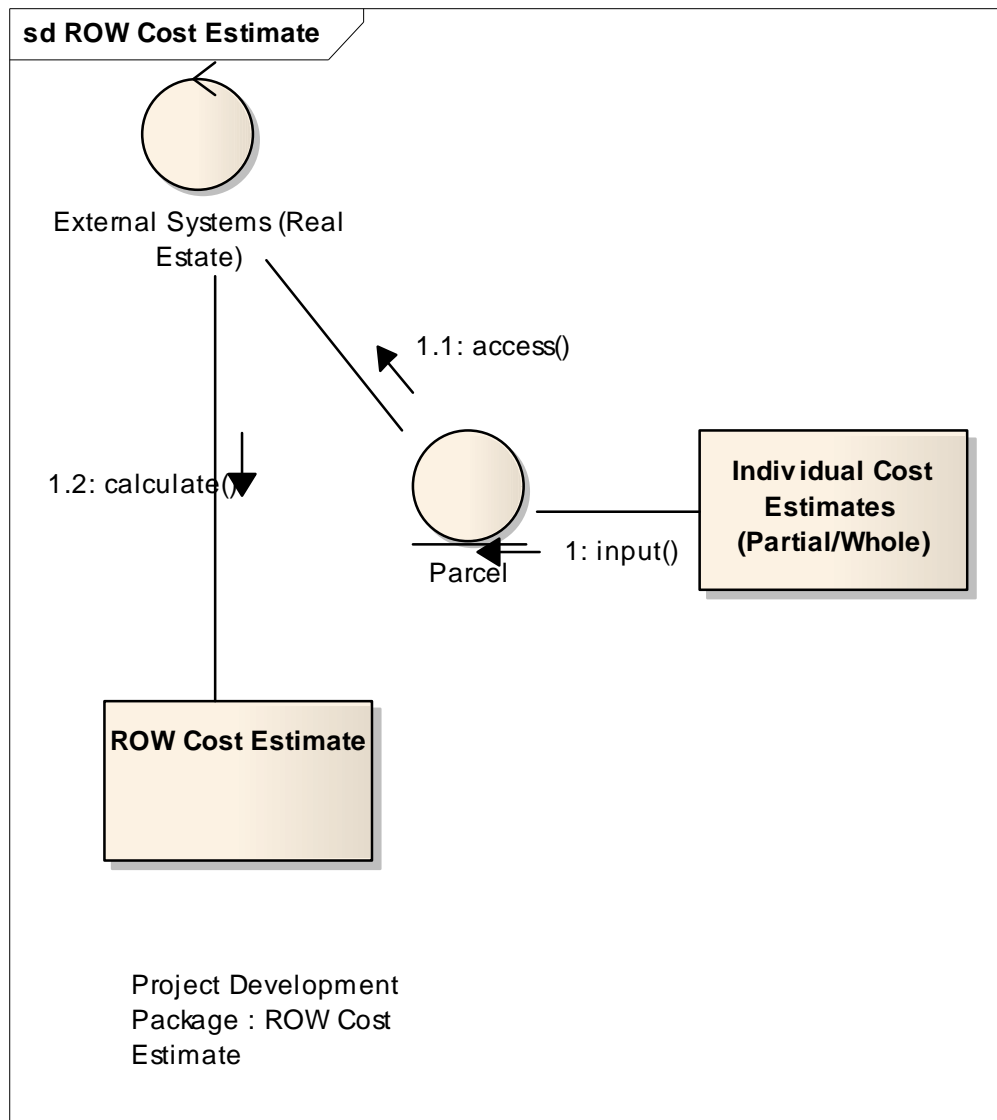
Diagram: ROW Cost Estimate

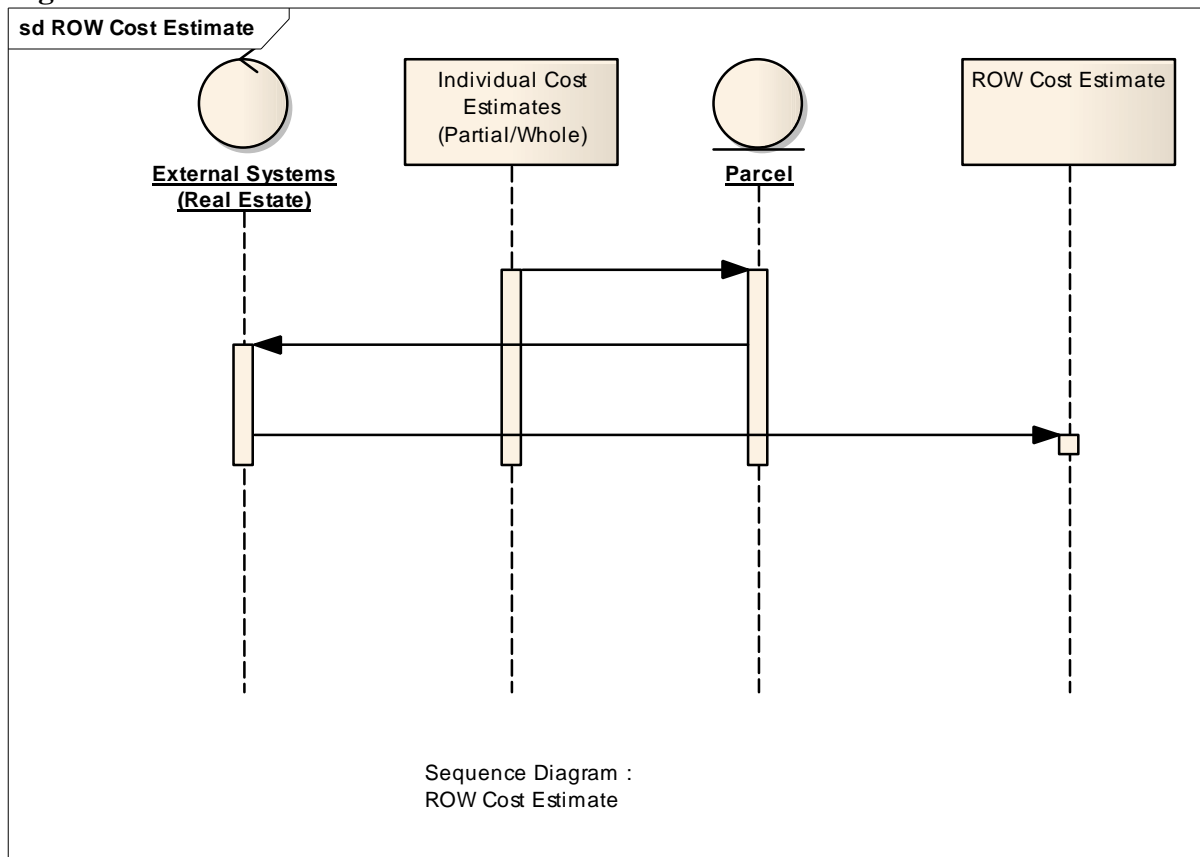
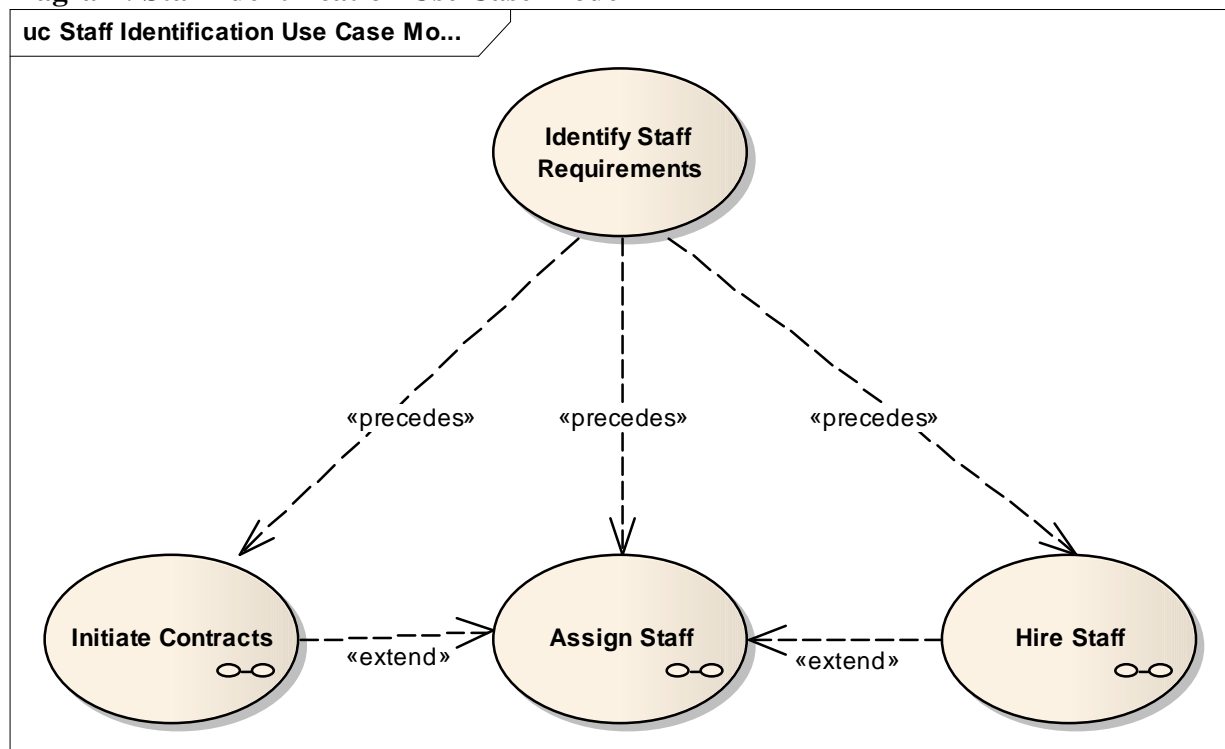
Diagram: ROW Cost Estimate**Diagram: Staff Identification Use Case Model**

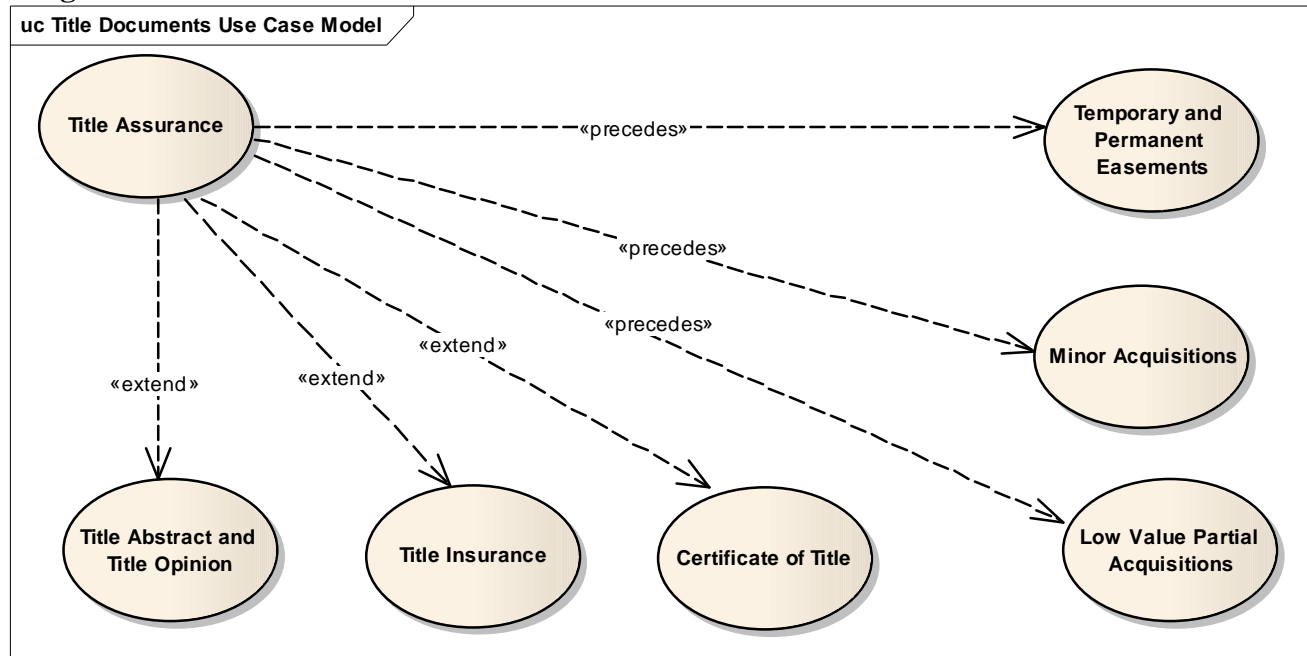
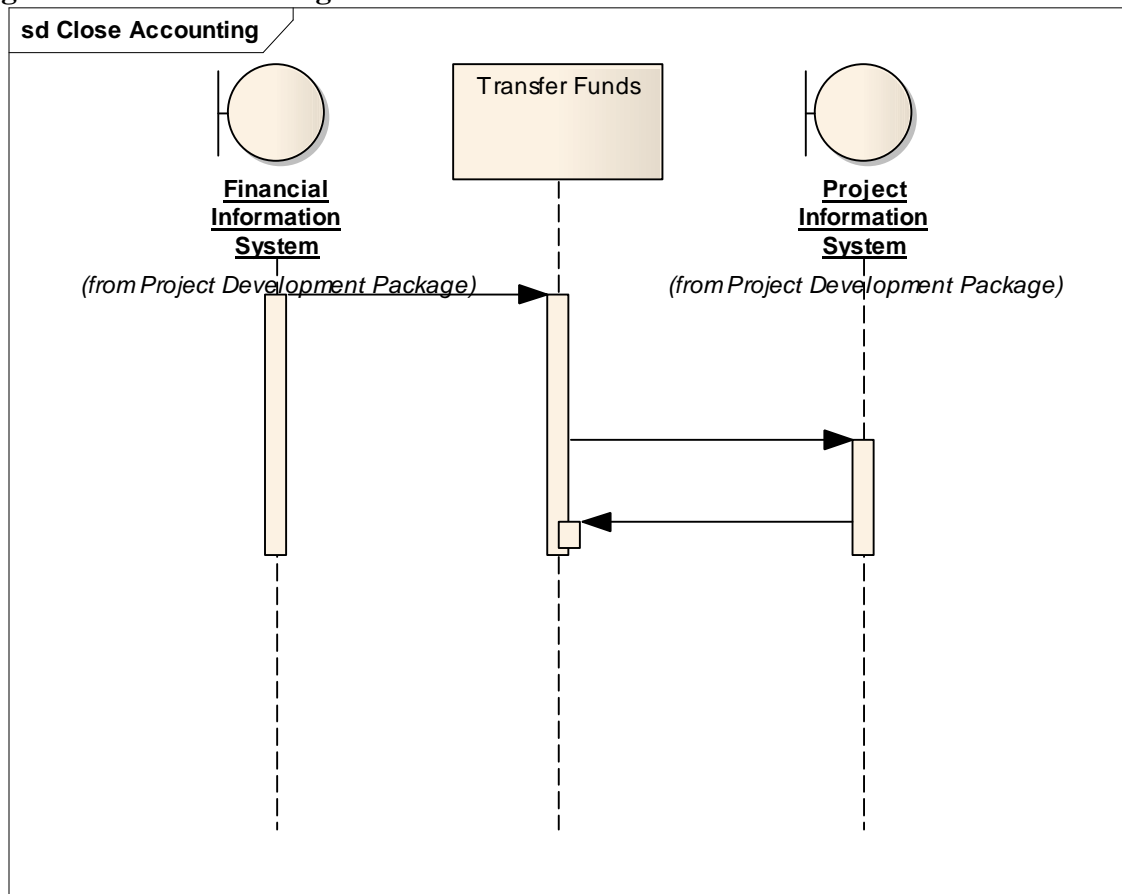
Diagram: Title Documents Use Case Model**Diagram: Close Accounting**

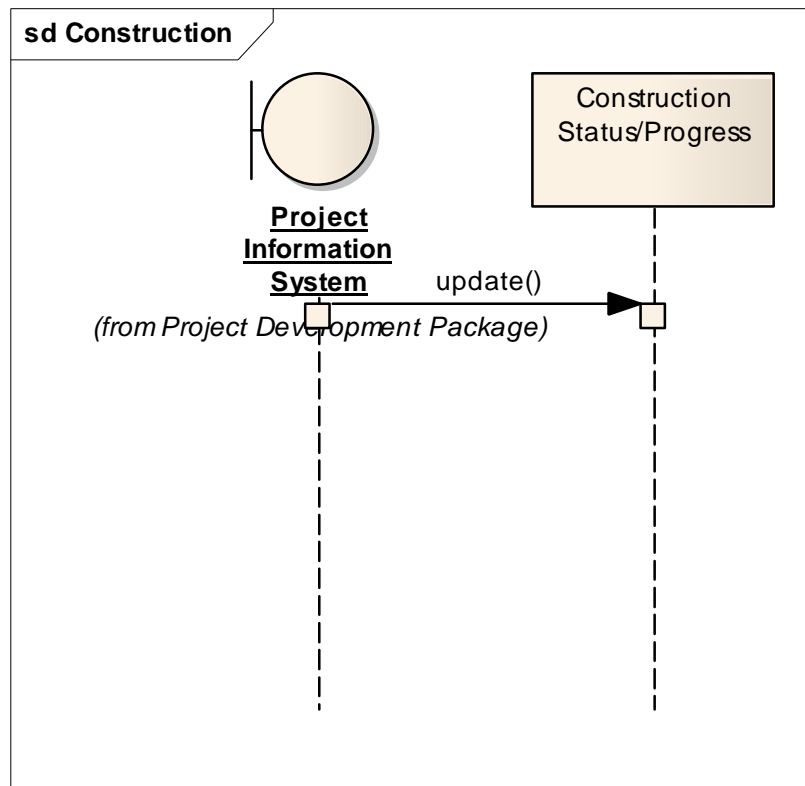
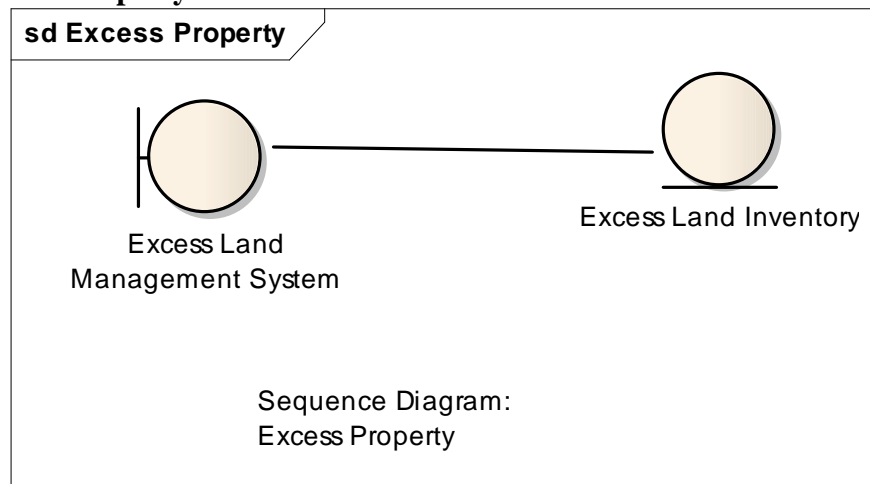
Diagram: Construction**Diagram: Excess Property**

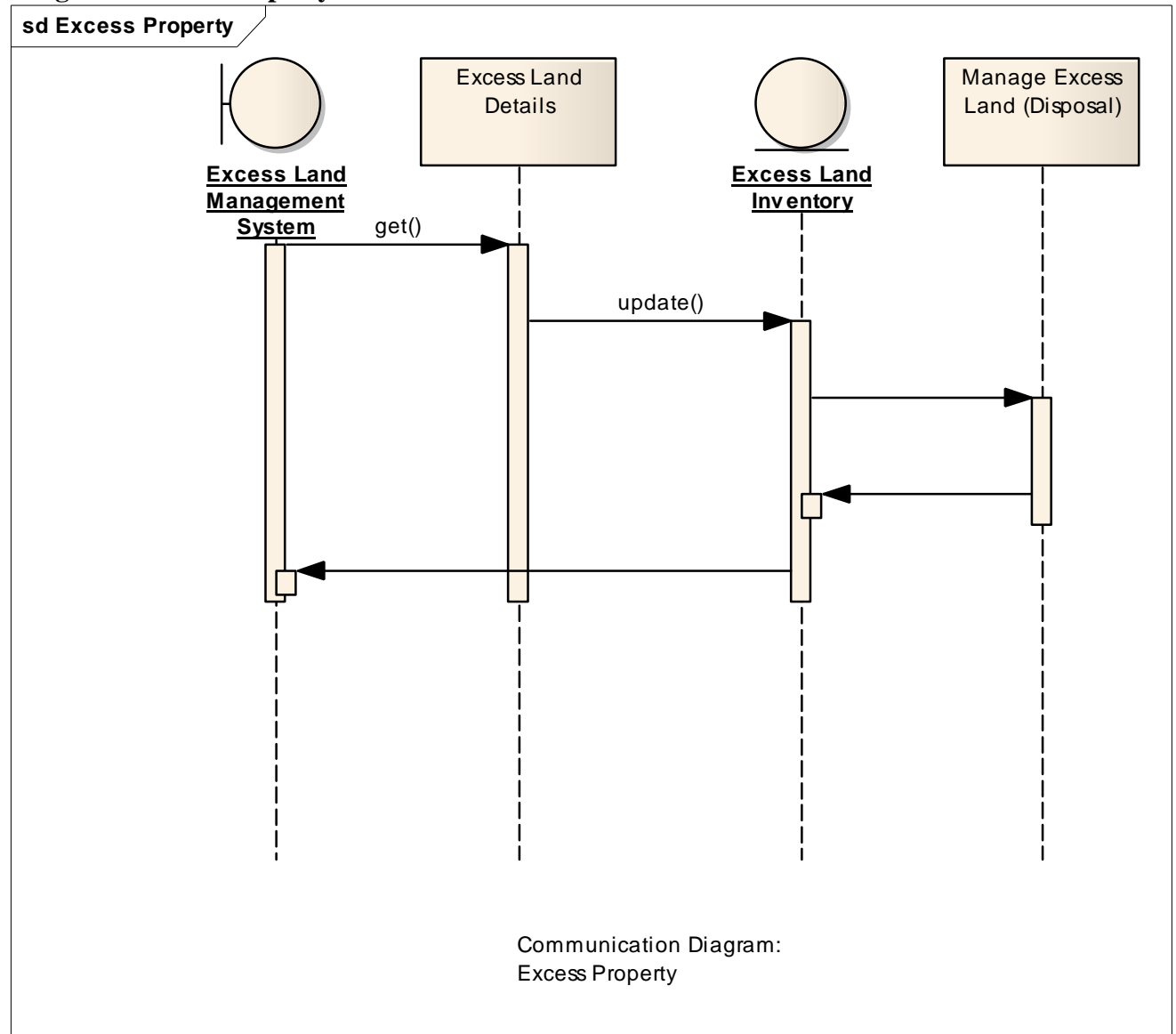
Diagram: Excess Property

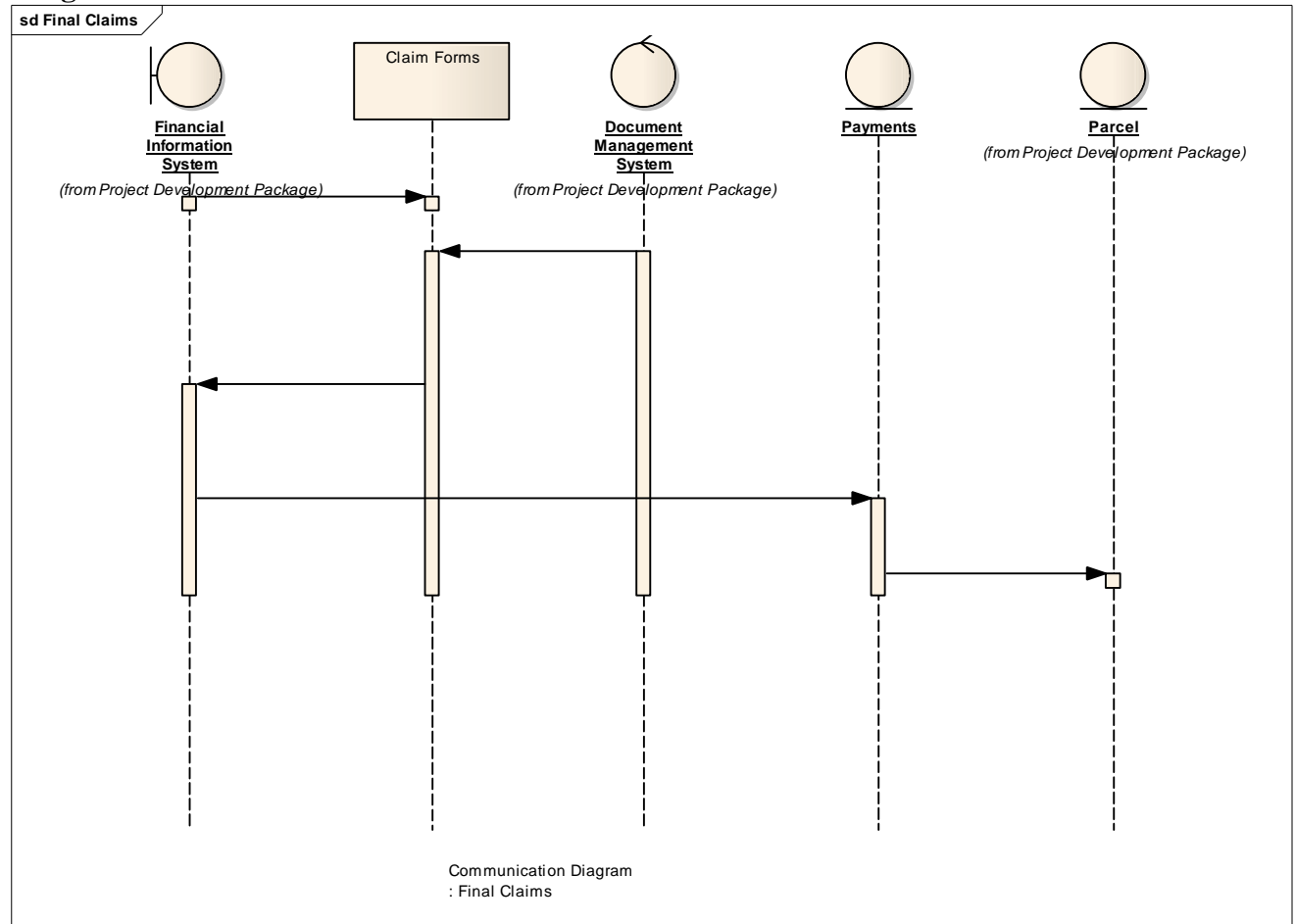
Diagram: Final Claims

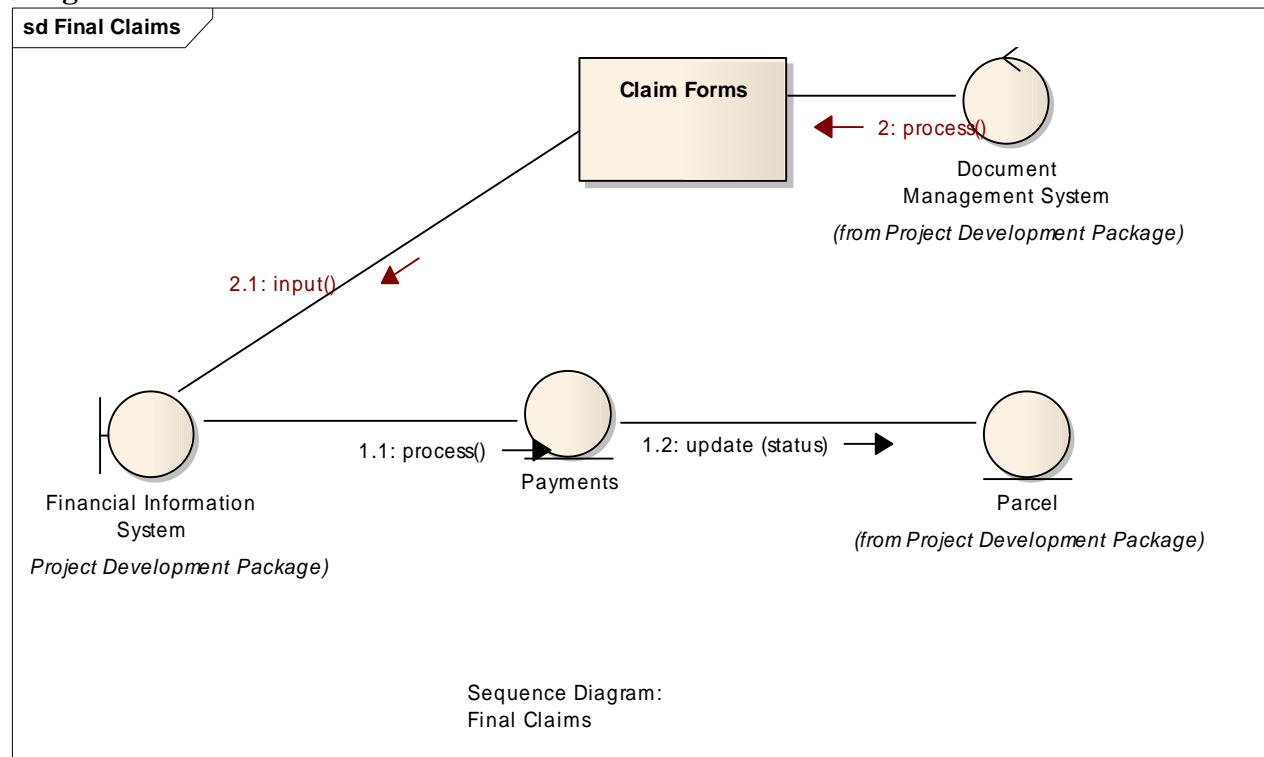
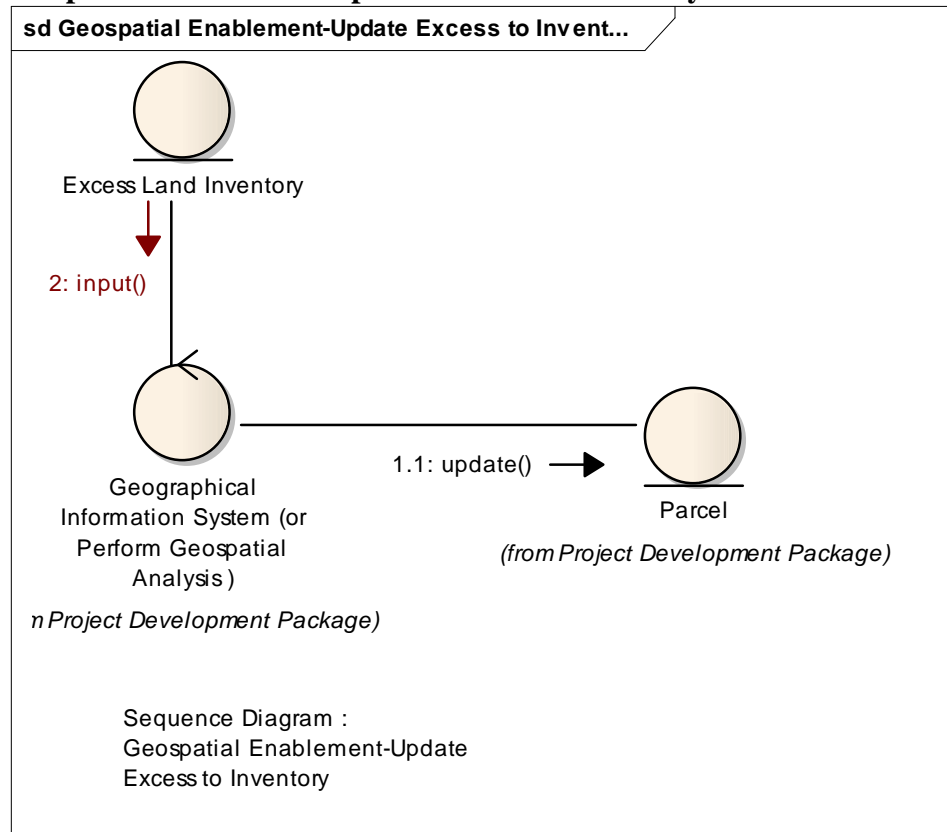
Diagram: Final Claims**Diagram: Geospatial Enablement-Update Excess to Inventory**

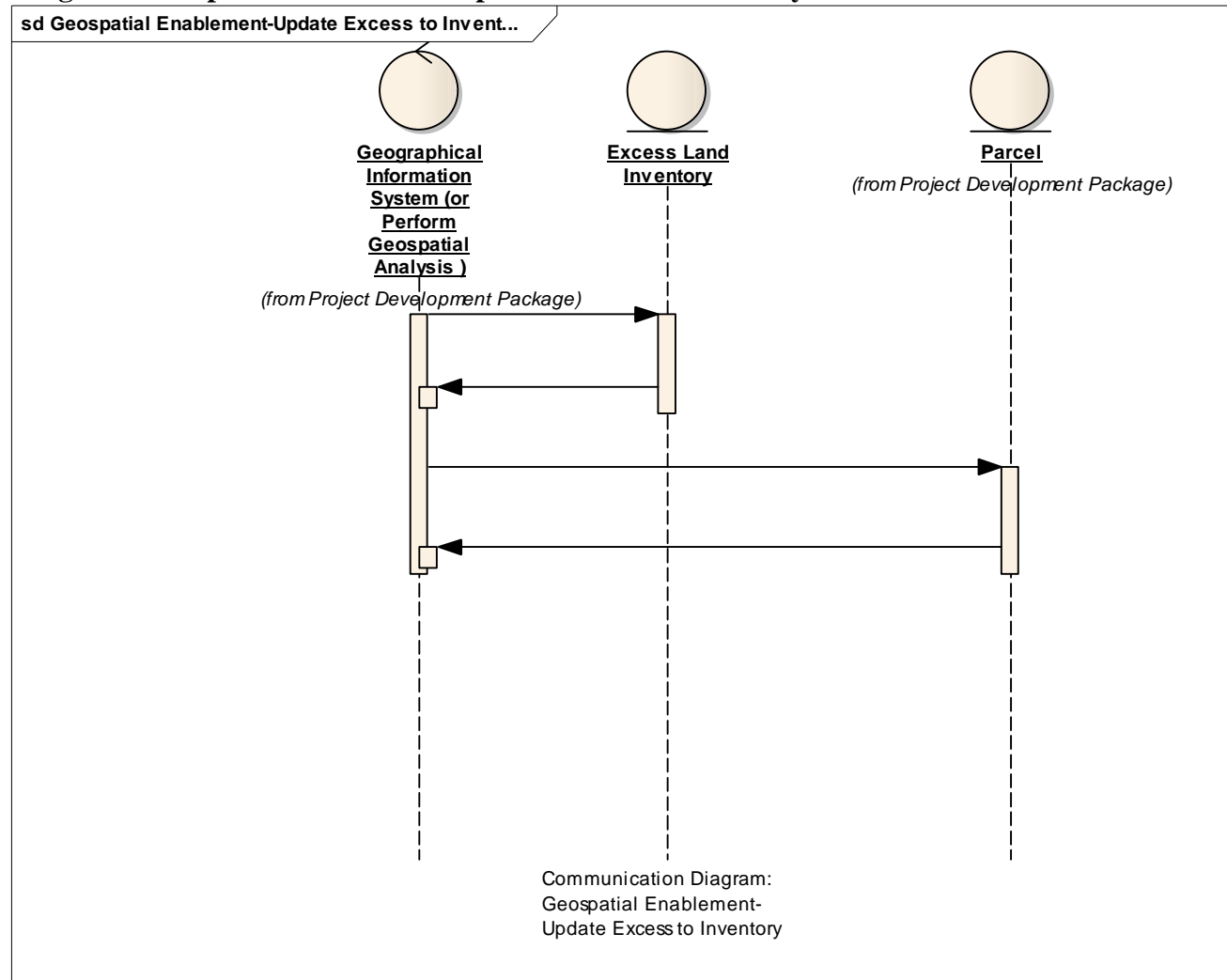
Diagram: Geospatial Enablement-Update Excess to Inventory

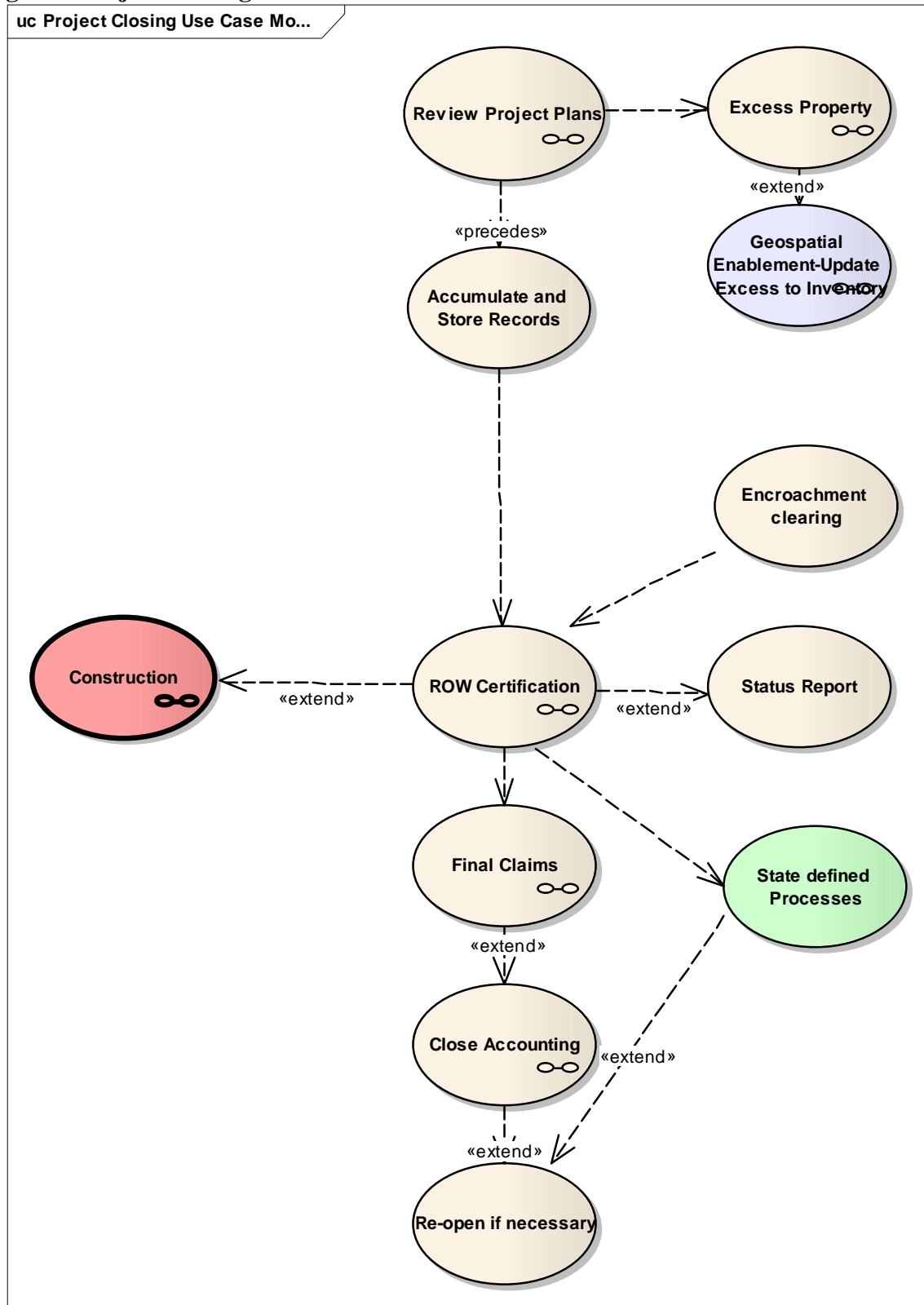
Diagram: Project Closing Use Case Model

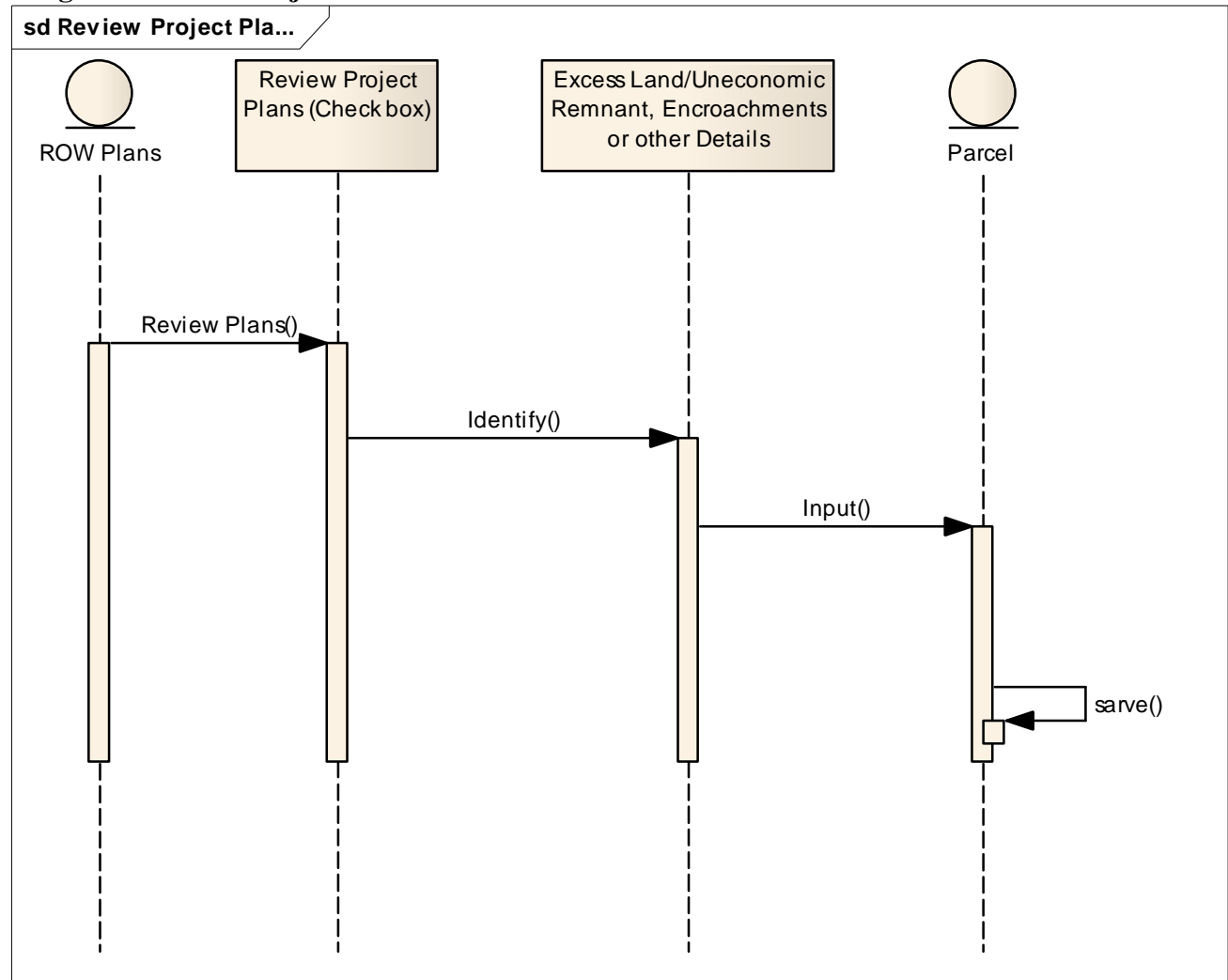
Diagram: Review Project Plans

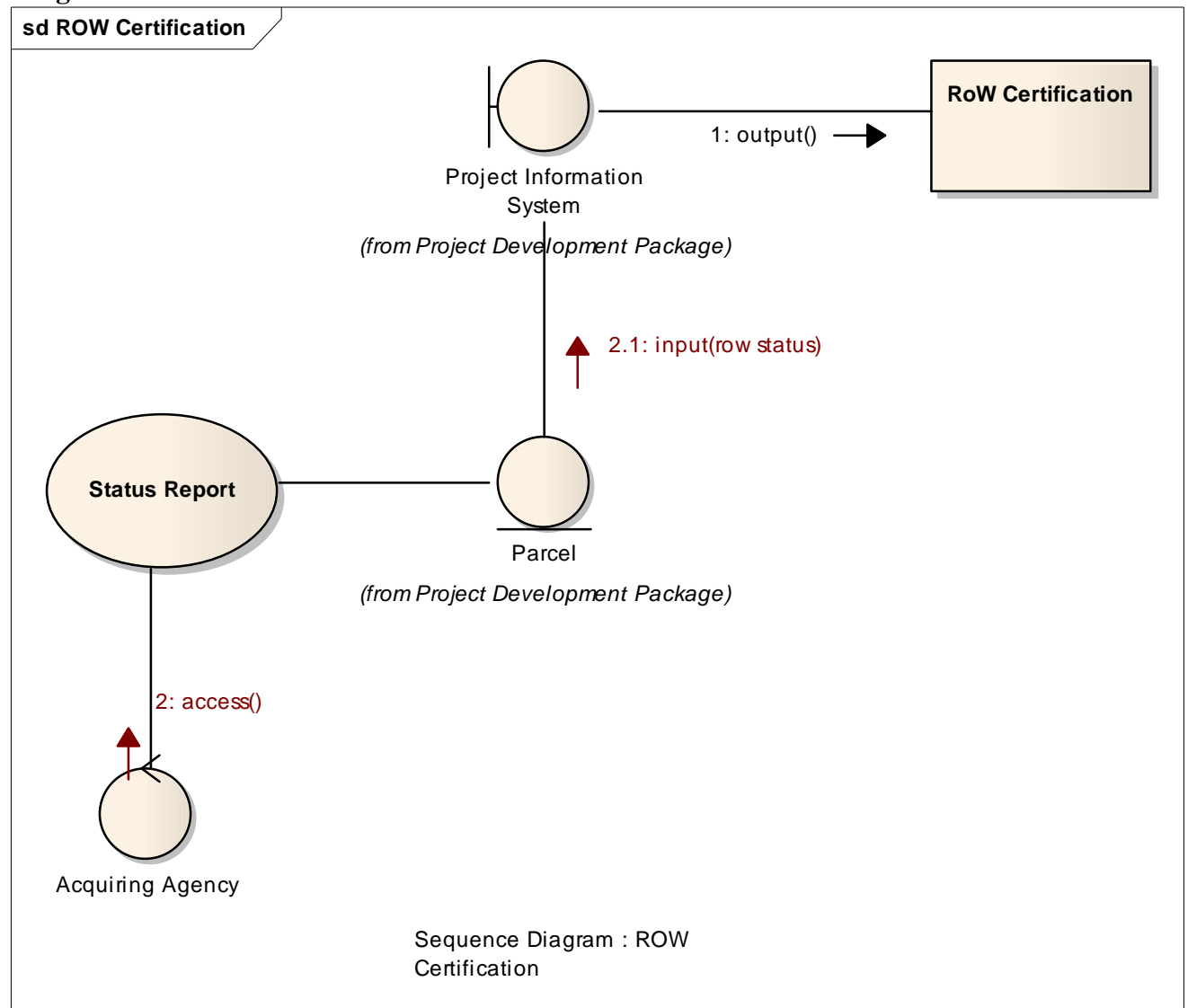
Diagram: ROW Certification

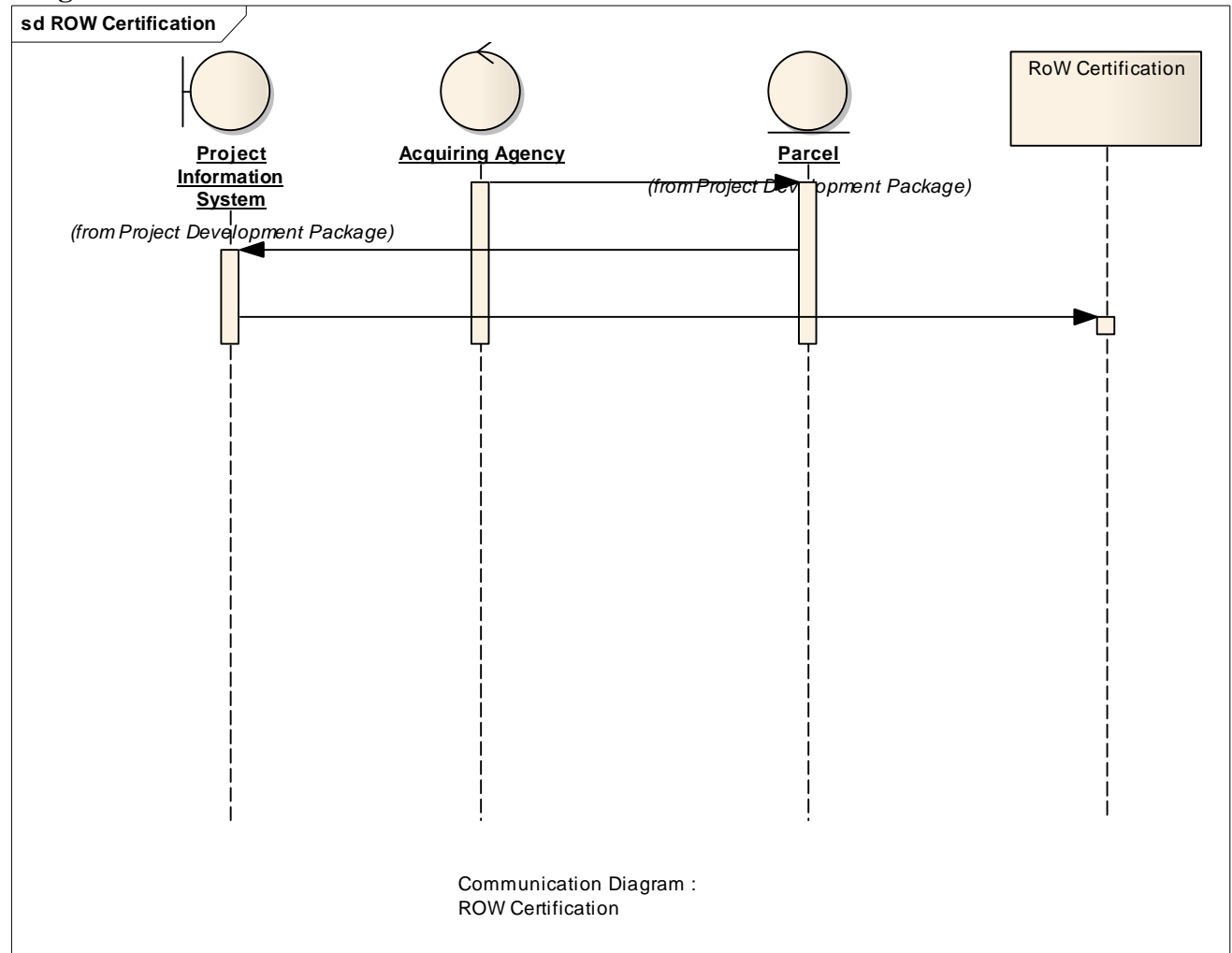
Diagram: ROW Certification

Diagram: Actors**uc Actors****Agency Actors**

- + Acquisition Agency
- + Disposition Committee (Global)
- + FHWA
- + Legal Office
- + Mapping Office
- + Planning Department
- + ROW Office
- + State
- + State Transportation Agency
- + Treasury

Human Actors

- + Agency Official
- + Appraisal Reviewer
- + Appraiser
- + Business Owner
- + Contractors
- + Displaced Person
- + Interim Tenant
- + Legal Council
- + Negotiator
- + Owner
- + Project Manager
- + Property Mgmt Personnel
- + Public
- + Relocation Agent
- + ROW Director
- + Tenant
- + Third Parties
- + Title Agent

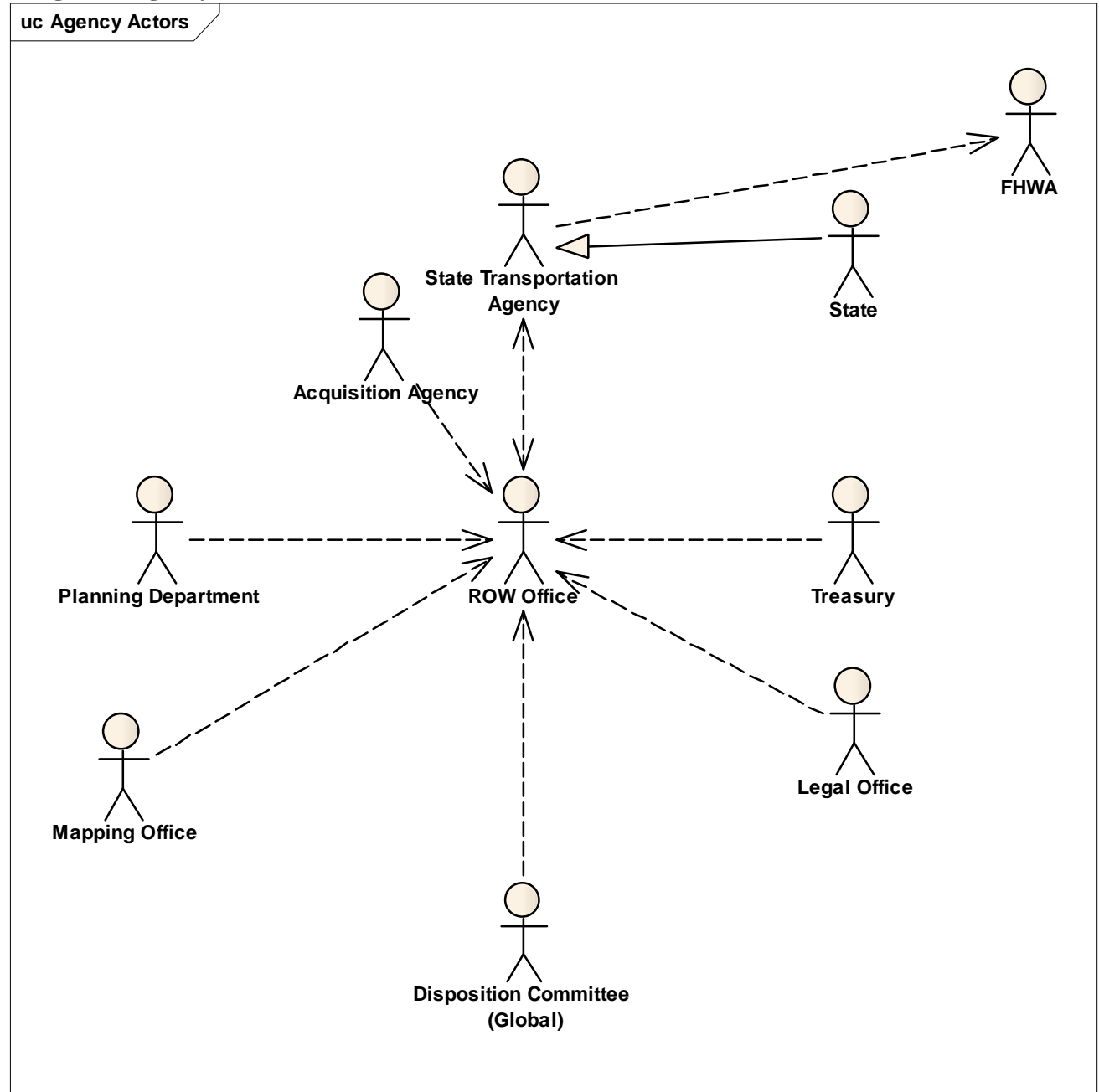
Diagram: Agency Actors

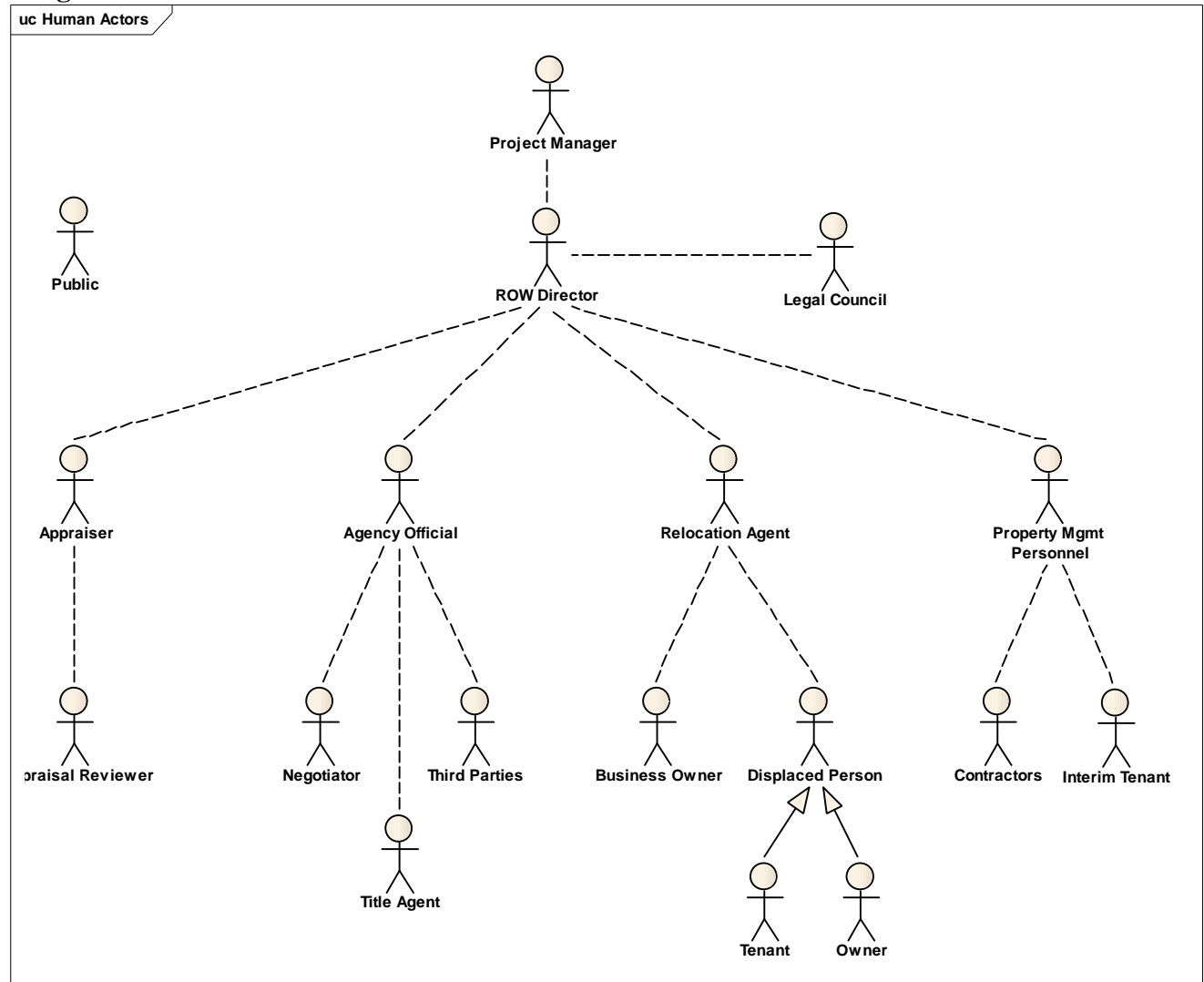
Diagram: Human Actors

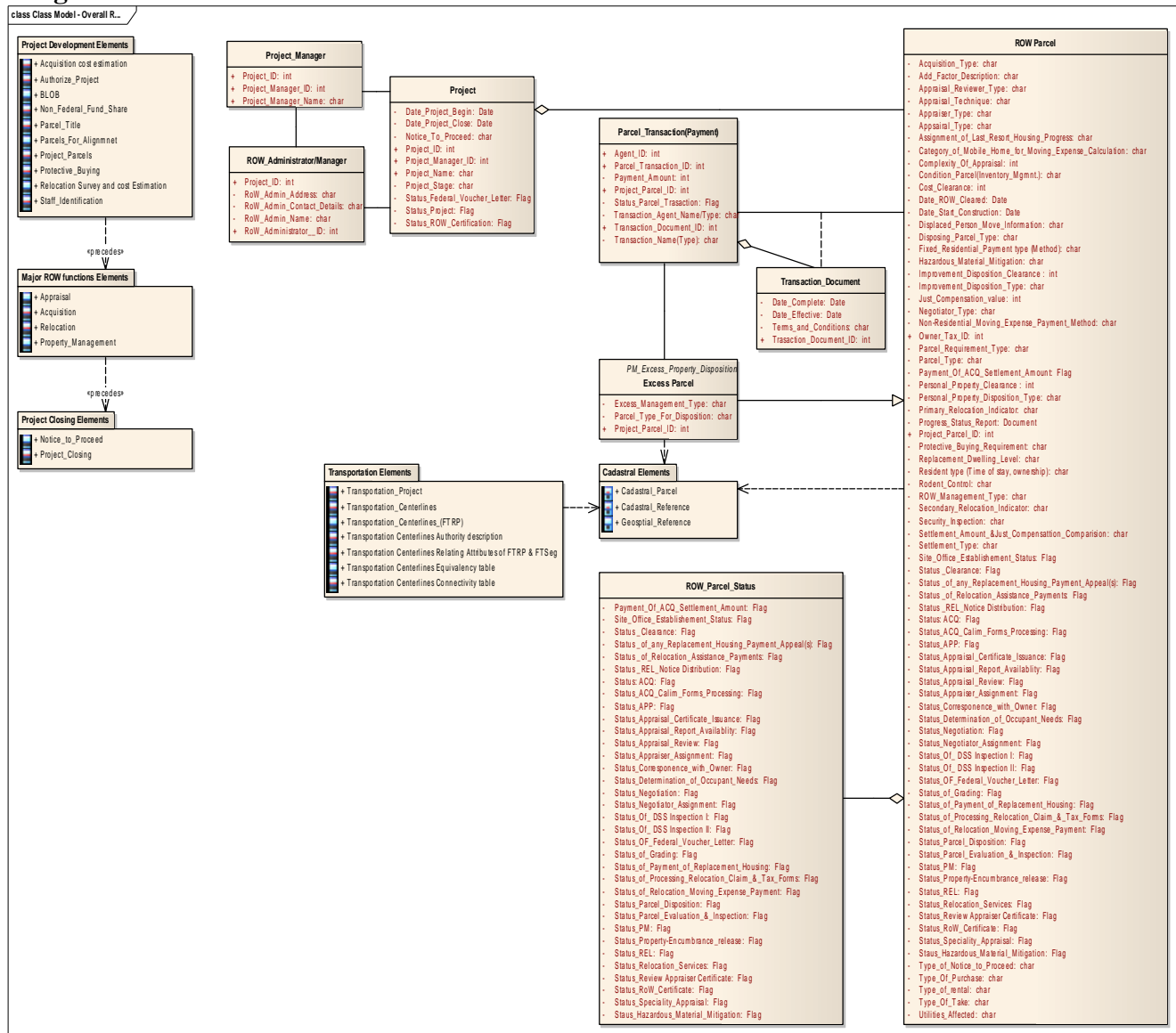
Diagram: Class Model - Overall ROW

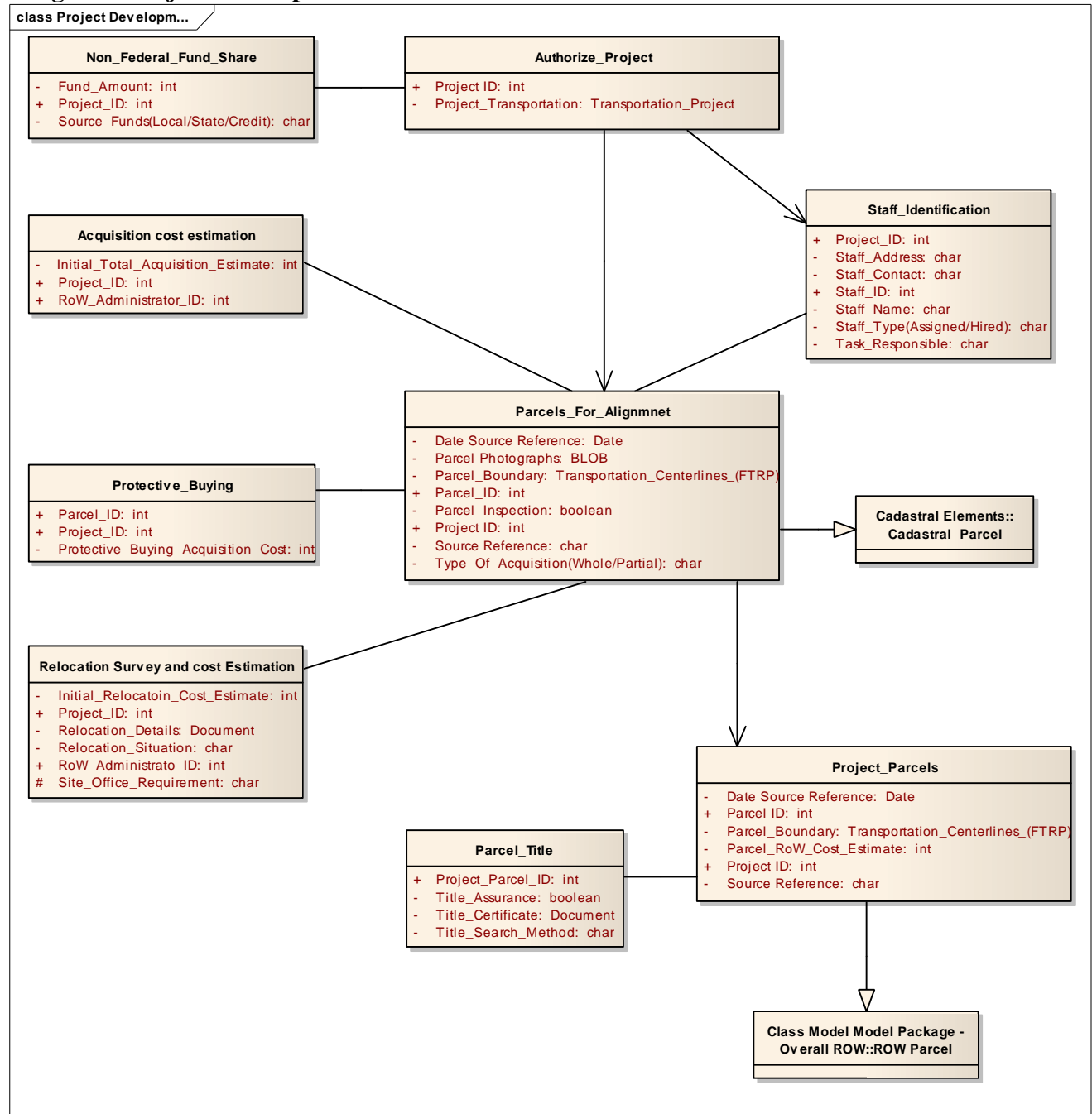
Diagram: Project Development

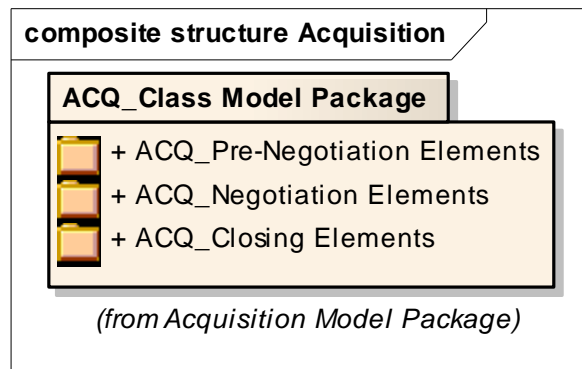
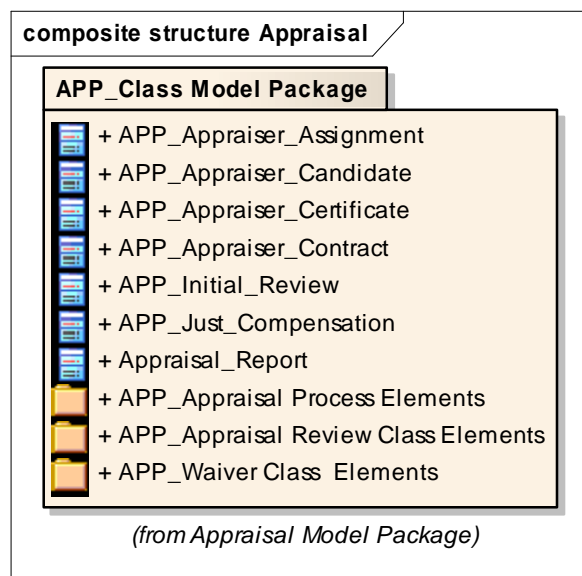
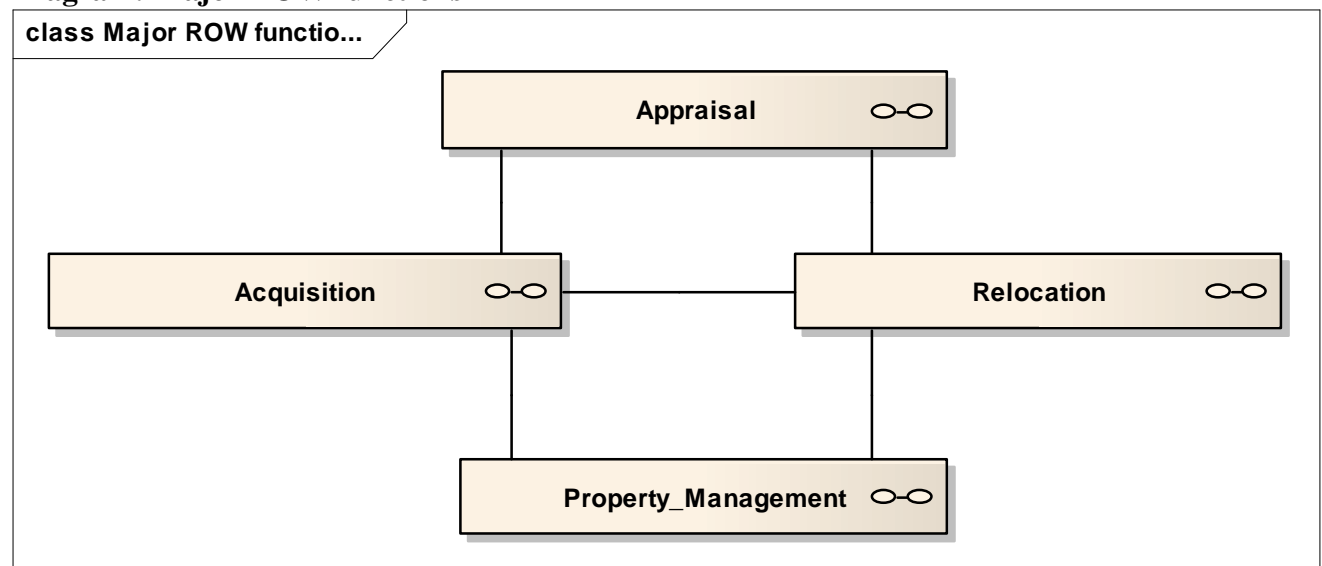
Diagram: Acquisition**Diagram: Appraisal****Diagram: Major ROW functions**

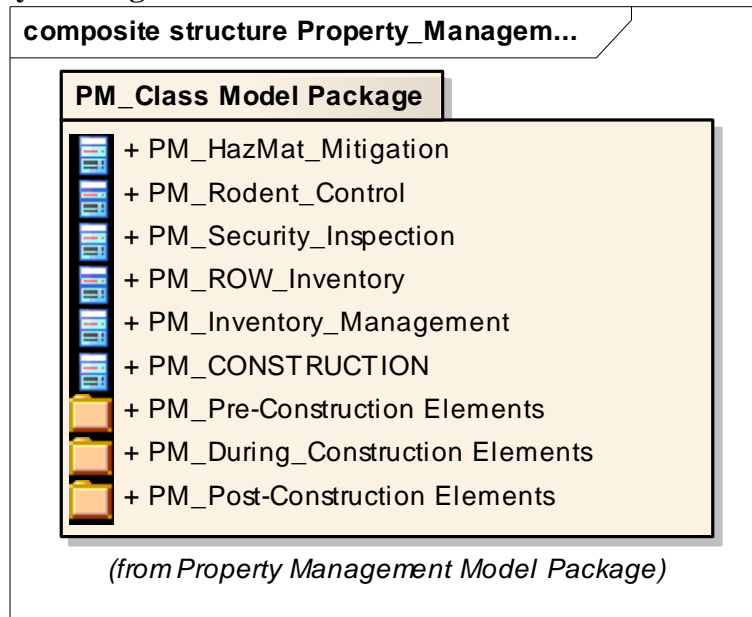
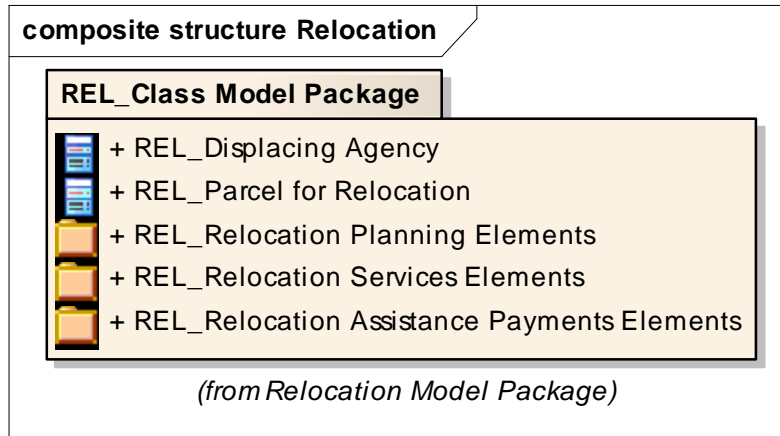
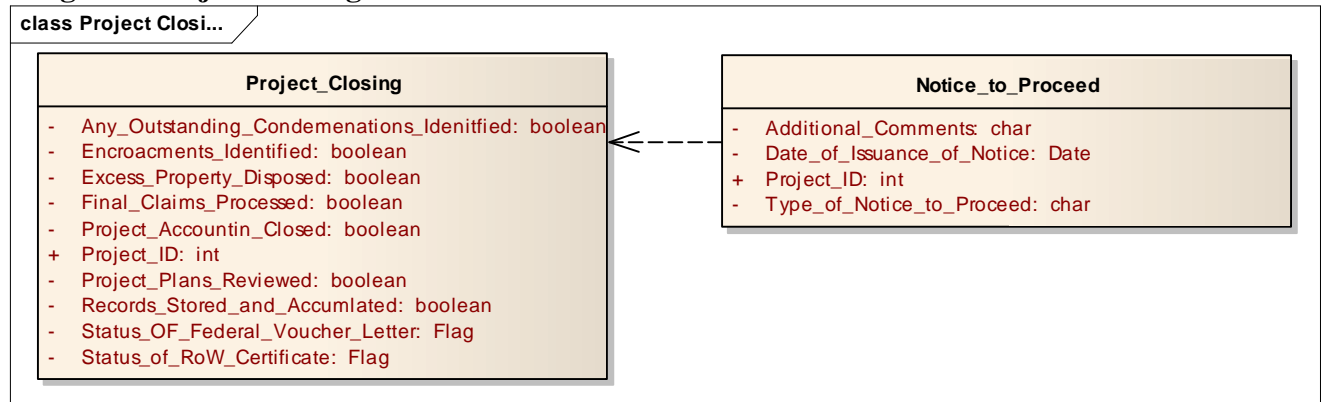
Diagram: Property_Management**Diagram: Relocation****Diagram: Project Closing**

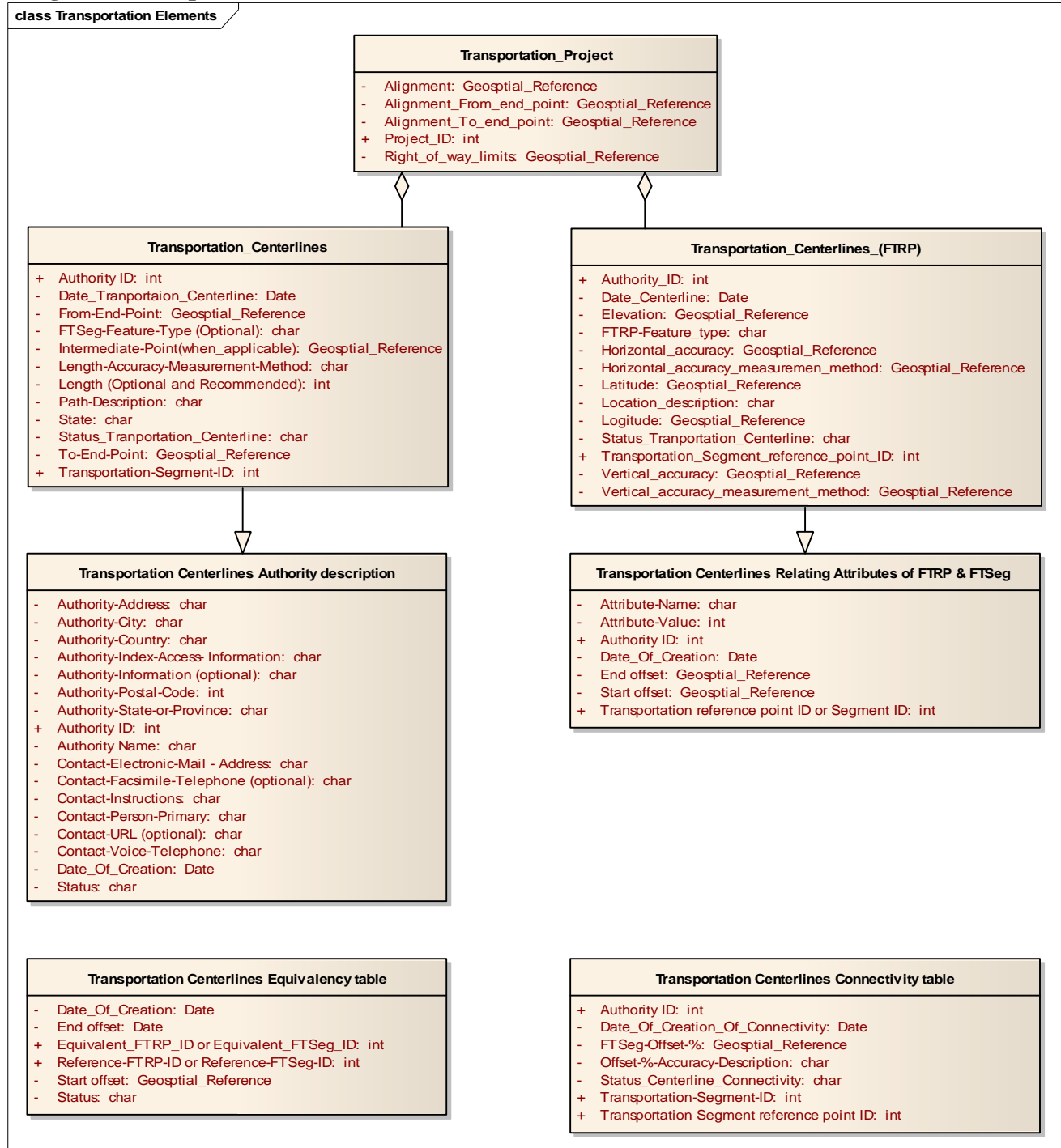
Diagram: Transportation Elements

Diagram: Cadastral Elements**class Cadastral Elements****Cadastral_Parcel**

- APP_Type: char
- Basis_Of_Assessment: char
- Date_Of_File: Date
- Improved: char
- Interpretation_Of_Assessment_Classification: char
- Jurisdiction_Name: char
- Jurisdiction_Parcel_Contact: char
- Owner_Name: char
- Owner_Type: char
- Parcel_Area: double
- Parcel_Centroid: Geosptial_Reference
- + Parcel_ID: int
- Parcel_Outline: Geosptial_Reference
- Parcel_Street_Address: char
- Parcel_Type: char
- Parcel_Zoning: char
- Primary_Value_Classification: char
- Public_Parcel_Name: char
- Secondary_Value_Classification: char
- Source_Reference: char
- Source_Reference_Date: int
- Tax_Bill_Mailing_Address: char
- Total_Value: int
- Value_Of_Improvements: int
- Value_Of_Land: int

Cadastral_Reference

- Another_metadata_file(if_datum_not_unique_for_entire_jurisdiction): char
- + Control_ID: int
- Coordinate_System: char
- Coordinate_System_Description: char
- Date_Coordinate: Date
- Date_Monument: Date
- Date_of_File: Date
- East_X: Geosptial_Reference
- Elevation-Z: Geosptial_Reference
- Elevation_Accuracy: char
- Elevation_Datum: char
- Elevation_Units: Geosptial_Reference
- Horizontal_Accuracy: char
- Horizontal_and_Vertical_Datum: int
- Horizontal_Datum: char
- Jurisdiction_Contact: char
- Jurisdiction_Name: char
- Monument_Surveyor: char
- Monument_Type: char
- North_Y: Geosptial_Reference
- Units_Of_Measure: char

Geosptial_Reference

- Date_Of_Orthophotos: int
- Datums: int
- Jurisdiction: char
- Monumneted_points: int
- NGRS_Coordinate_System: char
- Orthography: int
- Terrain_Information: char

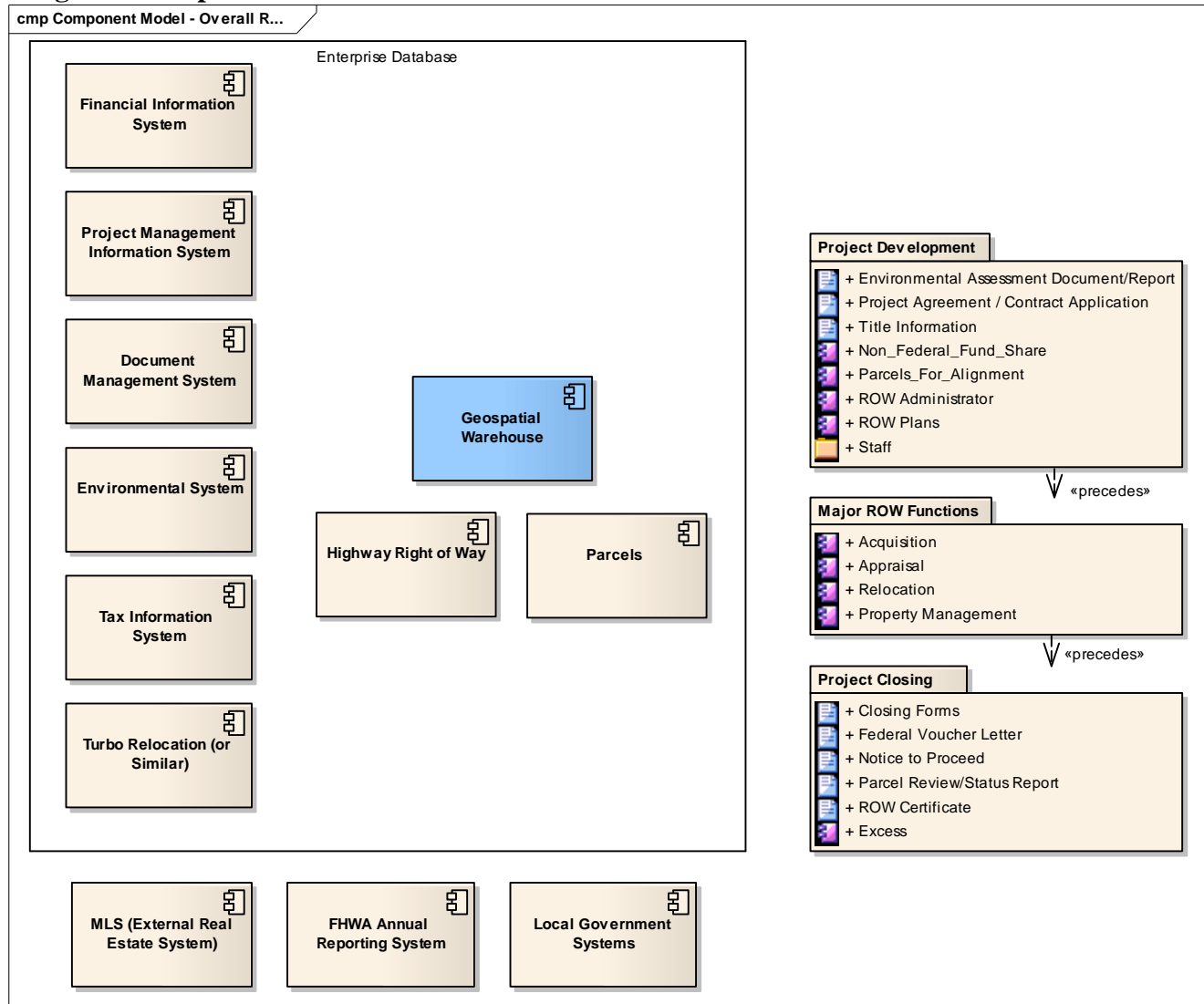
Diagram: Component Model - Overall ROW

Diagram: Project Closing

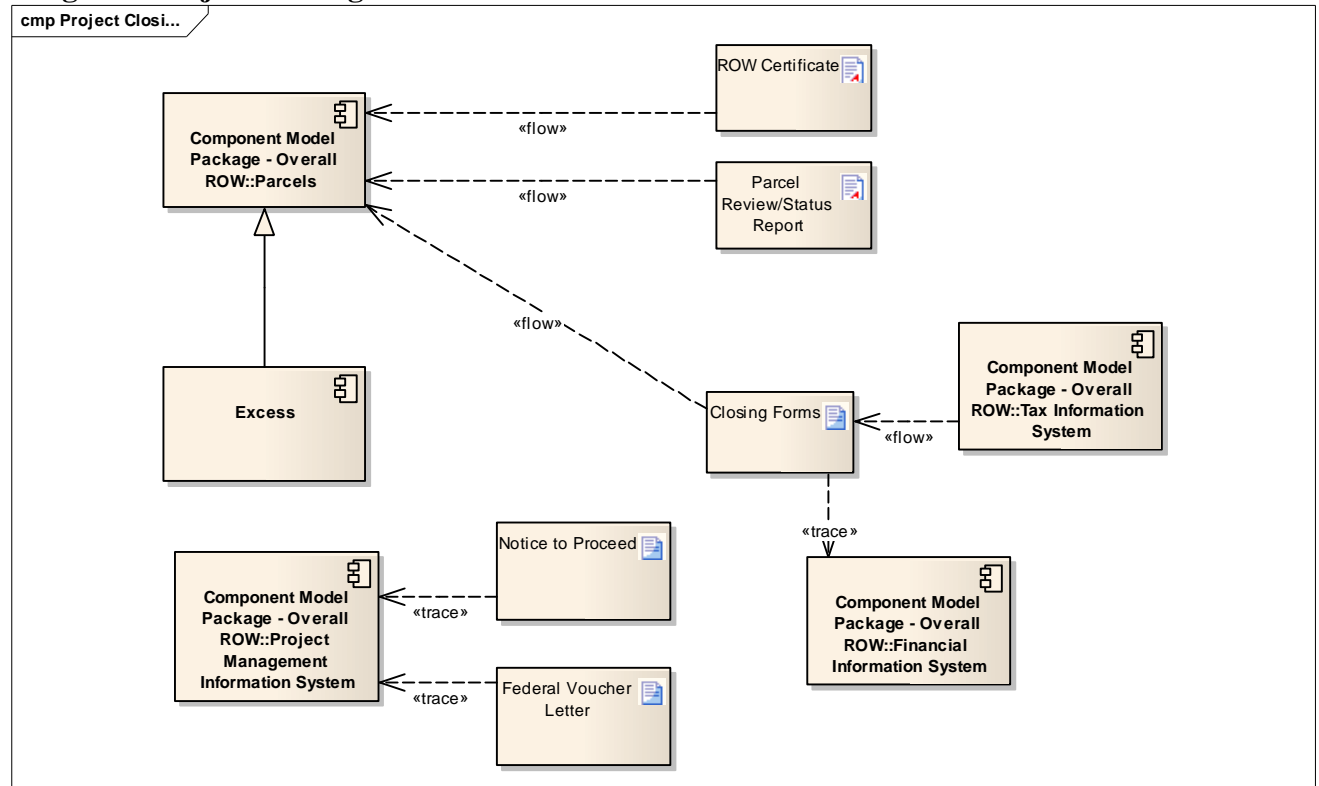


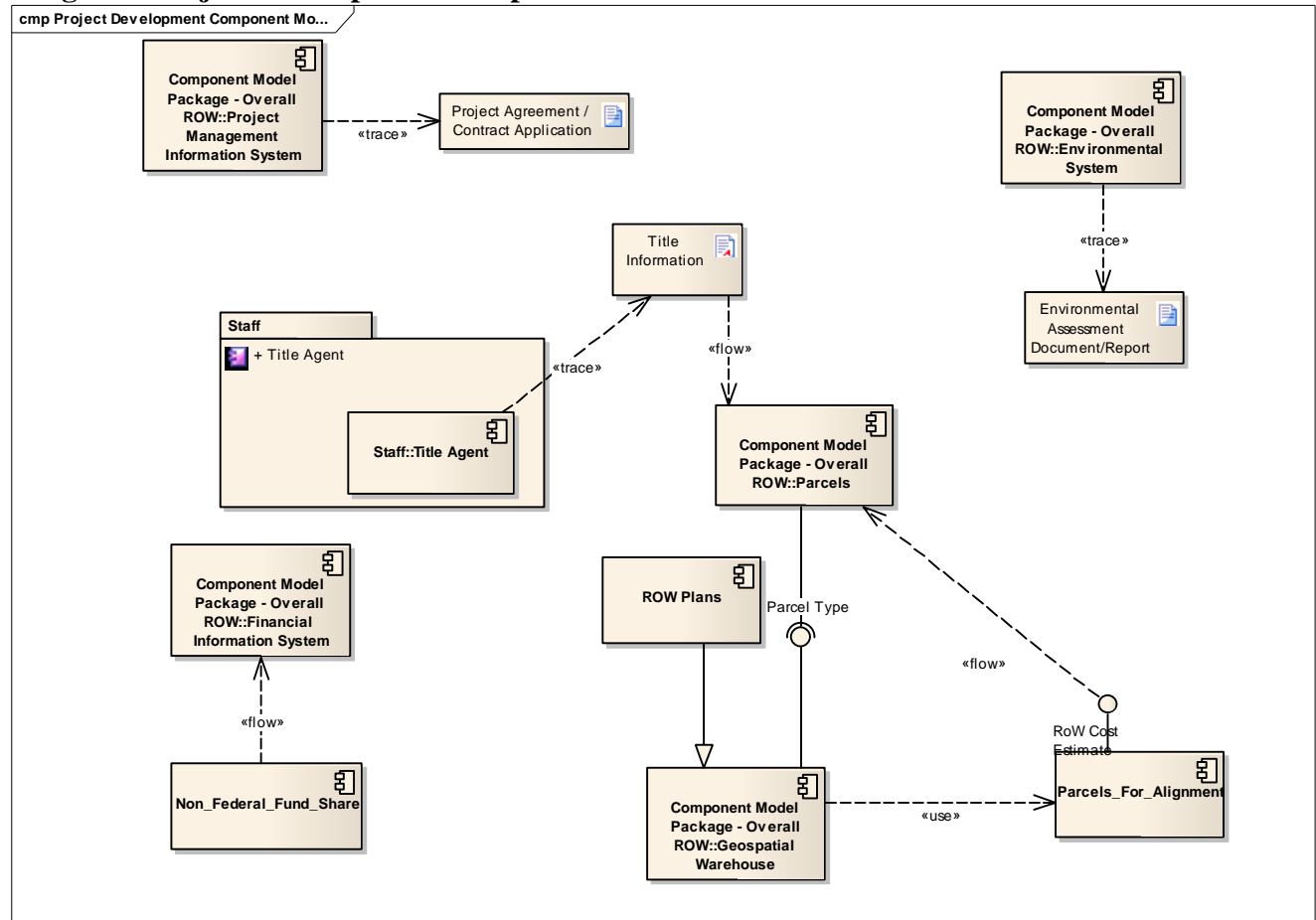
Diagram: Project Development Component Model

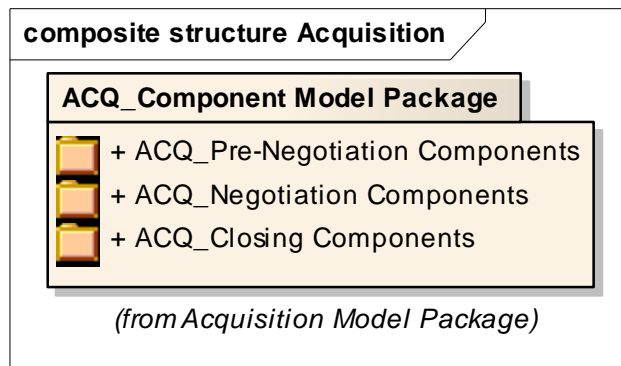
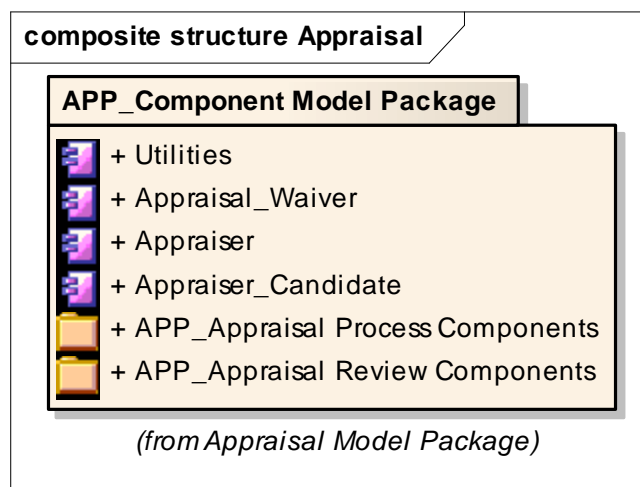
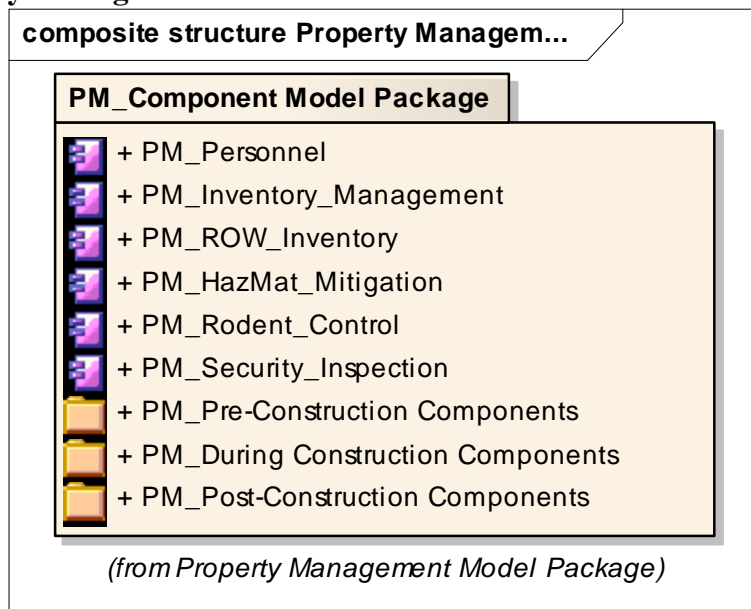
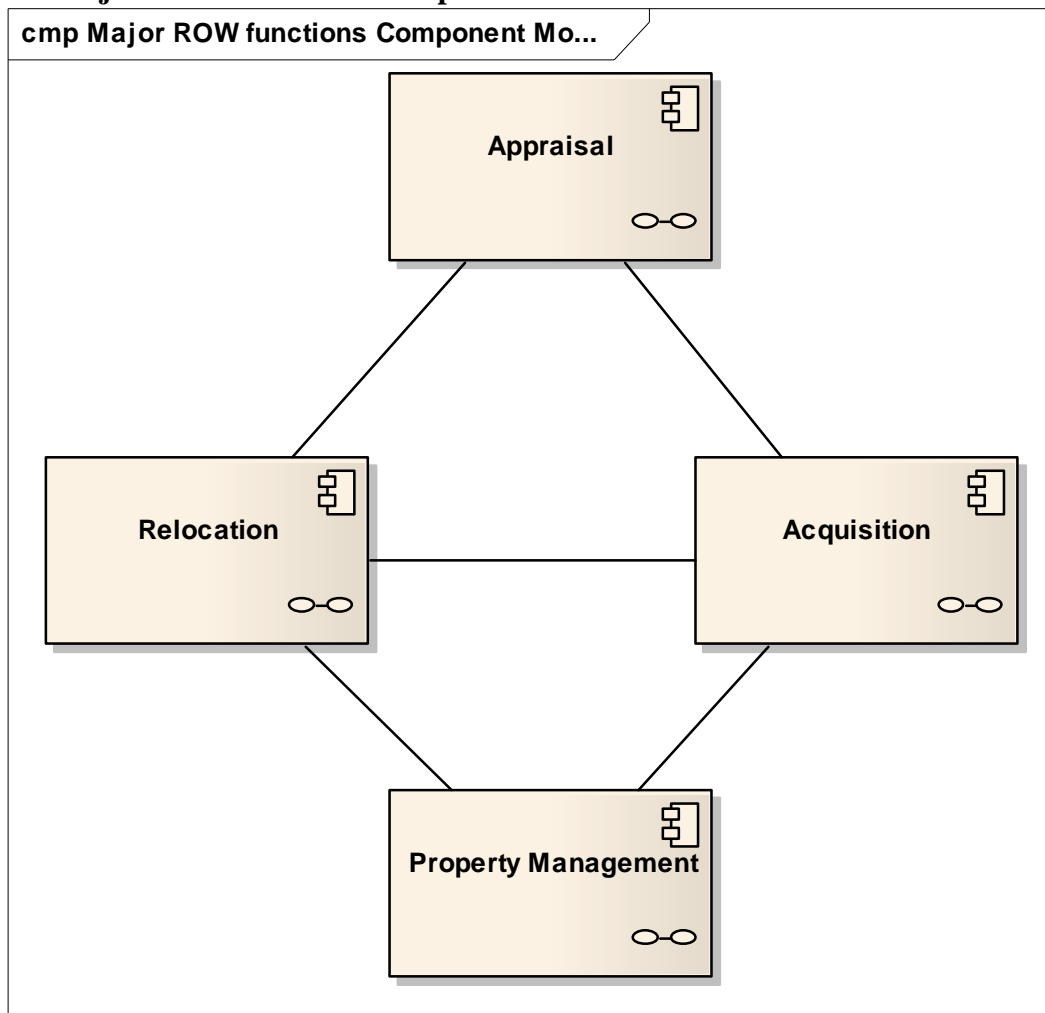
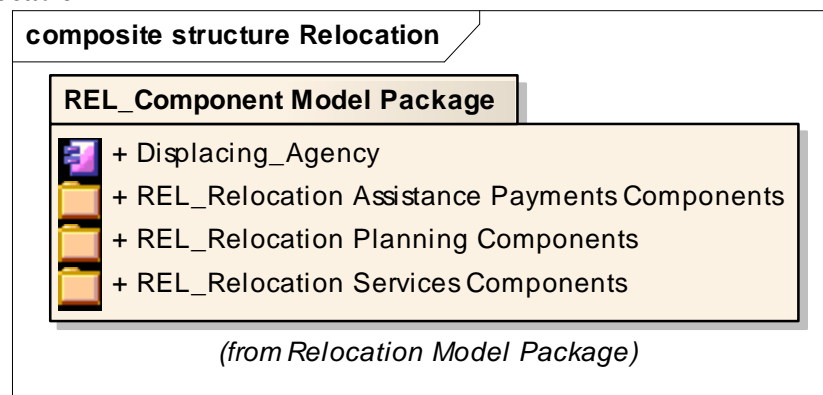
Diagram: Acquisition**Diagram: Appraisal****Diagram: Property Management**

Diagram: Major ROW functions Component Model**Diagram: Relocation**

Geospatial Decision Making Activities Model Diagrams

The following diagrams are in alphabetical order according to the method used by Enterprise Architect. It is **STRONGLY** recommended that you open the model in EALite and use the Project Browser to maneuver through the different diagrams since they are hyperlinked within the software.

Diagram: Geospatial Decision Making Activities

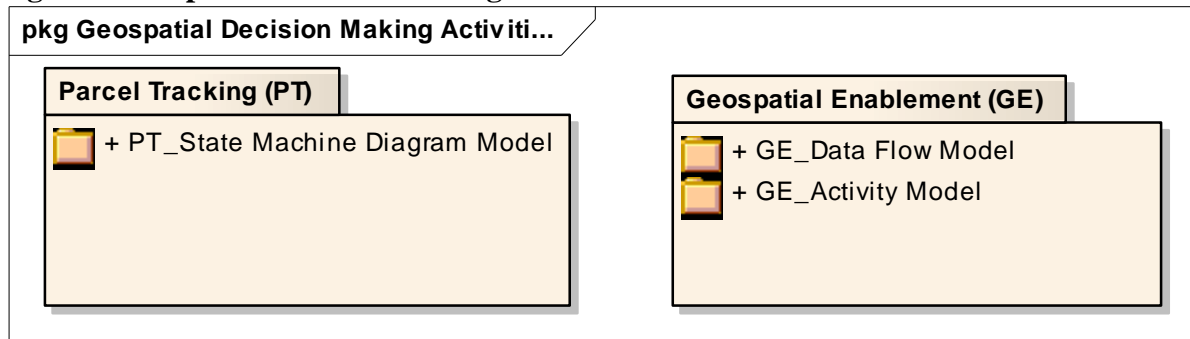


Diagram: Geospatial Enablement (GE)

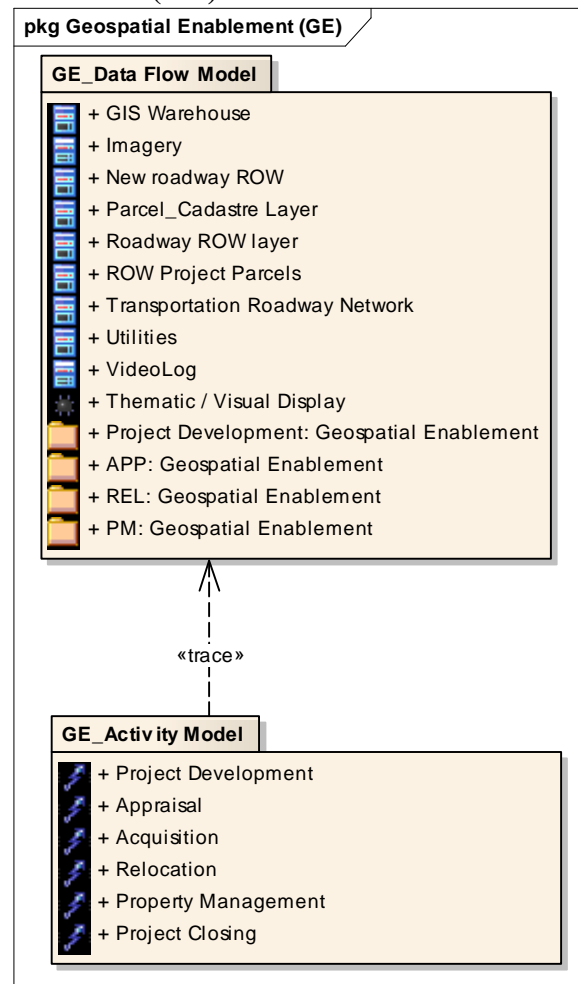


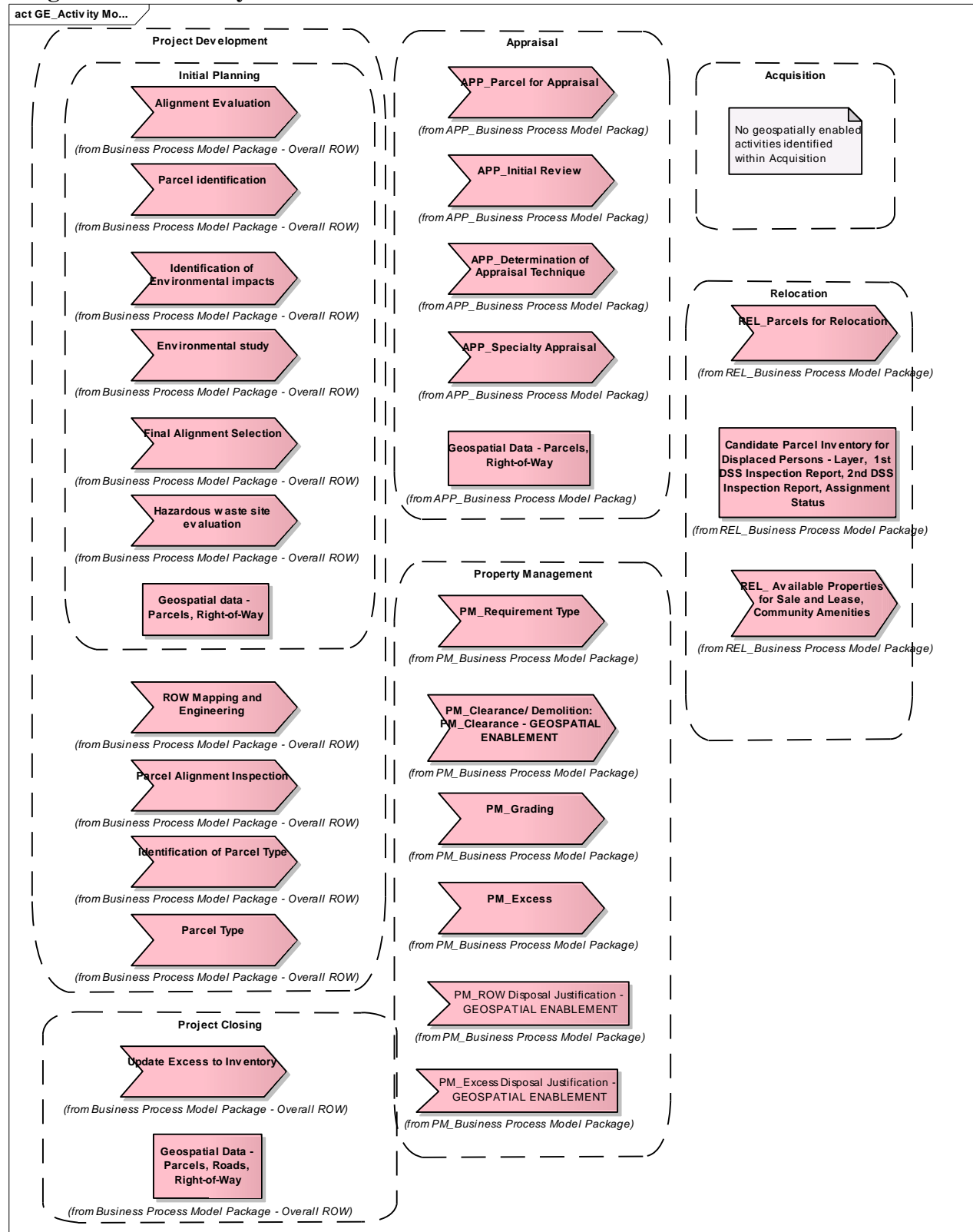
Diagram: GE_Activity Model

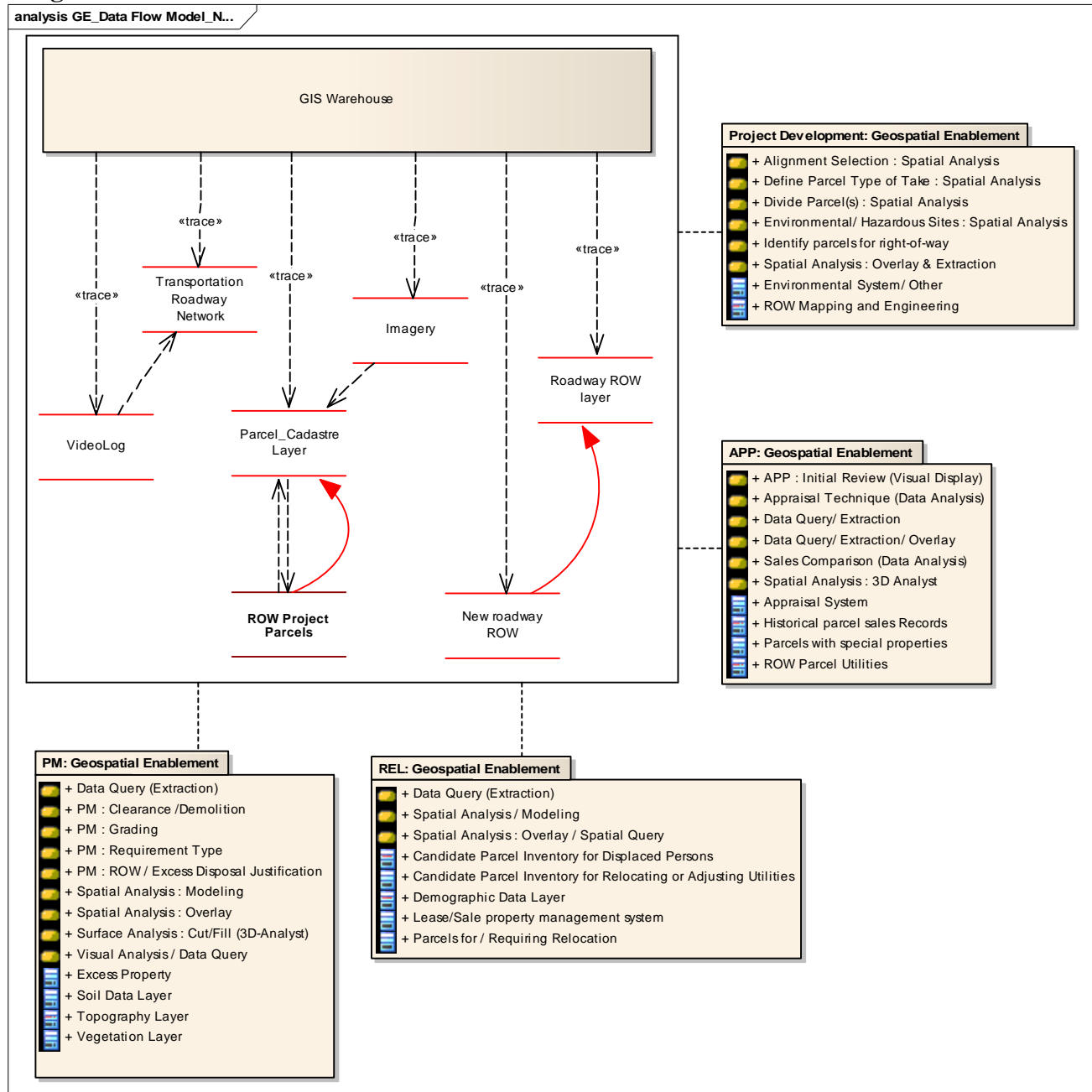
Diagram: GE Data Flow Model_New

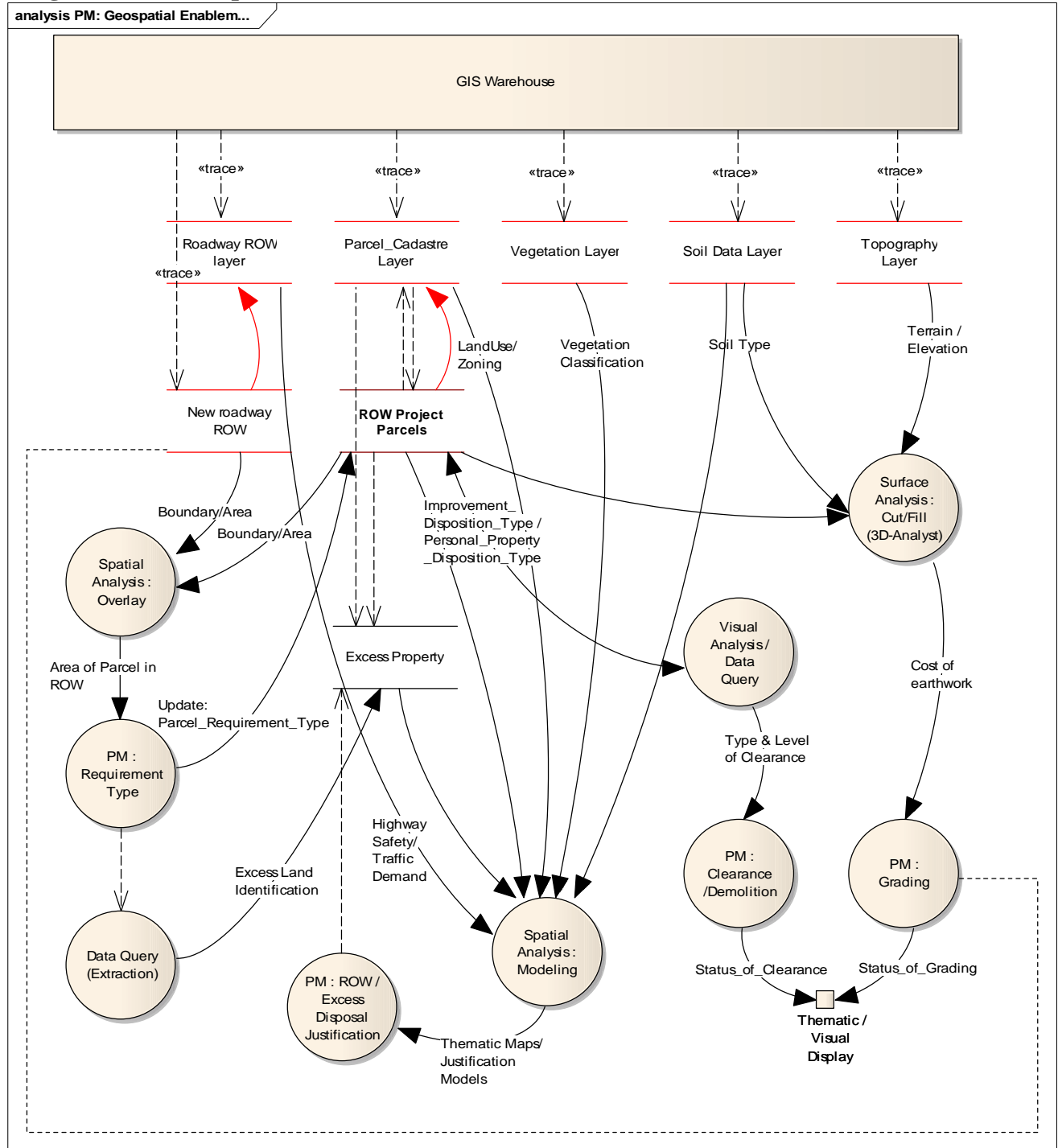
Diagram: PM: Geospatial Enablement

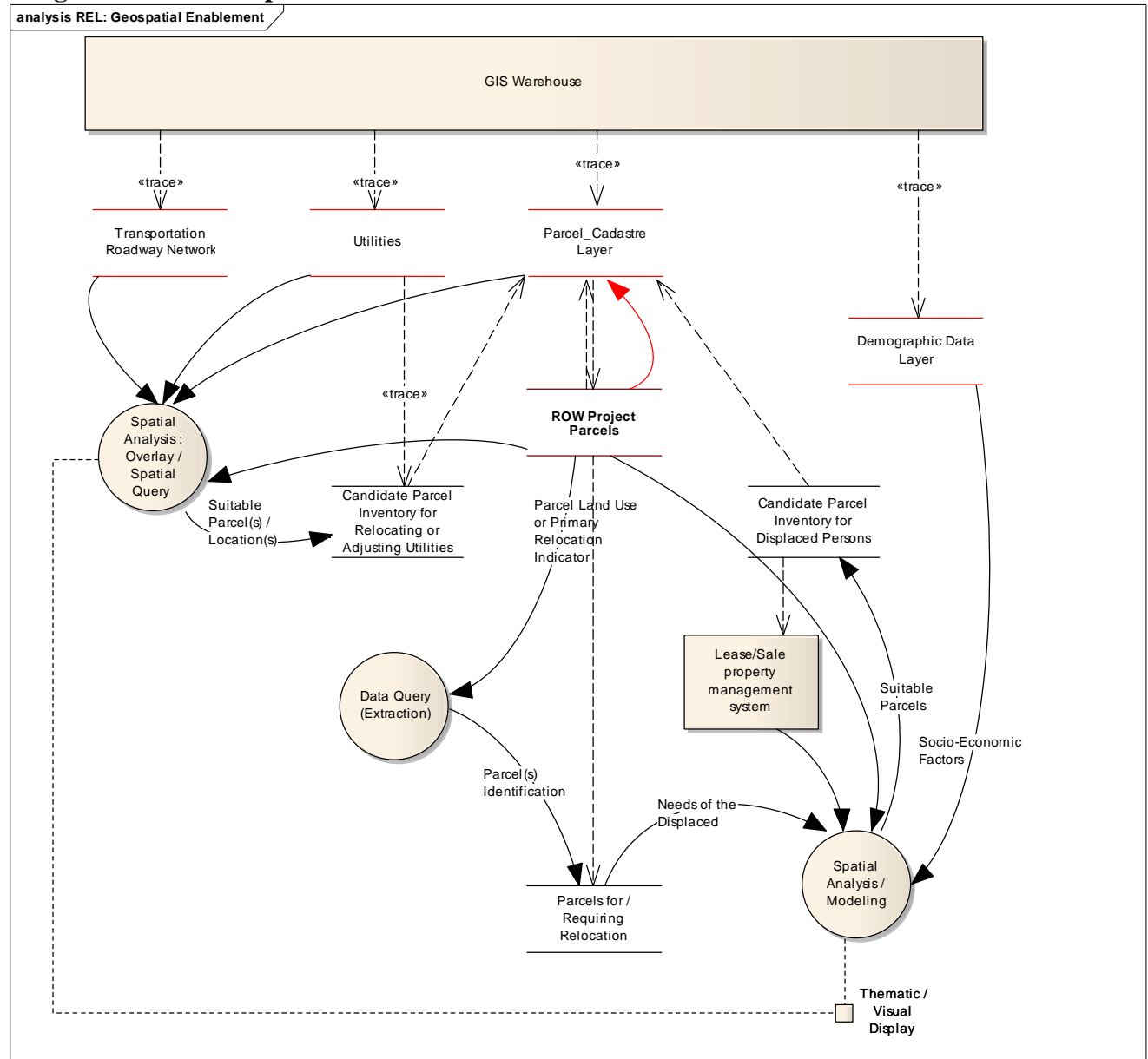
Diagram: REL: Geospatial Enablement

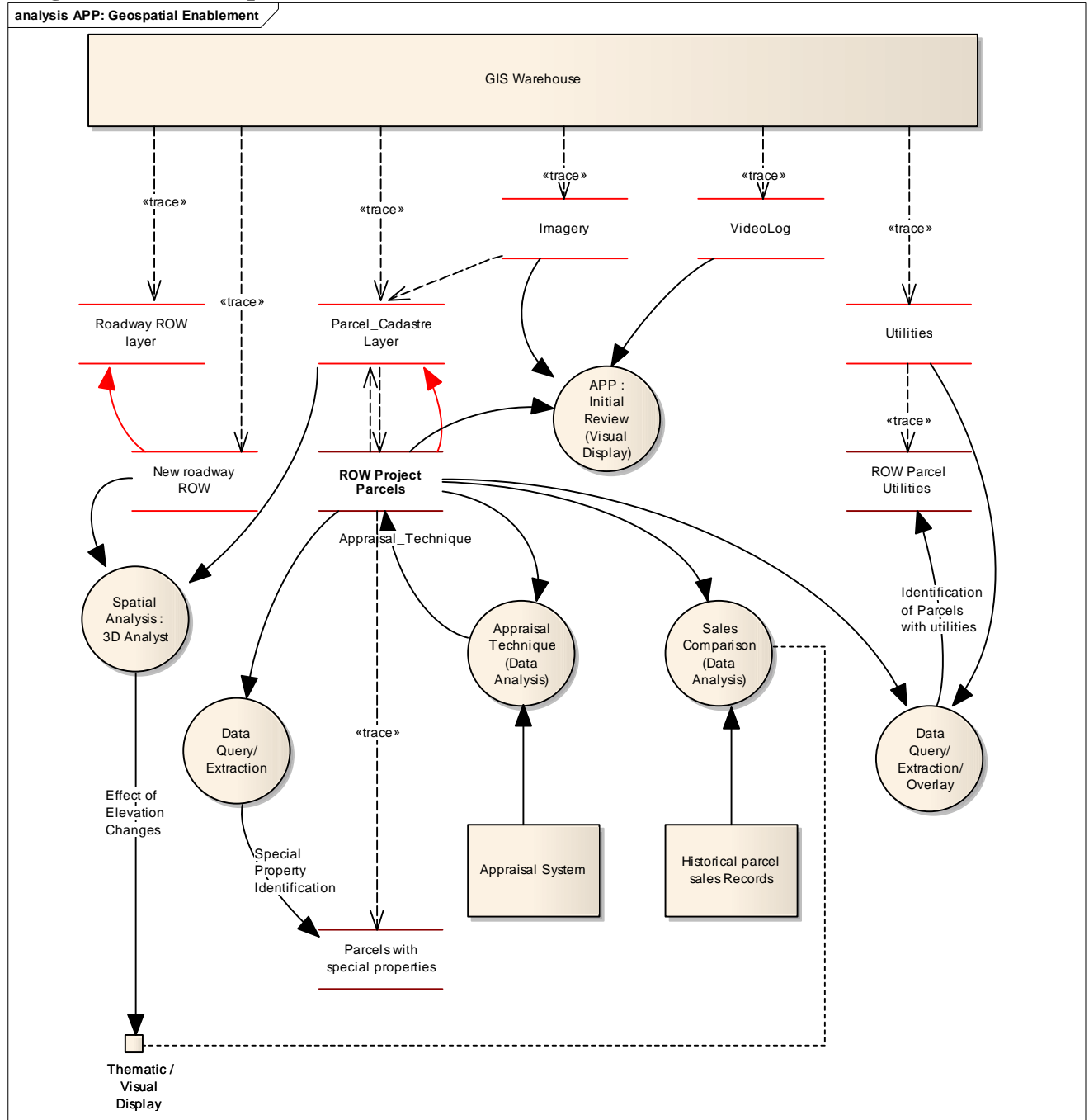
Diagram: APP: Geospatial Enablement

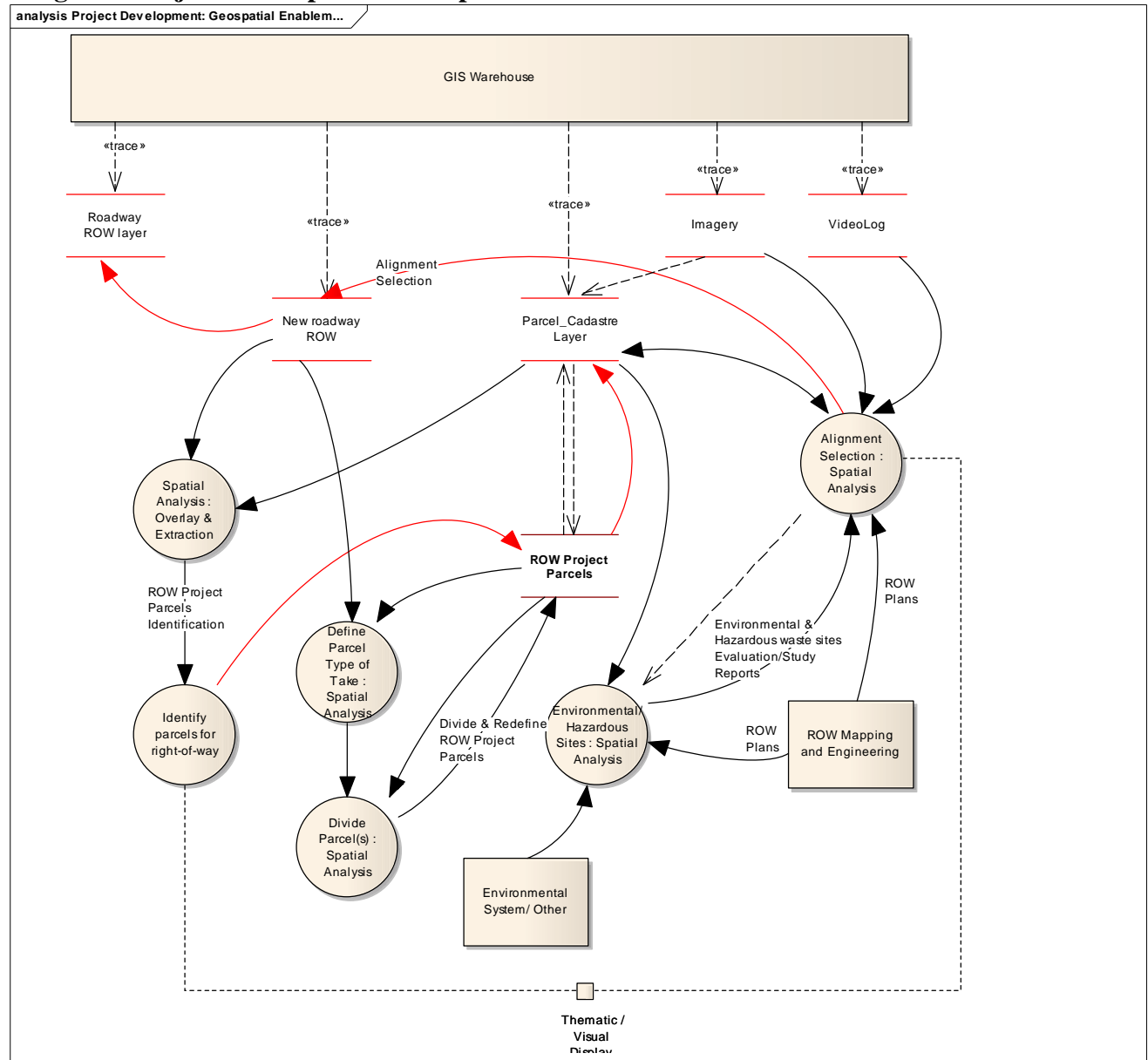
















Diagram: Project Development: Geospatial Enablement

Diagram: Parcel Tracking (PT)**pkg Parcel Tracking (PT)****PT_State Machine Diagram Model**

-  + Notice to Proceed
-  + Parcel Land Use
-  + Parcel Take
-  + Project Number
-  + Project Parcel Number
-  + State
-  + State
-  + State
-  + Status : Federal Voucher Letter
-  + Status : PM
-  + Status : REL
-  + Status : ROW Certification
-  + Status: ACQ
-  + Status: APP
-  + Final
-  + Initial

LEGEND

«Type»
State

(from PT_State Machine Diagram Model)

States in Blue represent: Attributes of the Parcel Log that are not related to any existing attribute; But, are derived from two or more classes or updated according to the corresponding activity in the ROW Parcel records.

«Type»
State

(from PT_State Machine Diagram Model)

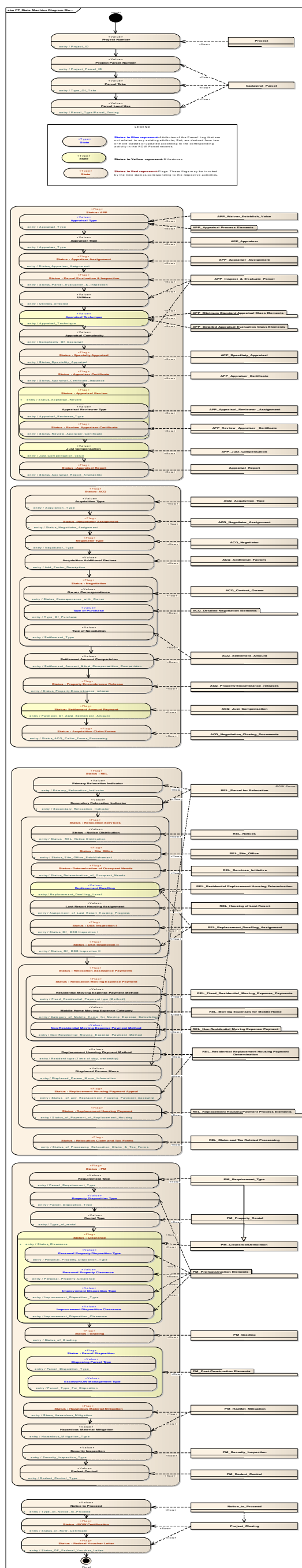
States in Yellow represent: Milestones

«Type»
State

(from PT_State Machine Diagram Model)

States in Red represent: Flags. These flags may be invoked by the time stamps corresponding to the respective activities.

Diagram: PT_State Machine Diagram Model Use Zoom function to see details



APPENDIX D *8-55A LOGICAL MODEL DATA ARCHITECTURE & CLASS MODEL*

As indicated in the Guide, two primary approaches are taken to building an information management system. One is typically built in a database management system and acts as an electronic ledger. The other is an electronic work environment that is structured to assist users in performing their activities with business rules and decision support modules. These two approaches tend to result in different data models.

The first approach, by nature, is data-centric and the data model typically consists of structured tables of identified data elements that stakeholders identify. The data tables in NCHRP 8-55 (http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_w95.pdf), pages C-9 to C-26, provide the preliminary elements for this approach.

The second approach builds the business processes and use cases and corresponding class diagrams around activities performed in the business that will be included in the information management system. The class diagrams then provide the contents of the data model as provided in this section.

Both approaches are valid and result in effective and useful systems. The resulting data models are in different formats when visualized.

A note on the data elements listed in the class diagrams: This data model does not include time stamps (data elements that indicate when an activity was initiated or terminated or when a value was entered or updated) or flags that are used for scheduling and status or resource reporting purposes. This was done for two reasons. The first is that many of these are tied to other data elements or actions performed in the system and will be included when the system is programmed. The second is that inclusion of these would easily have tripled the number of elements without adding value to the generic model.

Data Model Diagrams

Diagram: Class Model Package - Overall ROW

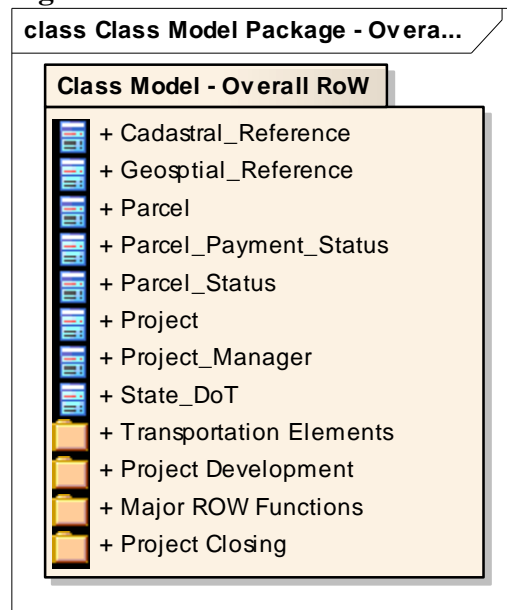


Diagram: Class Model Package - Acquisition

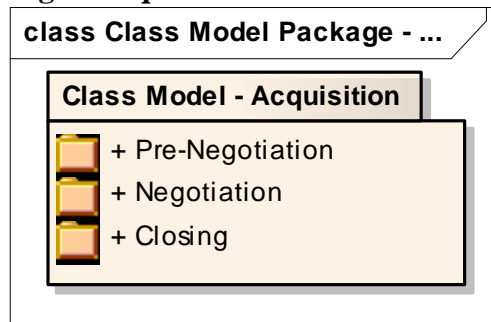


Diagram: Class Model Package- Appraisal

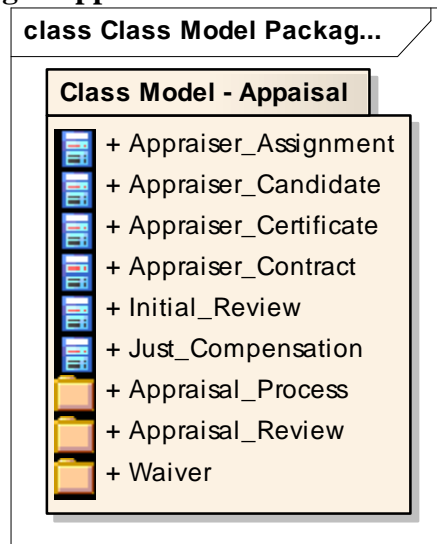


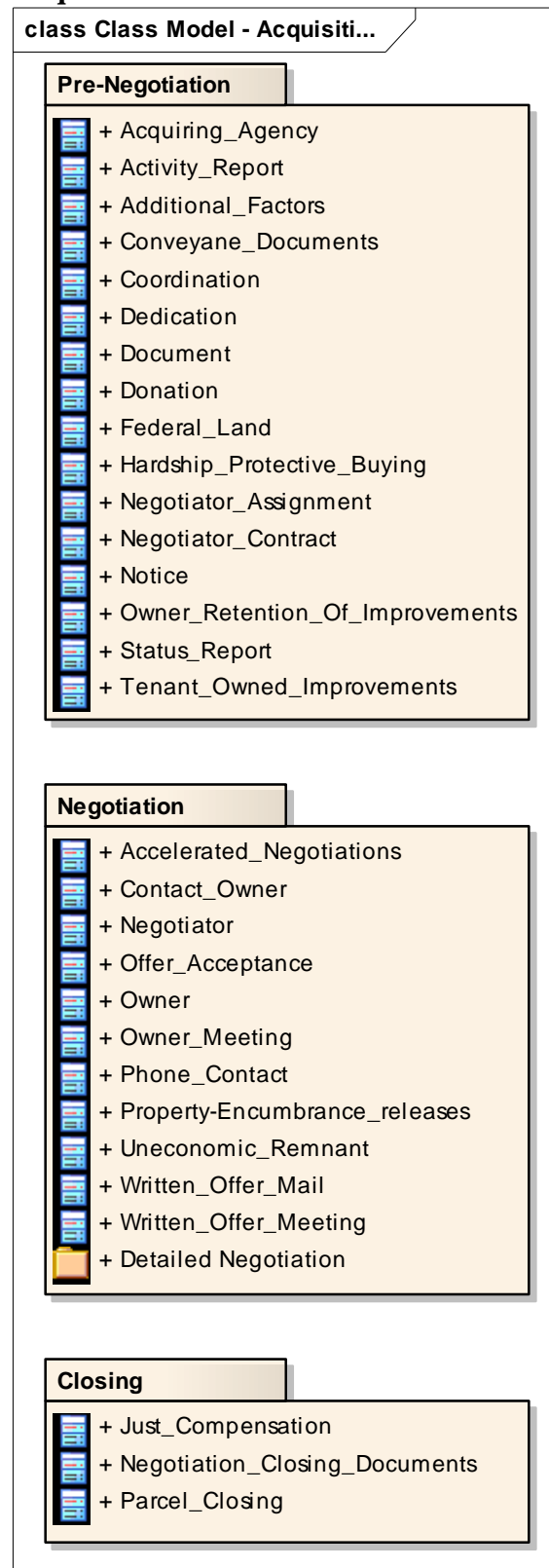
Diagram: Class Model - Acquisition

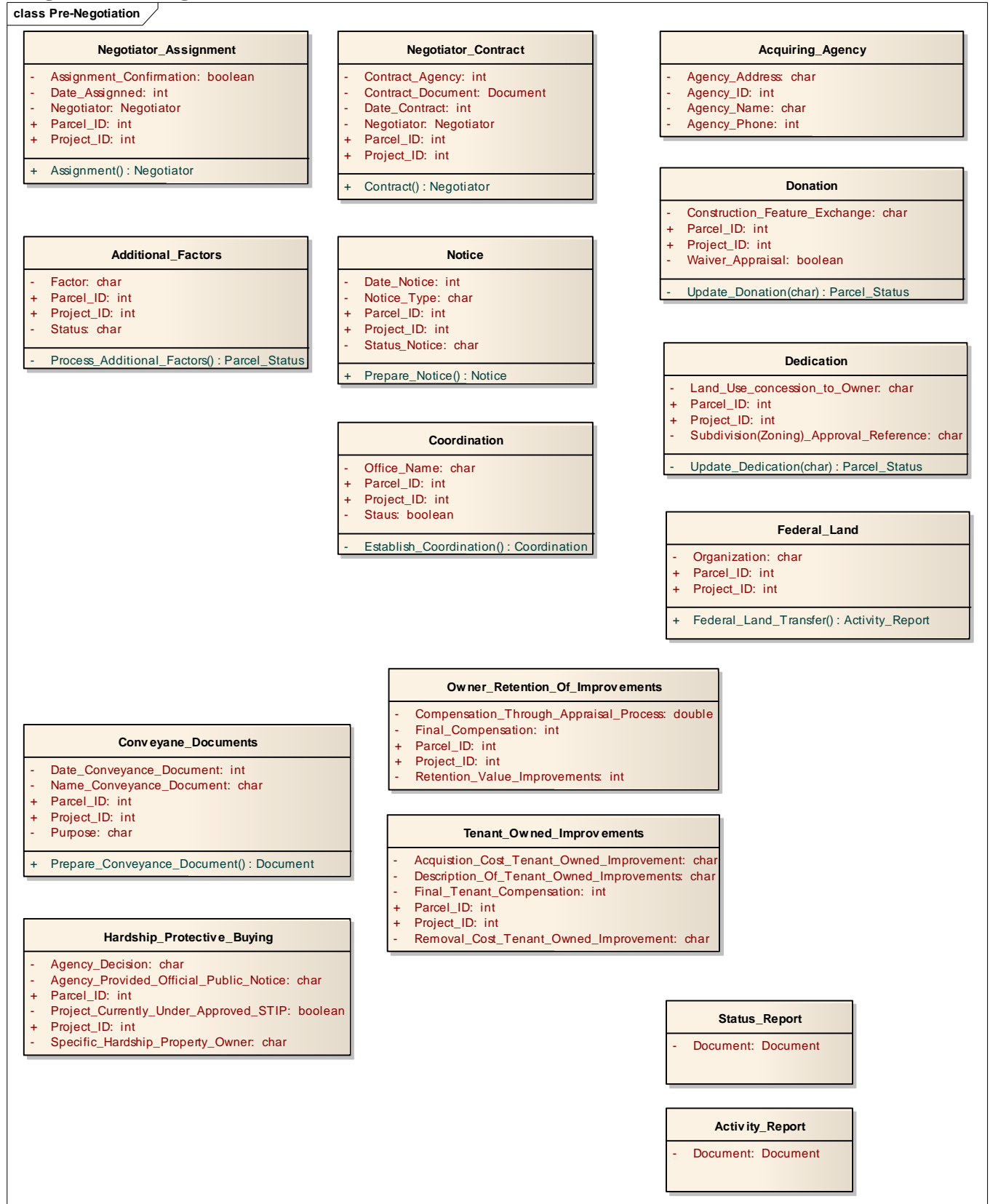
Diagram: Pre-Negotiation

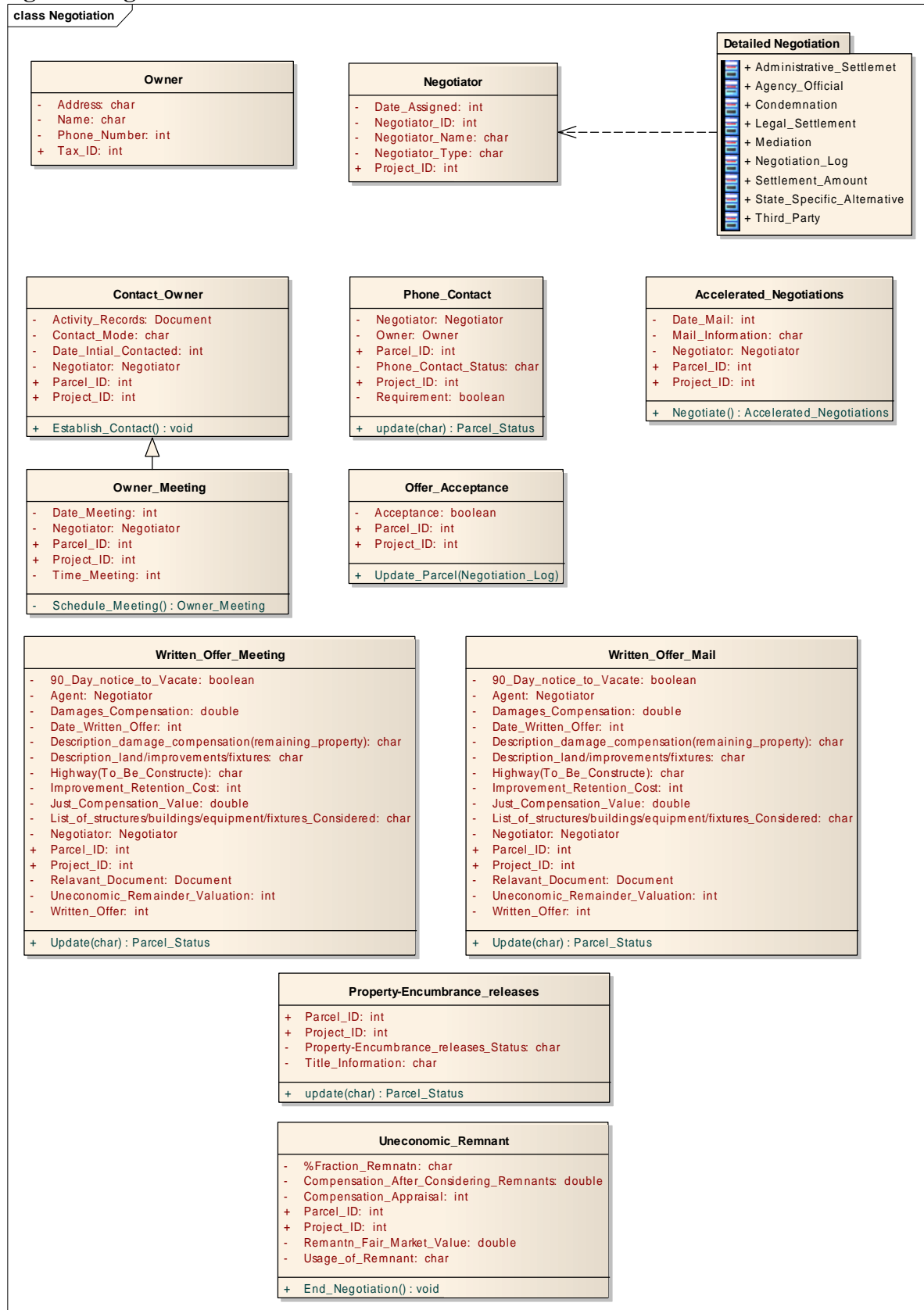
Diagram: Negotiation

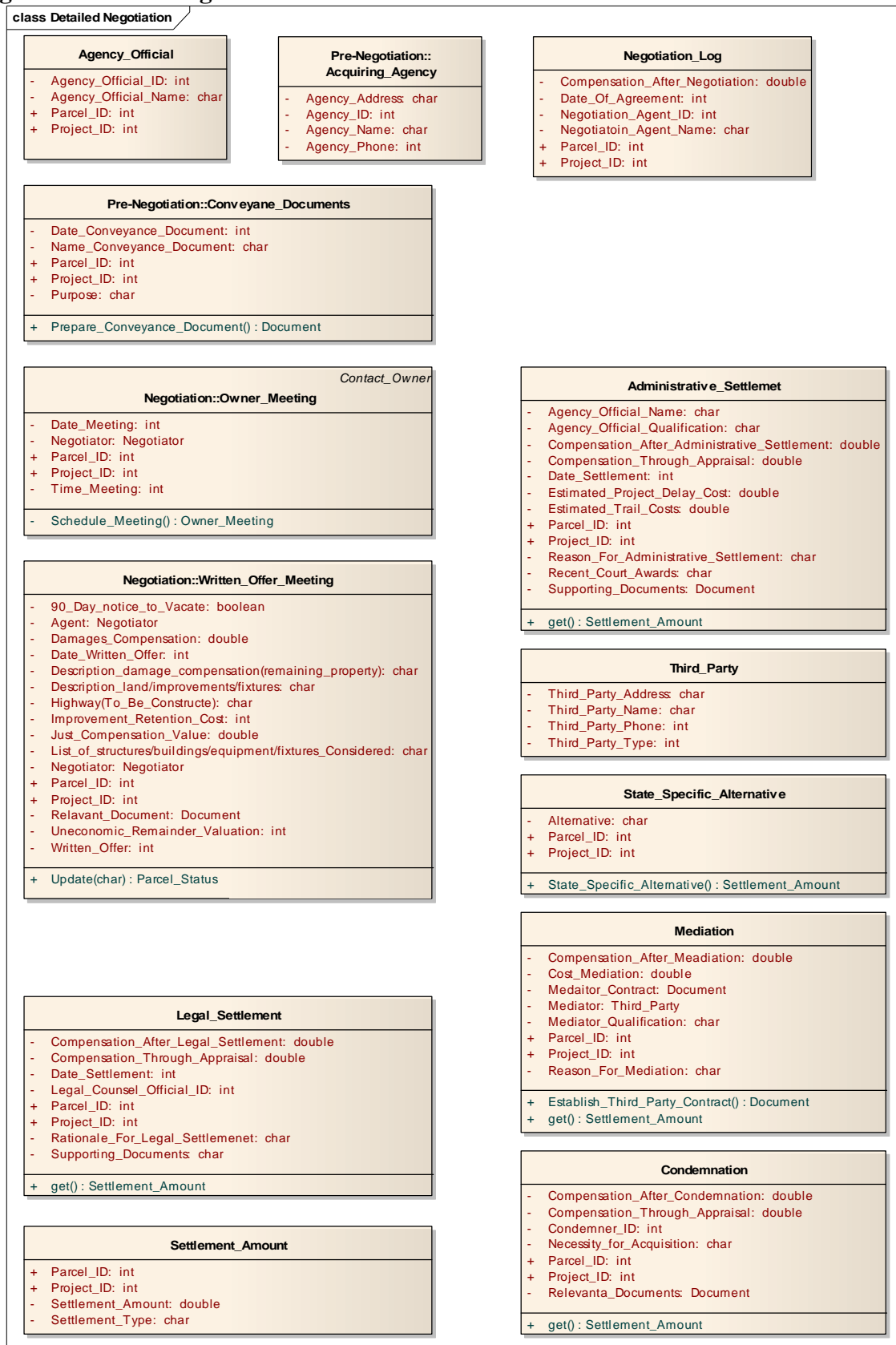
Diagram: Detailed Negotiation

Diagram: Closing**class Closing****Pre-Negotiation::
Acquiring_Agency**

- Agency_Address: char
- Agency_ID: int
- Agency_Name: char
- Agency_Phone: int

Negotiation::Owner

- Address: char
- Name: char
- Phone_Number: int
- + Tax_ID: int

Just_Compensation

- Amount: Settlement_Amount
- + Parcel_ID: int
- + Project_ID: int
- + Payment(Just_Compensation) : boolean

Negotiation_Closing_Documents

- + Parcel_ID: int
- + Project_ID: int
- Tax_Forms: Document
- Title_Release: boolean
- + Attach(Negotiation_Closing_Documents) : Parcel

Parcel_Closing

- Encumbrance_Release: Property-Encumbrance_releases
- + Parcel_ID: int
- + Project_ID: int
- Settlement_Statement(Deed): Document
- + update(int) : Parcel

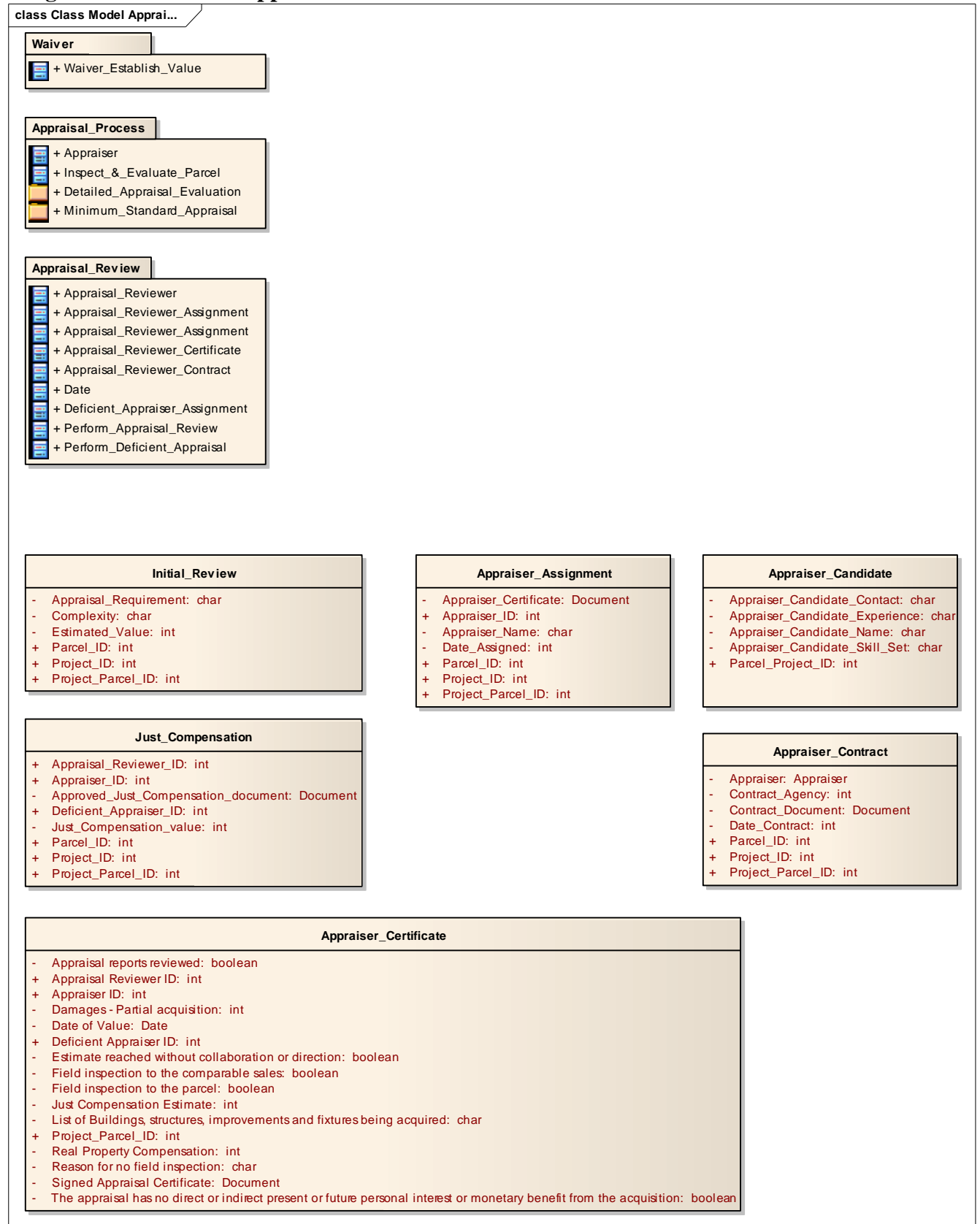
Diagram: Class Model Appraisal

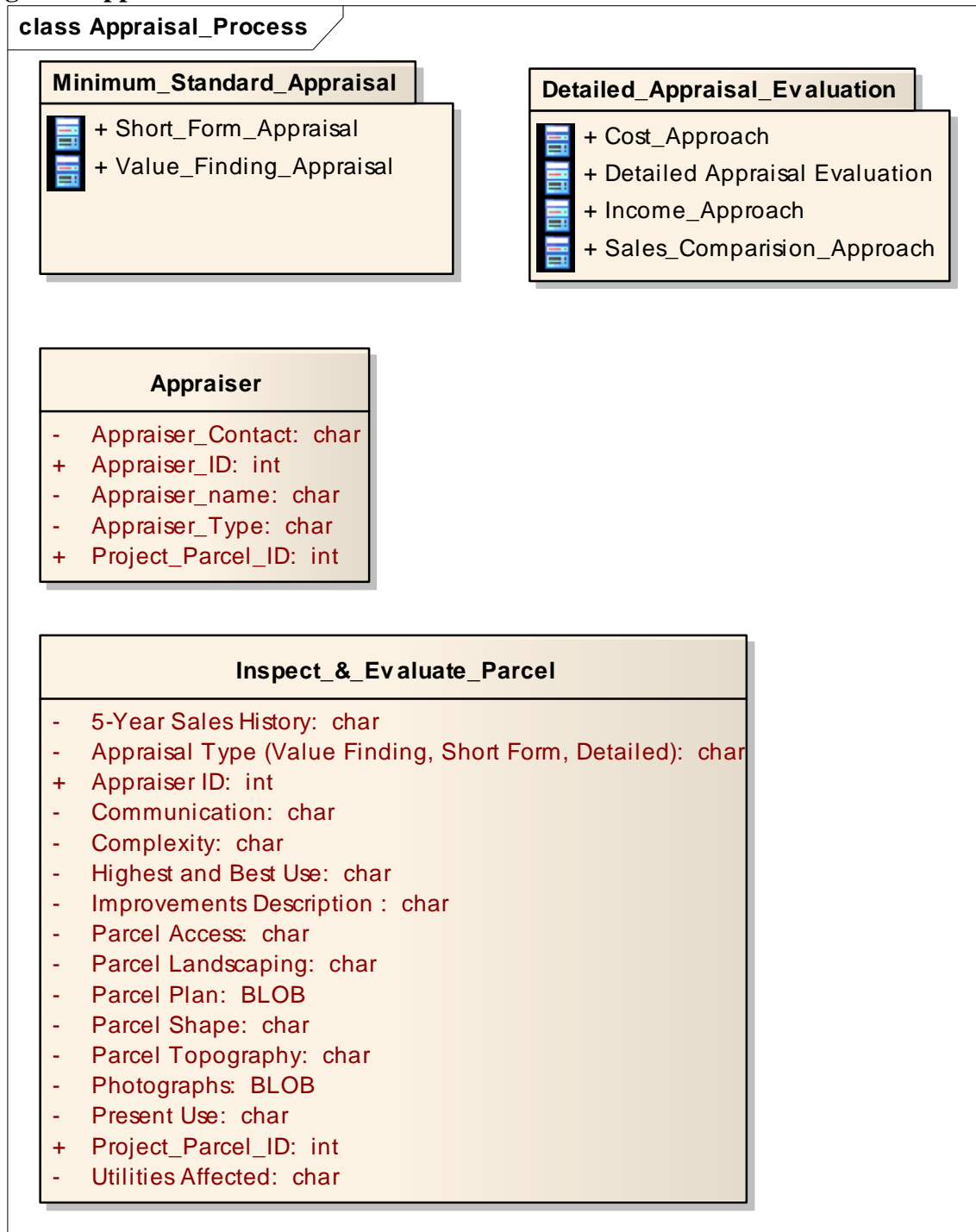
Diagram: Appraisal_Process

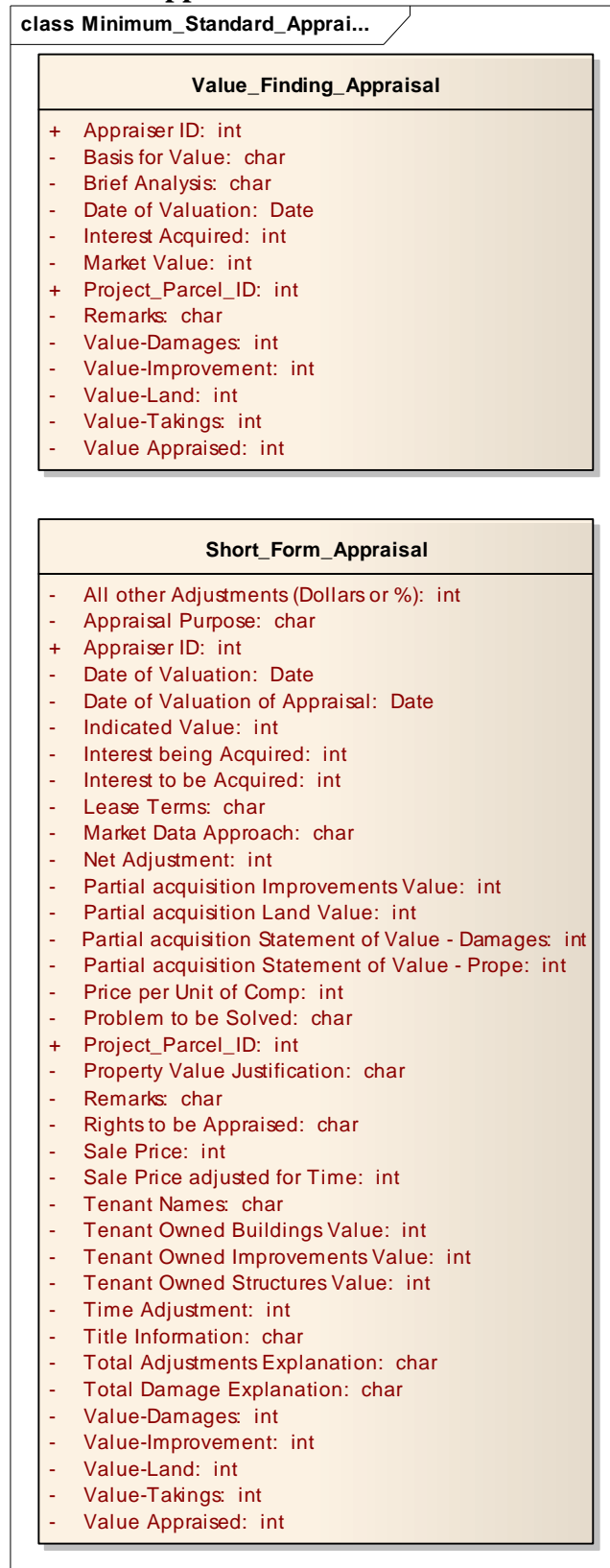
Diagram: Minimum_Standard_Appraisal

Diagram: Detailed Appraisal

class Detailed Appraisal

Sales Comparision Approach

- Zoning_(at_the_date_of_sale): char
- Access_to_the_comparable: char
- Adjustment-Economic_characteristics_(Dollars_or%): int
- Adjustment-Time_(Dollars_or%): int
- Adjustment_Location_(Dollars_or%): int
- Adjustment_Motivation_for_the_transactions_(Dollars_or%): int
- Adjustment_Physical_characteristics_(Dollars_or%): int
- + Appraiser ID: int
- Cadaster(Parcel): Geosptial_Reference
- Comparable_data_map: BLOB
- Conditions_of_sale_(Motivation): char
- Consideration_paid: int
- Date_of_Appraiser's_Inspection: Date
- Date_of_data_verification: Date
- Date_of_sale_or_offering: Date
- Description_of_Comparable_sales: char
- Highest_and_best_use_at_date-of_sale-Analysis: char
- Improvements_Description: char
- Listings_Available: char
- Location_of_comparable: char
- Method_of_financing: char
- Mineral_water_and_other_rights: char
- Offerings_Available: char
- Parties_to_the_transaction: char
- Person(s)_with_whom_data_was_verified: char
- Photographs_of_principal_improvements: BLOB
- Price_per_Unit_of_area: int
- + Project_Parcel_ID: int
- Rental Data Available: char
- Similarities or dissimilarities - Economic characteristics: char
- Similarities or dissimilarities - Location: char
- Similarities or dissimilarities - Motivation for the transactions: char
- Similarities or dissimilarities - Physical characteristics: char
- Similarities or dissimilarities - Time: char
- Size of the Improvements: char
- Source of financing: char
- Total area: int
- Type of easements: char
- Type of improvements: char
- Verification by party involved in transaction: char

Cost Approach

- Access to the comparable: char
- Adjustment - Economic characteristics (Dollars or %): int
- Adjustment - Location (Dollars or %): int
- Adjustment - Motivation for the transactions (Dollars or %): int
- Adjustment - Physical characteristics (Dollars or %): int
- Adjustment - Time (Dollars or %): int
- + Appraiser ID: int
- Comparable data map.: BLOB
- Conditions of sale (Motivation): char
- Consideration paid: int
- Date of Appraiser's Inspection: Date
- Date of data verification: Date
- Date of sale or offering: Date
- Description of functional and economical obsolescence: char
- Description of Physical Deterioration: char
- Detailed analysis including calculation: char
- Explanation for lack of Sales comparison approach: char
- Highest and best use at date of sale-Analysis: char
- Land value (based on sales data): int
- Location of comparable: char
- Method of financing: char
- Mineral, water, and other rights: char
- Parties to the transaction: char
- Person(s) with whom data was verified: char
- Photographs of principal improvements: BLOB
- Price per Unit of area: int
- + Project_Parcel_ID: int
- Reproduction or Replacement cost: int
- Similarities or dissimilarities - Economic characteristics: char
- Similarities or dissimilarities - Location: char
- Similarities or dissimilarities - Motivation for the transactions: char
- Similarities or dissimilarities - Physical characteristics: char
- Similarities or dissimilarities - Time: char
- Source of financing: char
- Total area: int
- Type of easements: char
- Verification by party involved in transaction: char
- Zoning (at the date of sale): char

Income Approach

- Adjustment - Economic characteristics (Dollars or %): int
- Adjustment - Location (Dollars or %): int
- Adjustment - Physical characteristics (Dollars or %): int
- Adjustment - Time (Dollars or %): int
- Allowance for vacancy and Credit loss: int
- + Appraiser ID: int
- Capitalization rate estimated: char
- Capitalization rate of the comparable: int
- Comparable data map: BLOB
- Date of Appraiser's Inspection: Date
- Date of data verification: Date
- Estimated gross Market rent or income: int
- Explanation for lack of Sales comparison approach: char
- Improvements Description: char
- Location of comparable: char
- Method used for Capitalization rate: char
- Person(s) with whom data was verified: char
- Photographs of the comparable improvements: BLOB
- + Project_Parcel_ID: int
- Remaining economic life: char
- Rental Data of the comparable: char
- Similarities or dissimilarities - Economic characteristics: int
- Similarities or dissimilarities - Location: char
- Similarities or dissimilarities - Physical characteristics: char
- Similarities or dissimilarities - Time: char
- Size of the Improvements: char
- Source of rates and factors by appraiser: char
- Type of improvements: char
- Verification by the owner: char
- Zoning: char

Detailed Appraisal Evaluation

- Appraisal Purpose: char
- + Appraiser ID: int
- Approach used (sales comparison, cash approach, income approach): char
- Basis for Highest use being different from Present use (Legally and Economically): char
- Consideration of Easements: char
- Consideration of Leases: char
- Estate Definition: char
- Partial acquisition Statement of Value - Benefits to the remaining property: int
- Partial acquisition Statement of Value - Damages to the remaining property: int
- Partial acquisition Statement of Value - Property: int
- + Project_Parcel_ID: int
- Remarks: char
- Statement of assumptions and limiting conditions: char
- Statement of known and observed encumbrances: char
- Statement of Value - Real Property: int
- Strengths and Weaknesses of each approach: char
- Title Information: char

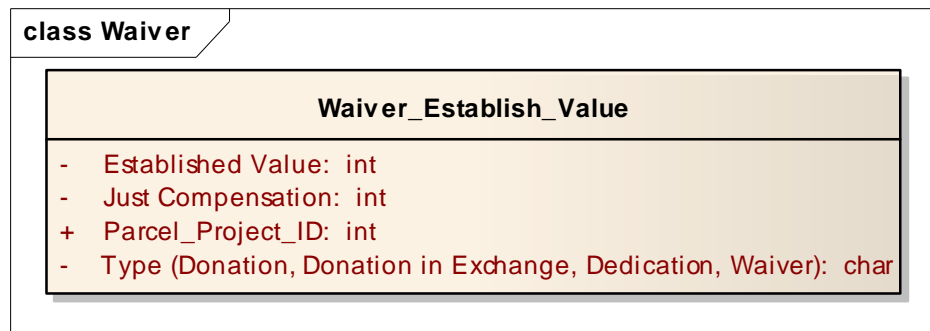
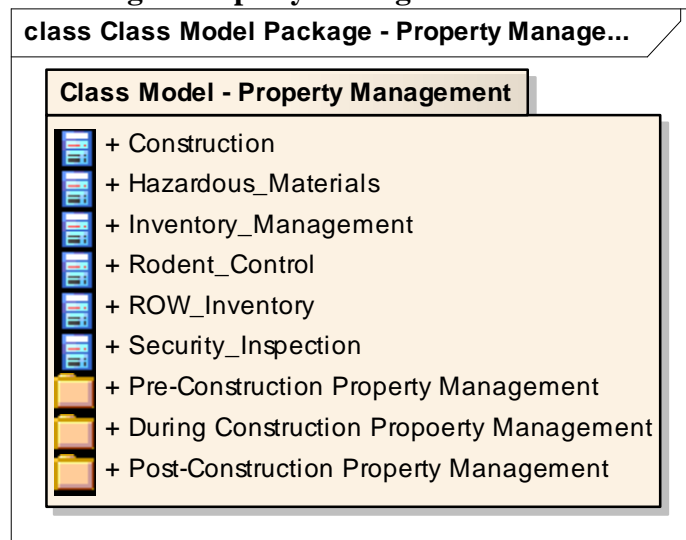
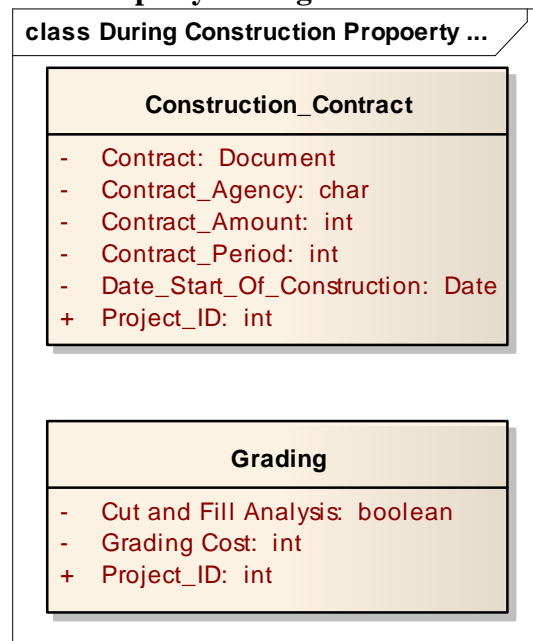
Diagram: Waiver**Diagram: Class Model Package - Property Management****Diagram: During Construction Property Management**

Diagram: Appraisal_Review

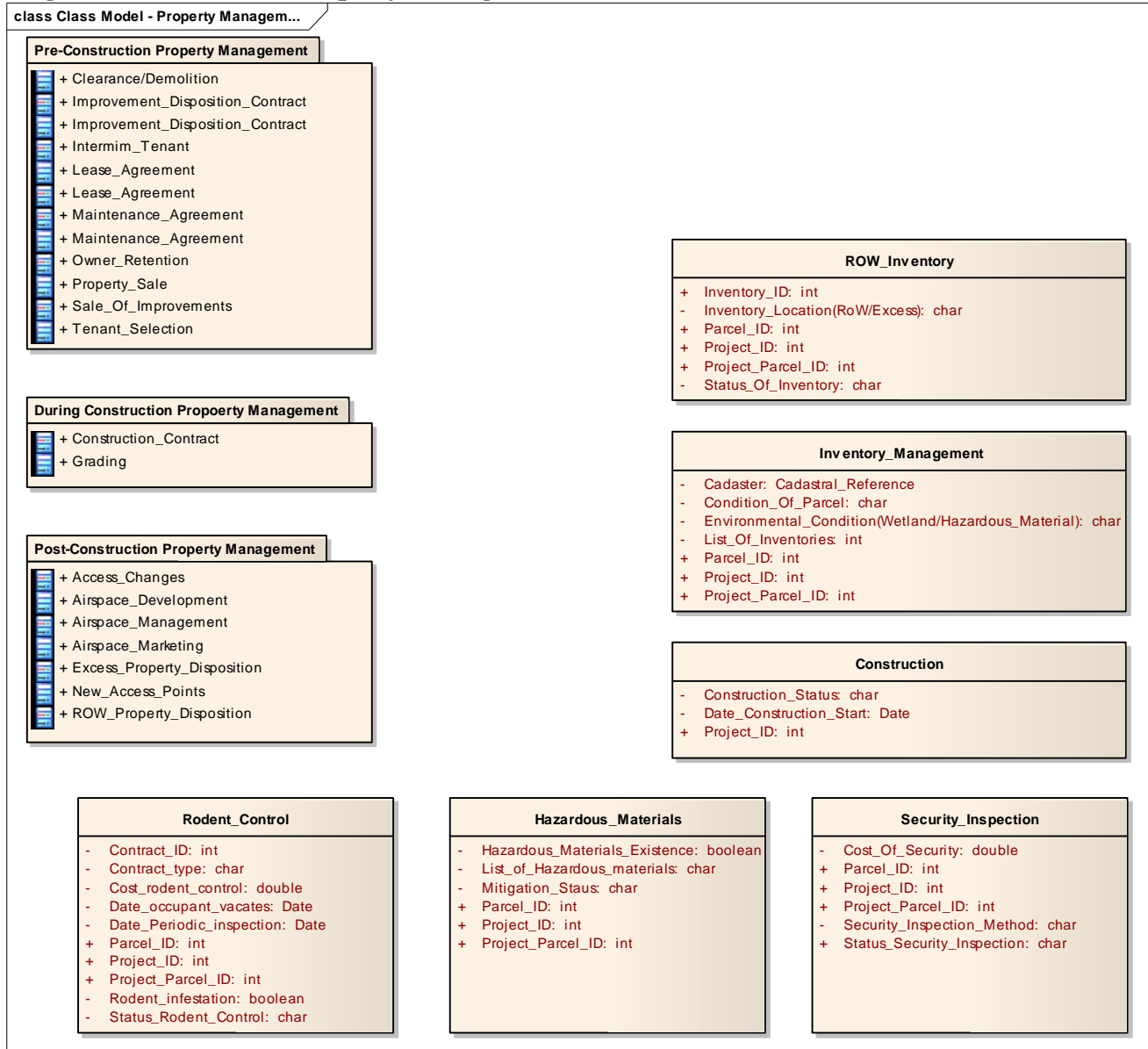
Diagram: Class Model - Property Management

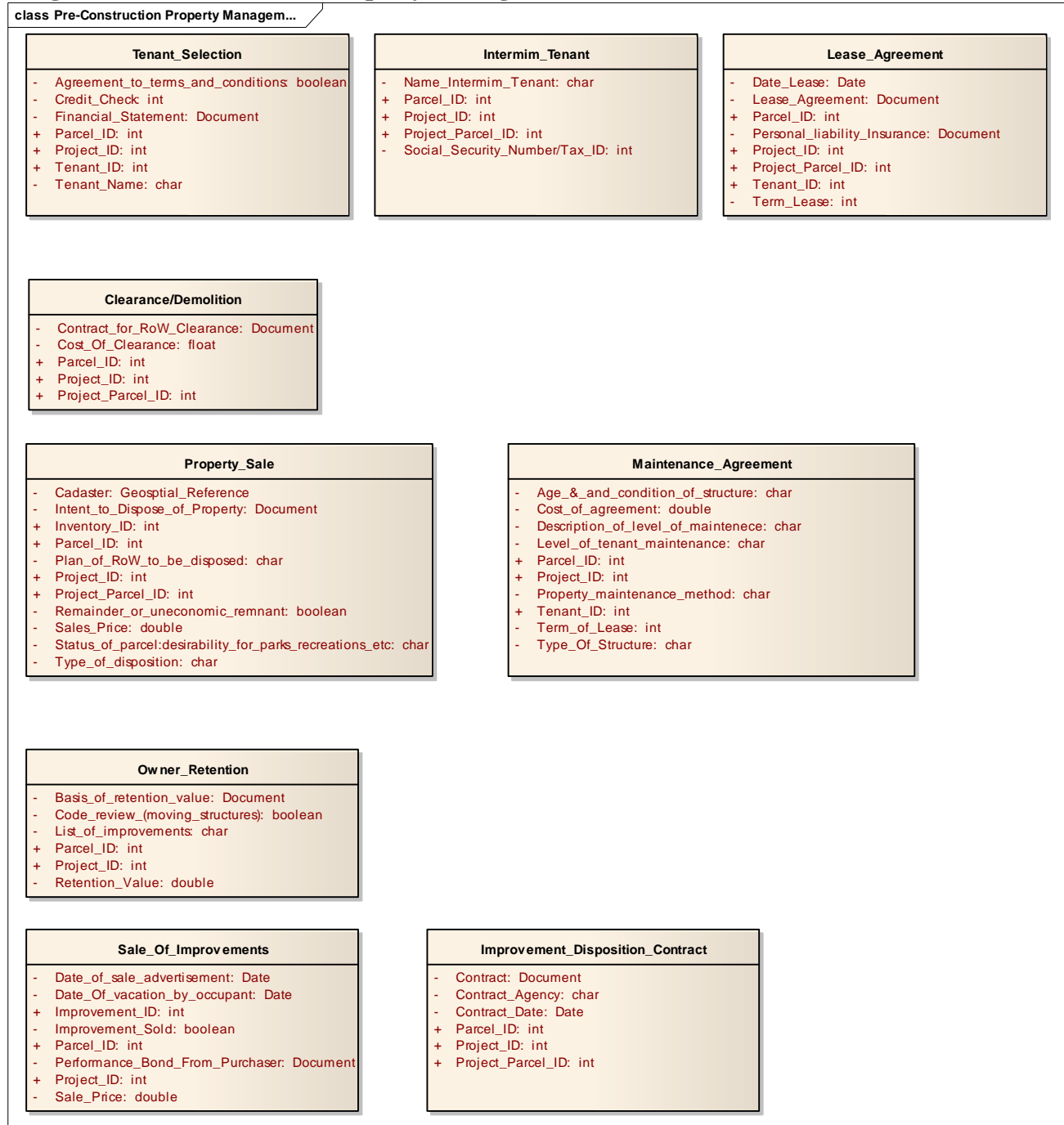
Diagram: Pre-Construction Property Management

Diagram: Post-Construction Property Management

class Post-Construction Property Managem...

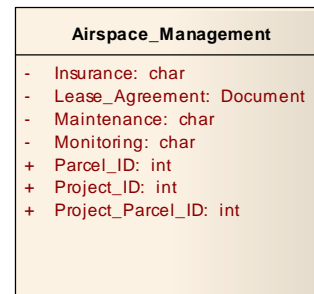
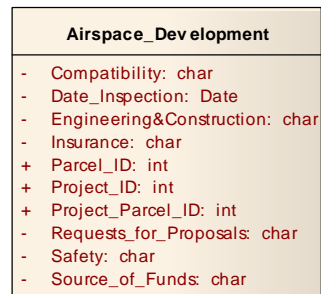
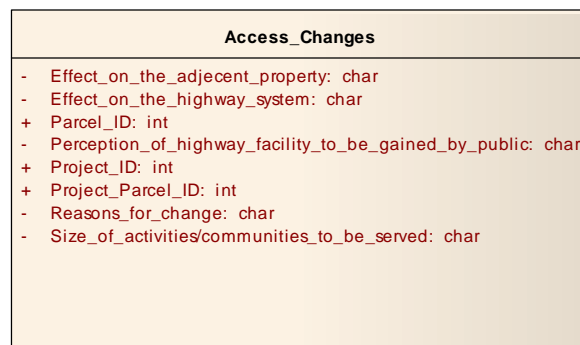
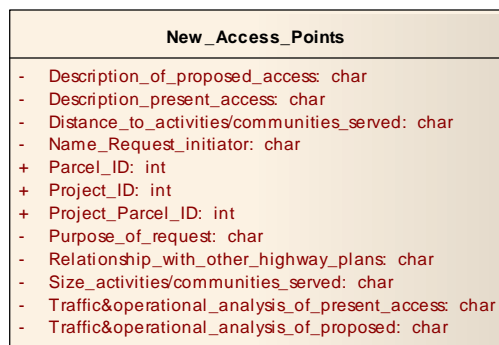
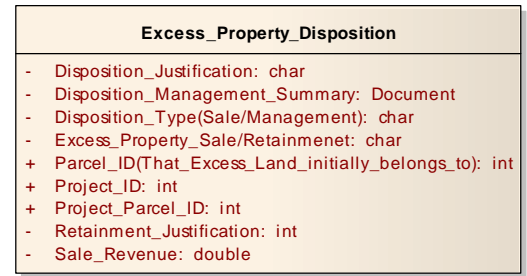
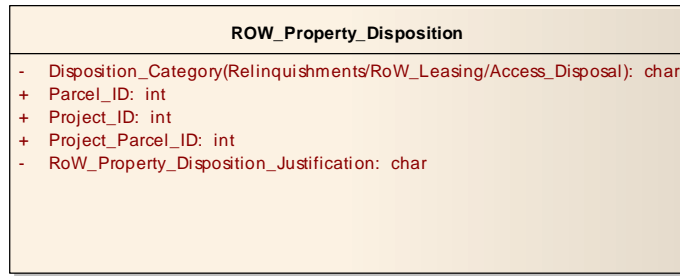


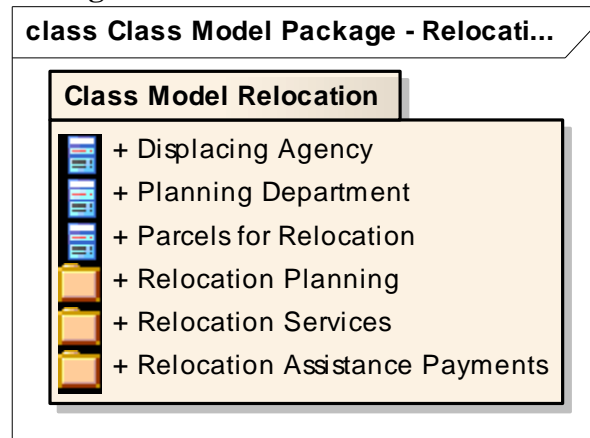
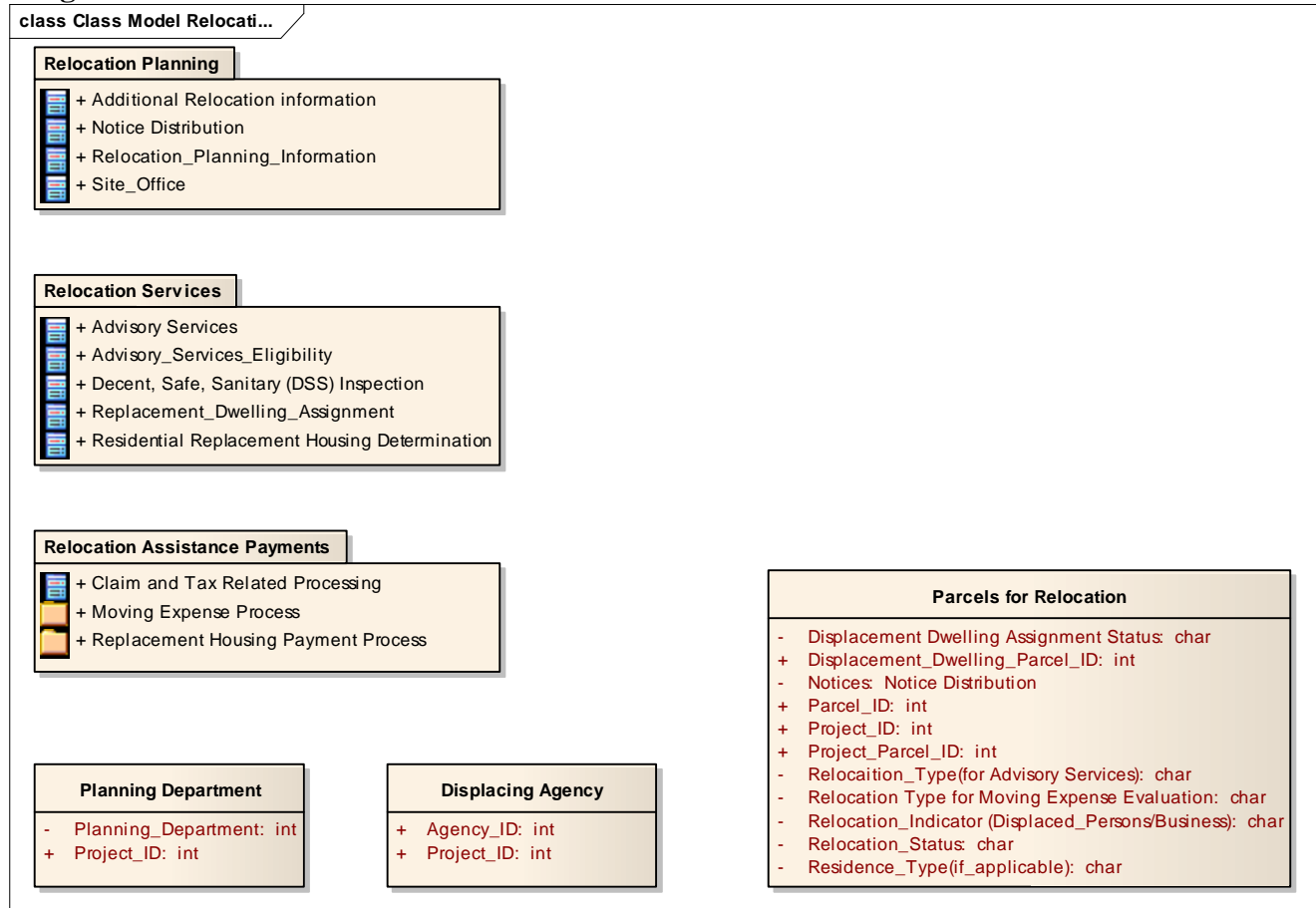
Diagram: Class Model Package - Relocation**Diagram: Class Model Relocation**

Diagram: Relocation Planning**class Relocation Planning****Site_Office**

- Hours of operation: char
- Location (point): Geospatial_Reference
- + Parcel_ID: int
- + Project_ID: int
- + Project_Parcel_ID: int
- + Relocation_Agent_ID: int

Relocation_Planning_Information

- + Parcel_ID: int
- Possible_shortage_of_dwellings_for_the_above_people: boolean
- Presence_of_large_families?: boolean
- Presence_of_Low-income_elderly_people?: boolean
- Presence_of_People_with_disabilities?: boolean
- + Project_ID: int
- + Project_Parcel_ID: int

Notice Distribution

- 90 day Notice (with 30 day specific notice distributed?): boolean
- Additional Information (if applicable): char
- Date_Of_General Information Notice: Date
- Date of initiation of negotiations: Date
- Date of locating at least one replacement dwelling: Date
- Date_Of_Date of issuing notice: Date
- Date_Of_Notice of Relocation Eligibility: Date
- General Information Notice Distributed?: boolean
- Information about advisory services: boolean
- Instructions about moving: boolean
- Language of notices: char
- Notice of Intent to Acquire distributed?: boolean
- Notice of Relocation Eligibility Distributed?: boolean
- + Parcel_ID: int
- + Project_ID: int
- + Project_Parcel_ID: int
- Relocation payments description: boolean
- Vacate property before Negotiations?: boolean

Additional Relocation information

- Basis for determination: char
- Denial_of_relocation_benefits_impacts_adversely_any_family_member: boolean
- Denial_of_relocation_benefits_impacts_adversely_the_continued_existence_of_family_unit: boolean
- Denial_of_relocation_benefits_impacts_adversely_the_health_or_safety_of_family_member: boolean
- Description of the comparable dwelling: char
- Each family member, either citizen or national of the US or legal alien in the US: boolean
- In case of incorporated business, farm, or nonprofit organization, corporation is authorized: boolean
- Individual, either citizen or national of the US or legal alien in the US: boolean
- Location: char
- Owner of unincorporated business, farm, or nonprofit organization, either citizen or national of the US or legal alien in the US: boolean
- + Parcel_ID: int
- Price used to set upper limit of replacement housing payment: int
- + Project_ID: int
- + Project_Parcel_ID: int
- Rent used to set upper limit of replacement housing payment: int
- Required certification: Document

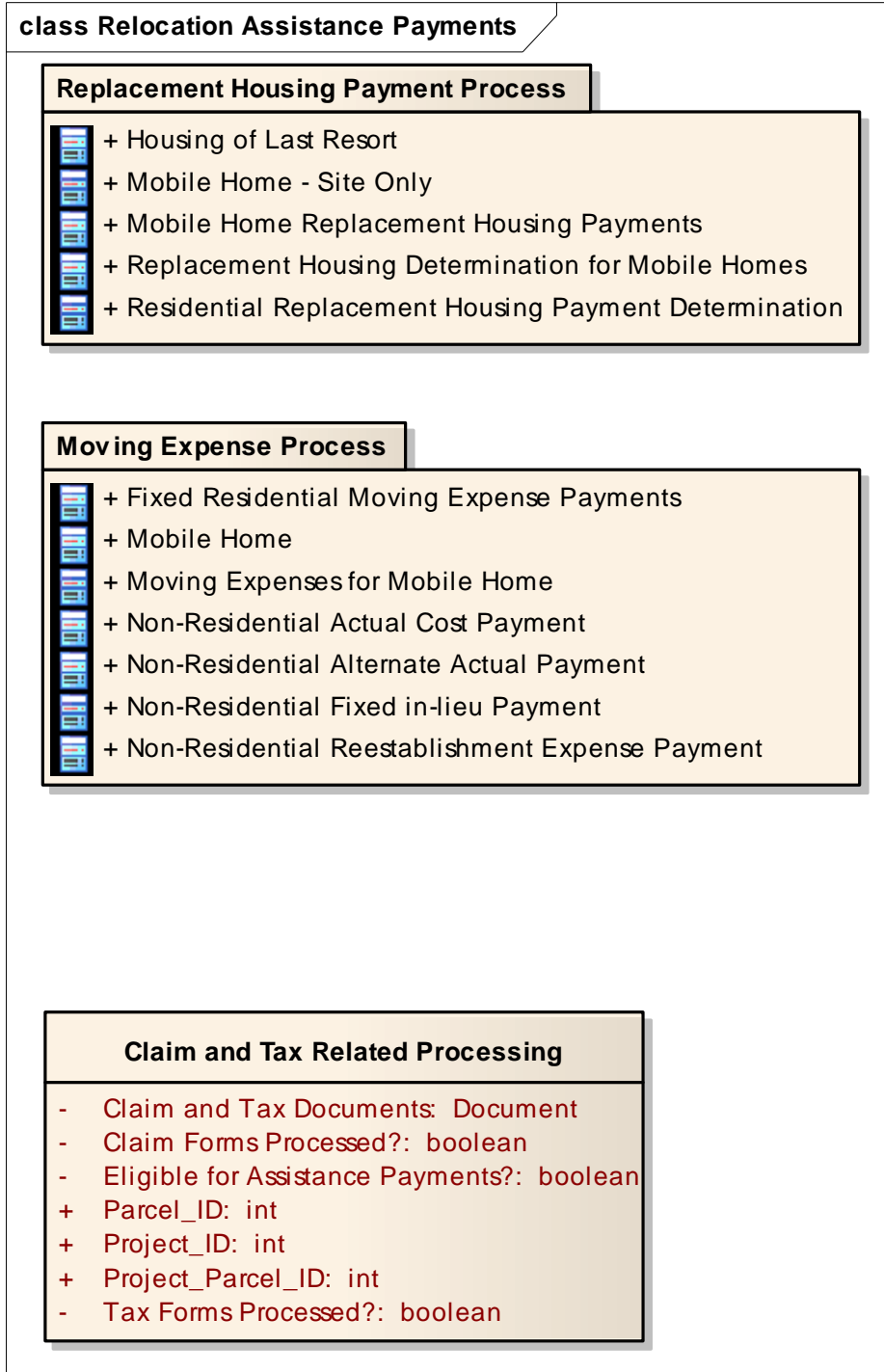
Diagram: Relocation Assistance Payments

Diagram: Moving Expense Process

class Moving Expense Proce...

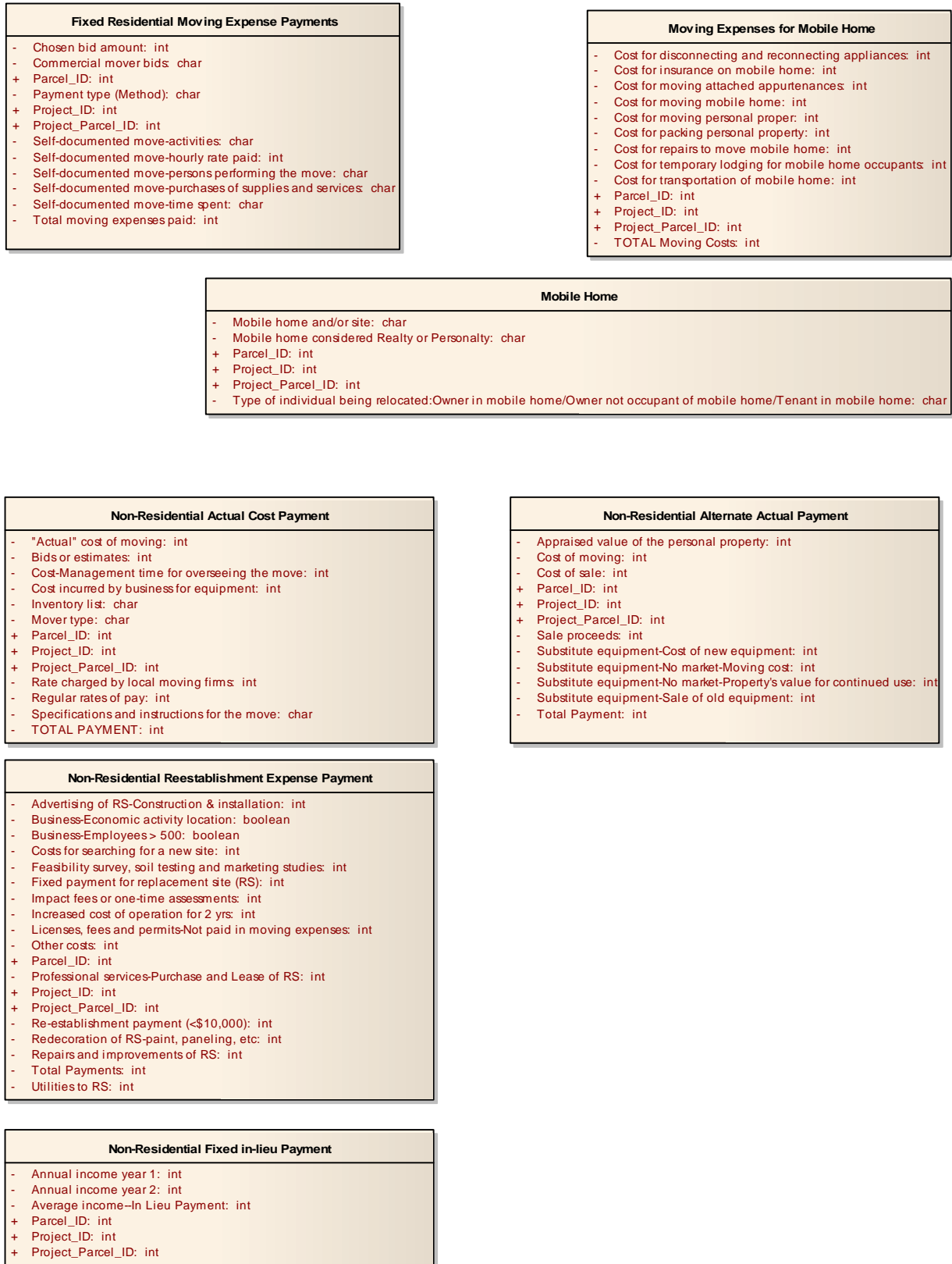


Diagram: Replacement Housing Payment Process



Diagram: Relocation Services**class Relocation Service...****Advisory_Services_Eligibility**

- Eligibility category: char
- Eligibility Description: char
- + Parcel_ID: int
- + Project_ID: int
- + Project_Parcel_ID: int

Advisory Services

- Advisory service(s) provided: char
- Agencies providing services: char
- Application or claim forms: Document
- Current listings: char
- Federal & state housing programs: char
- Other social services: char
- + Parcel_ID: int
- + Project_ID: int
- + Project_Parcel_ID: int
- + Relocation agent ID: int
- Transportation services: char

Replacement_Dwelling_Assignment

- DSS Inspection 2: Decent, Safe, Sanitary (DSS) Inspection
- DSS Inspection1: Decent, Safe, Sanitary (DSS) Inspection
- DSS_Inspection_Result_Notificatoin: boolean
- DSS_Inspectoin_Report_2: Document
- First_DSS_Report: Document
- + Parcel_ID: int
- + Project_ID: int
- + Project_Parcel_ID: int
- Replacement_Dwelling_Selected?: boolean

Residential Replacement Housing Determination

- Access to employment: char
- Access to public & commercial facilities: char
- Adverse environmental conditions: boolean
- Comperable Dwelling Notification: Document
- Currently available: boolean
- Location of replacement dwelling: Geosptial_Reference
- Number of comperable dwellings offered: int
- Other needs: char
- + Parcel_ID: int
- Physical condition of replacement dwelling: char
- + Project_ID: int
- + Project_Parcel_ID: int
- + Replacement dwelling ID: int
- Size of replacement dwelling: char
- Typical residential site: boolean
- Utility and cost of replacement dwelling: char

Decent, Safe, Sanitary (DSS) Inspection

- ADA Accessible: boolean
- Adequate in size: boolean
- Bathroom: boolean
- DSS Inspection: Document
- Electrical System: boolean
- Heating System: boolean
- Kitchen: boolean
- Local housing/occupancy code compliance: boolean
- + Parcel_ID: int
- + Parcel_Project_ID: int
- Potable Water: boolean
- + Project_ID: int
- + Replacement dwelling ID: int
- Structurally sound: boolean

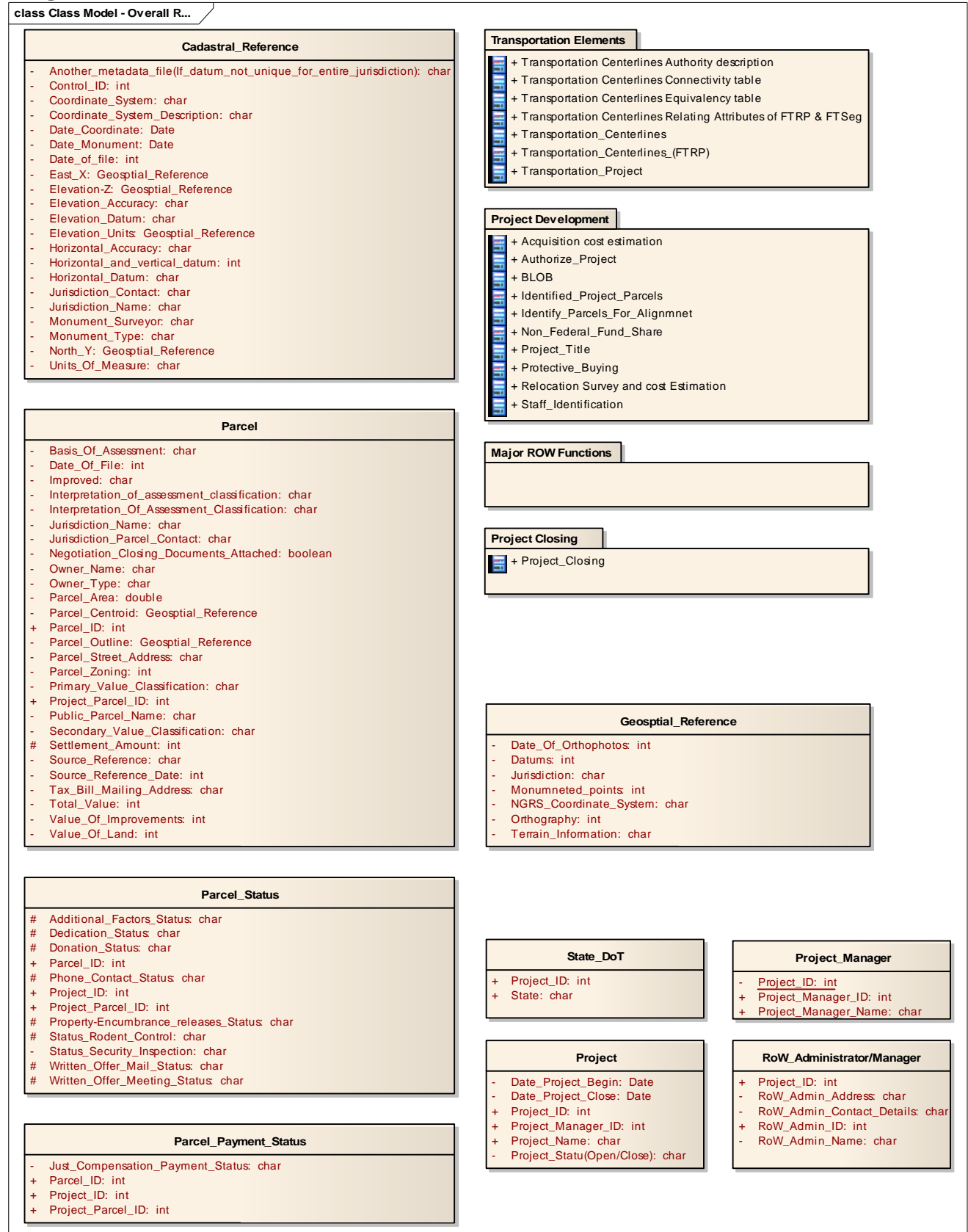
Diagram: Class Model - Overall ROW

Diagram: Project Development

class Project Developm...

Project_Title
<ul style="list-style-type: none"> + Project_ID: int - Title_Assurance: boolean - Title_Search_Method: char

Authorize_Project
<ul style="list-style-type: none"> + Project ID: int - Project_Transportation: Transportation_Project

Staff_Identification
<ul style="list-style-type: none"> + Project_ID: int - Staff_Address: char - Staff_Contact: char + Staff_ID: int - Staff_Name: char - Staff_Type(Assigned/Hired): char - Task_Responsibile: char

Identify_Parcels_For_Alignmnet
<ul style="list-style-type: none"> - Cadastre (Parcel): Parcel - Date Source Reference: Date - Parcel Photographs: BLOB - Parcel_Boundary: Transportation_Centerlines_(FTRP) + Parcel_ID: int - Parcel_Inspection: boolean + Project ID: int - Source Reference: char - Type_Of_Acquisition(Whole/Partial): char

Identified_Project_Parcels
<ul style="list-style-type: none"> - Cadastre (Parcel): Parcel - Date Source Reference: Date + Parcel ID: int - Parcel_Acquisition_Cost_Estimate: int - Parcel_Boundary: Transportation_Centerlines_(FTRP) - Parcel_RoW_Cost_Estimate: int + Project ID: int - Source Reference: char - Type_Of_Acquisition(Whole/Partial): char - Type_Of_Parcel(RoW/Unecomomic_Remnant): char

Acquisition cost estimation
<ul style="list-style-type: none"> - Initial_Total_Acquisition_Estimate: int + Project_ID: int + RoW_Administrato_ID: int

Protective_Buying
<ul style="list-style-type: none"> - Acquisition_Cost: int + Parcel_ID: int + Project_ID: int

Relocation Survey and cost Estimation
<ul style="list-style-type: none"> - Initial_Relocatoin_Cost_Estimate: int + Project_ID: int - Relocation_Details: Document - Relocation_Situation: char + RoW_Administrato_ID: int

Non_Federal_Fund_Share
<ul style="list-style-type: none"> - Fund_Amount: int + Project_ID: int - Source_Funds(Local/State/Credit): char

Diagram: Major ROW Functions

class Ma...

Class Model - Appraisal

- + Appraiser_Assignment
- + Appraiser_Candidate
- + Appraiser_Certificate
- + Appraiser_Contract
- + Initial_Review
- + Just_Compensation
- + Appraisal_Process
- + Appraisal_Review
- + Waiver

*(from Appraisal - Model)***Class Model - Acquisition**

- + Pre-Negotiation
- + Negotiation
- + Closing

*(from Acquisition - Model)***Class Model Relocation**

- + Displacing Agency
- + Planning Department
- + Parcels for Relocation
- + Relocation Planning
- + Relocation Services
- + Relocation Assistance Payments

*(from Relocation - Model)***Class Model - Property Management**

- + Construction
- + Hazardous_Materials
- + Inventory_Management
- + Rodent_Control
- + ROW_Inventory
- + Security_Inspection
- + Pre-Construction Property Management
- + During Construction Property Management
- + Post-Construction Property Management

*(from Property Management - Model)***Class Model - Overall RoW::
Parcel_Payment_Status**

- Just_Compensation_Payment_Status: char
- + Parcel_ID: int
- + Project_ID: int
- + Project_Parcel_ID: int

Diagram: Project Closing**class Project Closi...****Project_Closing**

- Any_Outstanding_Condemnations_Identified: boolean
- Encroacments_Identified: boolean
- Excess_Property_Disposed: boolean
- Final_Claims_Processed: boolean
- Project_Accountin_Closed: boolean
- + Project_ID: int
- Project_Plans_Reviewed: boolean
- Records_Stored_and_Accumlated: boolean
- RoW_Certification_Submitted: boolean

Diagram: Transportation Elements**class Transportation Elements****Transportation_Project**

- Alignment: Geospatial_Reference
- Alignment_From_end_point: Geospatial_Reference
- Alignment_To_end_point: Geospatial_Reference
- + Project_ID: int
- Right_of_way_limits: Geospatial_Reference

Transportation_Centerlines

- + Authority ID: int
- Date_Transportation_Centerline: Date
- From-End-Point: Geospatial_Reference
- FTSeg-Feature-Type (Optional): char
- Intermediate-Point(when_applicable): Geospatial_Reference
- Length-Accuracy-Measurement-Method: char
- Length (Optional and Recommended): int
- Path-Description: char
- State: char
- Status_Transportation_Centerline: char
- To-End-Point: Geospatial_Reference
- + Transportation-Segment-ID: int

Transportation_Centerlines_(FTRP)

- + Authority_ID: int
- Date_Centerline: Date
- Elevation: Geospatial_Reference
- FTRP-Feature_type: char
- Horizontal_accuracy: Geospatial_Reference
- Horizontal_accuracy_measurement_method: Geospatial_Reference
- Latitude: Geospatial_Reference
- Location_description: char
- Longitude: Geospatial_Reference
- Status_Transportation_Centerline: char
- + Transportation_Segment_reference_point_ID: int
- Vertical_accuracy: Geospatial_Reference
- Vertical_accuracy_measurement_method: Geospatial_Reference

Transportation Centerlines Authority description

- Authority-Address: char
- Authority-City: char
- Authority-Country: char
- Authority-Index-Access-Information: char
- Authority-Information (optional): char
- Authority-Postal-Code: int
- Authority-State-or-Province: char
- + Authority ID: int
- Authority Name: char
- Contact-Electronic-Mail - Address: char
- Contact-Facsimile-Telephone (optional): char
- Contact-Instructions: char
- Contact-Person-Primary: char
- Contact-URL (optional): char
- Contact-Voice-Telephone: char
- Date_Of_Creation: Date
- Status: char

Transportation Centerlines Relating Attributes of FTRP & FTSeg

- Attribute-Name: char
- Attribute-Value: int
- + Authority ID: int
- Date_Of_Creation: Date
- End offset: Geospatial_Reference
- Start offset: Geospatial_Reference
- + Transportation reference point ID or Segment ID: int

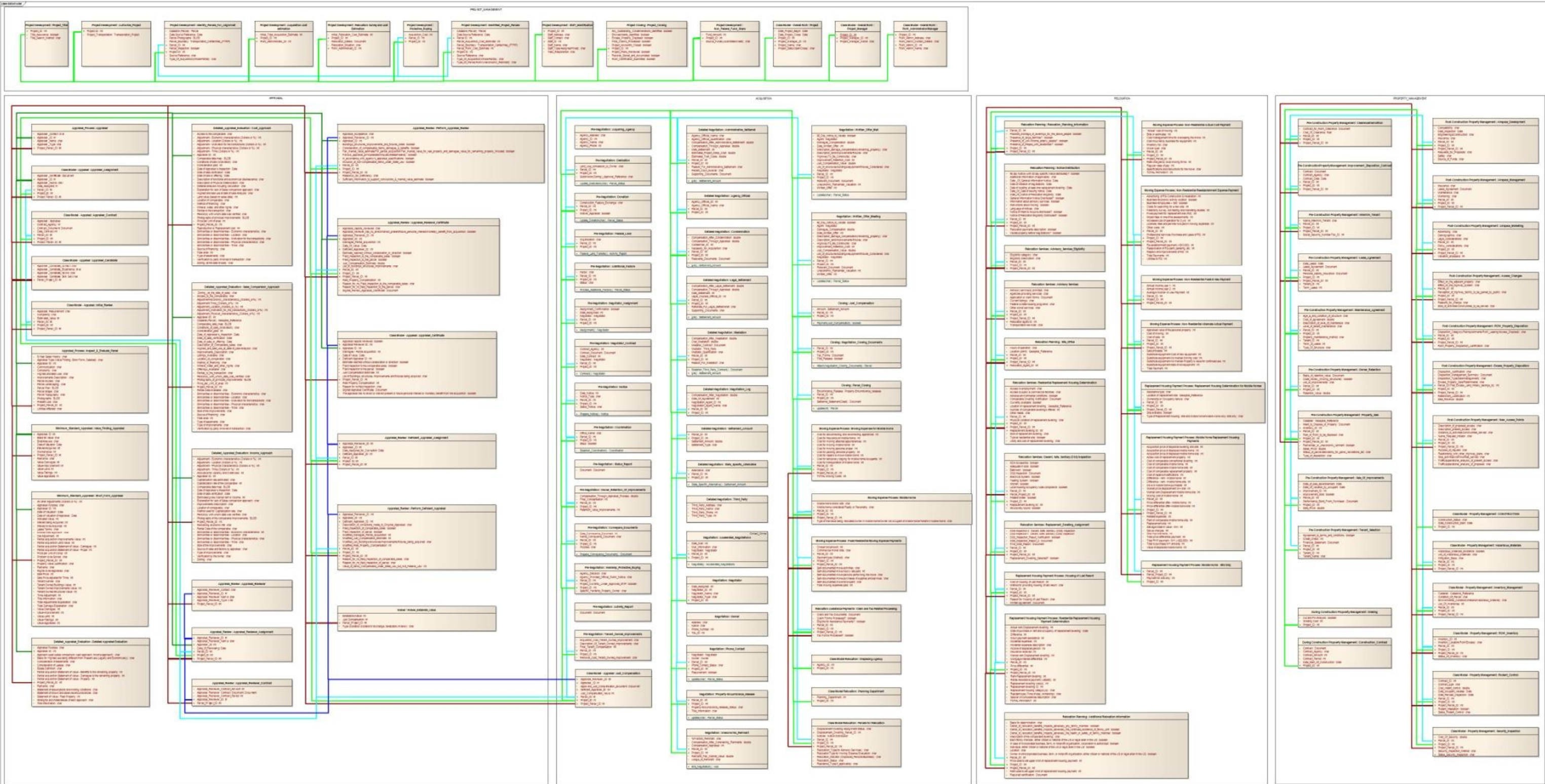
Transportation Centerlines Equivalency table

- Date_Of_Creation: Date
- End offset: Date
- + Equivalent_FTRP_ID or Equivalent_FTSeg_ID: int
- + Reference-FTRP-ID or Reference-FTSeg-ID: int
- Start offset: Geospatial_Reference
- Status: char

Transportation Centerlines Connectivity table

- + Authority ID: int
- Date_Of_Creation_Of_Connectivity: Date
- FTSeg-Offset-%: Geospatial_Reference
- Offset-%-Accuracy-Description: char
- Status_Centerline_Connectivity: char
- + Transportation-Segment-ID: int
- + Transportation Segment reference point ID: int

Diagram: overall data model Note: Use Zoom feature to see details of this diagram.



APPENDIX E ANNOTATED BIBLIOGRAPHY

The following documents relate to information management systems

Building a Successful ArcIMS based Transportation Corridor Property Acquisition Tool

D Herle, Latitude Geographics. (2007), Building a Successful ArcIMS based Transportation Corridor Property Acquisition Tool, Proceedings of the American Association of State Highway and Transportation Officials, Geographic Information Systems – Transportation, 20th Annual Meeting, Nashville, Tennessee.

Web page: <http://www.gis-t.org/files/aQFNU.pdf>

Category of ROW functions:	Property Acquisition
Information Management:	GIS
Type of article/study:	GIS-T Symposium presentation
Type of system:	Not identified
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

This presentation demonstrates the Property Acquisition Tracking (PAT) tool's key features with the intent of sharing best practices for managing MOT/DOT property acquisition application.

Summary:

This presentation describes the features of the Property Acquisition Tracking (PAT) tool which allows stakeholders involved in the acquisition of property adjacent to transit thoroughfares, to track the complex event flow involved with this process. The application includes powerful symbology tools to render property in different states of acquisition, allows for attribute editing from within the web application, includes advanced search tools, custom query, export to excel, advanced markup tools and document management. The built in security mechanism allows administrators to restrict access to property jurisdictions based on an agent's profile.

Engineering Design Data Management – Practices and Framework Development

C Quiroga and N Koncz, (2007), Engineering Design Data Management – Practices and Framework Development, Texas Transportation Institute, Research and Technology Implementation Office, Austin, Texas.

Web page: <http://tti.tamu.edu/documents/0-5246-1.pdf>

Category of ROW functions:	Other
Information Management:	Data management framework GIS
Type of article/study:	Technical Report
Type of system:	Various
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	Yes
Contact information:	Yes

Applicability:

This report summarizes research conducted to evaluate and document current engineering design data management practices at TxDOT.

Summary:

This report summarizes research conducted to evaluate and document current engineering design data management practices at TxDOT. The report also describes a prototype engineering data management framework to assist divisions and districts in their effort to manage engineering data effectively. The focus of the report is on data types; spatial and temporal data attributes, and associated documentation used during the design phase of typical highway improvement projects. The report summarizes procedures, practices, and systems TxDOT and other government agencies use for managing engineering design data; describes an integrated geographic information system (GIS)-based data model for engineering design data that complies with TxDOT data architecture requirements; and documents the results of tests completed on the engineering design data model by using offline and online testing environments.

Enhanced Coordination of Cadastral Information

F Harvey, (2005), Enhanced Coordination of Cadastral Information, Proceedings of the American Association of State Highway and Transportation Officials, Geographic Information Systems – Transportation, 20th Annual Meeting, Nashville, Tennessee.

Web page: <http://www.lrrb.org/pdf/200536.pdf>

Category of ROW functions:	Other
Information Management:	Map Inventory GIS
Type of article/study:	Report
Type of system:	Digital Inventory
Survey results:	No
Benefit/cost information:	No
Lessons learned:	Yes
Data elements:	No
Contact information:	Yes

Applicability:

This report presents the benefits of using the State Parcel Map Inventory (SPMI) and the benefits of coordination of cadastral and highway right-of-way information.

Summary:

Any project conducted by Mn/DOT that impacts property owners requires the coordination of cadastral (land ownership) and highway right-of-way information. The timely and accurate identification sharing and coordination of cadastral information is the basis for well-managed highway projects. Mn/DOT has already taken a step towards improving coordination between Mn/DOT offices and other government agencies with the State Parcel Map Inventory (SPMI), a resource with information about the status and accuracy of cadastral information in 87 Minnesota counties. Government agencies have seen the potential in the SPMI to better optimize data development and exchange through the use of GIS technologies. The finding of this project suggest that the SPMI is a starting point for helping coordination, but more targeted efforts are called for. Considering the heterogeneity of local government, individual relationships between organizational staff are crucial to overcoming institutional and technical obstacles.

Enterprise Content Management Systems (Right of Way)

Oregon DOT (2008), Enterprise Content Management Systems (Right of Way), Survey Request to the American Association of State Highway and Transportation Officials.

Web page:

Category of ROW functions: All

Information Management: Business Process Management automation tools
Electronic forms
GIS Tools

Type of article/study: Survey

Type of system: Not applicable

Survey results: Yes

Benefit/cost information: No

Lessons learned: No

Data elements: No

Contact information: No

Applicability:

This document consists of survey responses to ODOT's request for information about information managements systems.

Summary:

The second phase of ODOT's development of a Content Management System where they asked for state experience with Business Process Management automation tools, Electronic forms and GIS based tools to manage the acquisition of property and capture forms and data electronically where feasible.

They asked about systems that use some form of Content Management tools or other tools that electronically manage workflows and forms with a focus on web based tools (internet, intranet and extranet).

Florida Department of Transportation - Enterprise Geographic Information System (Establishing a Business Case)

J Casseaux and Thrakabhushanam, (2008), Florida Department of Transportation-Enterprise Geographic information System (Establishing a Business Case), Proceedings of the American Association of State Highway and Transportation Officials, Geographic Information Systems – Transportation, 21st Annual Meeting, Houston, Texas.

Web page: <http://www.gis-t.org/files/CrTlr.pdf>

Category of ROW functions:	Other
Information Management:	Enterprise GIS
Type of article/study:	GIS-T Symposium Presentation
Type of system:	GIS
Survey results:	No
Benefit/cost information:	Yes
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

This presentation describes the different phases of the development of an Enterprise GIS by the Florida Department of Transportation.

Summary:

As part of developing an enterprise GIS, FDOT first conducted a literature review pertinent to the concept of enterprise GIS and later evaluated the past efforts in terms of certain parameters. Later the term enterprise GIS was clearly defined and a business needs assessment was conducted for developing an enterprise GIS. The study also evaluated four enterprise GIS implementation options which were:

- No-Build case: Status-quo
- Pseudo-Enterprise GIS: Ad-hoc data sharing
- Enterprise GIS: Distributed data storage with enterprise standards
- Enterprise GIS: Centralized data repository

After evaluating the options by doing a cost-benefit and risk analysis, it was found out that the distributed enterprise GIS implementation was the most beneficial option with moderate risk.

Geographic Information System Application for Transportation Right-Of-Way

Federal Highway Administration, Planning and Policy Analysis Division, U.S. Department of Transportation (2008), Geographic Information System Application for Transportation Right-Of-Way, Office of Interstate and Border Planning and Office of Real Estate Services, United States, Federal Highway Administration, U.S. Department of Transportation, Lee's Summit, Missouri.

Web page: <http://www.gis.fhwa.dot.gov/documents/rightOfWay.asp>

Category of ROW functions:	All
Information Management:	GIS
Type of article/study:	FHWA Peer Exchange Report
Type of system:	Various
Survey results:	No
Benefit/cost information:	No
Lessons learned:	Yes
Data elements:	No
Contact information:	Yes

Applicability:

The report provides a summary of the presentations made and conversations held at the 2008 peer exchange on GIS in Right of Way (ROW).

Summary:

A peer exchange program, which was a follow up to a peer exchange held in August 2007 on the same topic, was held to provide the participants with an update on the progress of the National Cooperative Highway Research Program's (NCHRP) *Project 8-55A Developing a Logical Model for a Geospatial ROW Information Management System*, to allow participants from the 2007 peer exchange to describe the progress each has made over the last year in developing their respective GIS for ROW applications and finally; to give state DOTs with noteworthy GIS applications for ROW the opportunity to share their knowledge and experiences with each other and with state DOTs in the beginning stages of implementing GIS in the ROW area. The current report provides a summary of the events at the peer exchange.

Geographic Information System Implementation of State Department of Transportation Right-Of-Way

A. Saka, (2004), Geographic Information System Implementation of State Department of Transportation Right-Of-Way, United States, Federal Highway Administration, DTFH61-03-H-00121, Washington, DC.

Web page: <http://www.fhwa.dot.gov/realestate/rowsurvjuly04.htm>

Category of ROW functions: Planning & Management

Property acquisition

Property appraisal

Relocation assistance

Property/Asset management

Utility relocation management

Outdoor advertising control

Information Management: GIS

Type of article/study: Other

Type of system: Various

Survey results: Yes

Benefit/cost information: No

Lessons learned: Yes

Data elements: No

Contact information: Yes

Applicability:

The article reports the pros and cons of GIS implementation by various DOTs particularly in right of way (ROW) activities and suggests possible improvements that can be made to promote its use.

Summary:

This report, based on the case study of eight state DOTs, documents the extent GIS technology is used in the various right of way (ROW) functional areas. Based on a combination of literature review, survey and interview, the pros and cons of GIS implementation by various DOTs are presented and it was revealed that although the GIS technology is still very much localized and in its infancy, the state DOTs are aware of the opportunities GIS presents in streamlining the implementation processes of right of way (ROW) programs. The survey also revealed that the major hindrance to large scale GIS application in the state DOTs is the lack of time and personnel resources; and adequate allocation of resources is necessary in order to mainstream the use of GIS in the implementation of right of way (ROW) programs at the state DOTs. The report also includes the best practice methods of GIS implementation for ROW functional areas most likely targeted for GIS application.

Geographic Information Technologies for Asset Management – A Peer Exchange

Transportation Research Board, Transportation Asset Management Committee and Spatial Data and Information Science Committee (2006), Geographic Information Technologies for Asset Management – A Peer Exchange, Transportation Research Board, Kansas city, Missouri.

Web page: <http://onlinepubs.trb.org/onlinepubs/circulars/ec108.pdf>

Category of ROW functions:	Asset management
Information Management:	GIS
Type of article/study:	Peer Exchange Report
Type of system:	Various
Survey results:	Yes
Benefit/cost information:	No
Lessons learned:	Yes
Data elements:	No
Contact information:	Yes

Applicability:

This report describes the proceedings of a peer exchange program held to investigate the state and local agency applications of spatial technologies for asset management activities and to identify ongoing issues and research directions.

Summary:

The following document reports the proceedings of the peer exchange conducted by the Transportation Research Board (TRB) Transportation Asset Management Committee and spatial Data and Information Science Committee to investigate state and local agency applications of spatial technologies for asset management activities and to identify ongoing issues and research directions. Results of the questionnaires given to the participating organizations are provided and the issues related to implementation of a true spatial data warehouse for developing comprehensive asset management products were identified. The discussions of the peer exchange focused on three major issues areas in moving spatial technology applications to the next level: managing change, data integration, and communication. Upon a thorough discussion of these issues, the peer participants identified research to address three areas of interest: temporal issues, symbology, and data and visualization models. Finally the roles of national organizations in sharing best practices and in promoting standards and open data architectures are also reported.

Geospatially Enabling Information Management for Right-of-Way Activities

K Hancock, (2007), Geospatially Enabling Information Management for Right-of-Way Activities, Transportation Research Board 86th Annual meeting proceedings, Washington D.C

Web page: <http://pubsindex.trb.org/document/view/default.asp?lbid=801705>

Category of ROW functions:	All
Information Management:	GIS
Type of article/study:	Conference Article
Type of system:	GIS
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

This paper presents examples of various information systems used by various State department of Transportation and shows the benefits of a geospatial technology.

Summary:

Challenges associated with Right of Way (ROW) activities can often delay transportation projects and result in increased costs. Automation of ROW functions and development of information management systems, particularly when integrated with geospatial technologies, can substantially improve performance and resource management within Right of Way agencies. This paper presents several examples of different types of systems currently in use by state agencies and how these systems have impacted their activities. It also begins to address the issues associated with moving into an enterprise information structure.

GPS to LRM: Integration of Spatial Point Features with Linear Referencing Methods

S Hallmark (2001), GPS to LRM: Integration of Spatial Point Features with Linear Referencing Methods, Office Research and Special Programs Administration, U.S. Department of Transportation, University Transportation Centers Project MTC-A-4 and the Iowa Department of Transportation, CTRE Management Project 00-68.

Web page: <http://www.ctre.iastate.edu/reports/gpslrm.pdf>

Category of ROW functions:	Other
Information Management:	Data management
Type of article/study:	Technical Report
Type of system:	Other
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	Yes
Contact information:	Yes

Applicability:

The report evaluates the issues associated with integrating GPS data with a Linear Referencing Method (LRM)

Summary:

The following report summarizes the various issues in integrating point features with a LRM or between LRMs and recommendations are provided. The recommendations are based on a pilot study, where point features, linear datum, and a spatial representation of a LRM were created for six test roadway segments that were located within the boundaries of the pilot study conducted by the Iowa Department of Transportation linear referencing system project team. Topics relating to accuracy of GPS and loss of spatial information that occurs when a three-dimensional or two-dimensional spatial point feature is converted to one-dimensional representation on a LRM, are also discussed. Recommendations such as storing point features as spatial objects if necessary or preserving information such as coordinates and elevation are suggested. The lack of spatial accuracy characteristic of most cartography, on which LRM are often based, is another topic discussed. Finally some of the issues in transferring point feature data between LRMs are discussed.

Micro-Computer Based Real Estate Decision Making and Information Management – An Integrated Approach

P. Kershaw, R. Kooymans, & P. Rossini (1992), Micro-Computer Based Real Estate Decision Making and Information Management – An Integrated Approach, Department of Property Resource Management, University of South Australia, 2nd Australasian Real Estate Educators Conference.

Web page:

[http://www.unisanet.unisa.edu.au/staff/peterrossini/Documents/MICROCOMPUTER BASED REAL ESTATE DECISION MAKING.pdf](http://www.unisanet.unisa.edu.au/staff/peterrossini/Documents/MICROCOMPUTER_BASED_REAL_ESTATE_DECISION_MAKING.pdf)

Category of ROW functions:	General Real Estate
Information Management:	Information Management System
Type of article/study:	Conference Paper
Type of system:	Real Estate Information
Survey results:	No
Benefit/cost information:	No
Lessons learned:	Yes
Data elements:	Yes
Contact information:	No

Applicability:

This paper presents the research and development into an integrated Real Estate Decision Making and Information Management System.

Summary:

The introduction and acceptance of computers for use in the Real Estate industry is widespread. The use has been mainly limited to word processing, accounting, financial analysis and more recently limited use as an information management tool. However, there is little evidence of the use of any integrated system that allows for the direct analysis of data from a comprehensive, market-wide database. The aim of this research project is to develop such a system.

Nevada DOT's Integrated Right-of-Way Information Network Project

E Warmath and IRWIN coordination Team Member, (2008), Nevada DOT's Integrated Right-of-Way Information Network project, Proceedings of the American Association of State Highway and Transportation Officials, Geographic Information Systems – Transportation, 21st Annual Meeting, Houston, Texas.

Web page: <http://www.gis-t.org/files/GPSuY.pdf>

Category of ROW functions:	Property Acquisition
	Property Management
	Permits
	Billboards
Information Management:	GIS
	Document management
Type of article/study:	GIS-T Symposium Presentation
Type of system:	GIS, Internet services
Survey results:	No
Benefit/cost information:	No
Lessons learned:	Yes
Data elements:	Yes
Contact information:	Yes

Applicability:

This presentation summarizes the features of the Integrated Right of Way Information Network (IRWIN) application developed by the Nevada's DOT.

Summary:

This presentation summarizes the features of the Integrated Right of Way Information Network (IRWIN) application, developed by the Nevada's Department of Transportation. IRWIN consists of seven important modules for Geographic Information Systems (GIS), Videolog, Document management, Acquisition, Proper management, Permits, Billboards and Junkyards. All this modules put together form a complete GIS based Right-of-way information management system. The Graphical User Interface (GUI) for all the modules is shown and their features are explained. The things that are learned from the project and also its pros and cons are presented.

Peer Exchange on Applications of Geographic Information Systems in the Right-of-Way Area

Office of Interstate and Border Planning and Office of Real Estate Services, (2007), Peer Exchange on Applications of Geographic Information Systems in the Right-of-Way Area, United States, Federal Highway Administration, U.S. Department of Transportation, Lee's Summit, Missouri.

Web page: <http://www.gis.fhwa.dot.gov/gisrow.asp>

Category of ROW functions:	All
Information Management:	GIS
Type of article/study:	FHWA Report
Type of system:	Various
Survey results:	No
Benefit/cost information:	No
Lessons learned:	Yes
Data elements:	No
Contact information:	Yes

Applicability:

The following report provide a summary of the presentations made and the conversations held at the 2007 peer exchange program on GIS applications in Right-of-Way area.

Summary:

The Federal Highway Administration (FHWA) office of Interstate and Border Planning and Office of Real Estate Services sponsored a 1.5-day peer exchange program focusing on select State Departments of Transportation (DOTs) applications of the Geographic Information Systems (GIS) in the Right-of-Way (ROW) area. The purpose of the peer exchange was to allow State DOTs with noteworthy GIS applications for ROW to share their knowledge and experiences with each other and with State DOTs in the beginning stages of implementing GIS in the ROW area. This report provides a summary of the proceedings at the peer exchange program. An overview of the National Cooperative Highway Research Program's (NCHRP) project 8-55 was also given as part of the peer exchange program. This report serves as a resource for other DOTs and transportation agencies looking to learn more about successful implementations or planned implementations of GIS in ROW. Lessons learned by the participating DOTs are also presented at the end of the report.

Right Of Way Real Property Asset Management – Prototype Data Architecture

C. Quiroga, E. Kraus, N. Koncz, S. Lyle, Y. Li, (2009), Right of Way Real Property Asset Management – Prototype Data Architecture, Federal Highway Administration Technical Report, FHWA/Tx-09/0-5788-1, NTIS, Springfield, VA.

Web page: <http://tti.tamu.edu/documents/0-5788-1.pdf>

Category of ROW functions: Other: Right-of-Way Assets

Information Management: GIS

Data management

Type of article/study: Technical Report

Type of system: Data Architecture

Survey results: No

Benefit/cost information: No

Lessons learned: No

Data elements: Yes

Contact information: Yes

Applicability:

This report presents the results of a project to develop a prototype of a data architecture for right of way assets.

Summary:

The Texas Department of Transportation (TxDOT) is responsible for managing 1.1 million acres of land that provide right of way for approximately 80,000 centerline miles of state-maintained roads. Management of the huge right of way asset involves considerable resources and the integration of numerous business processes. There is an urgent need to develop a right of way asset data architecture to facilitate the inventory and management of TxDOT right of way assets. This architecture would facilitate the identification of current right of way boundaries, tracking of right of way boundary changes, automatic mapping of right of way surveying data to other layers of information such as control section job and route number locations, and complete attribution of right of way assets. It would also simplify the production of reports, including those needed to address financial reporting requirements. As part of the research, the researchers evaluated current right of way data practices at TxDOT and other agencies, and developed and tested a prototype geographic information system (GIS)-based right of way asset data model. The data model included a logical model, a physical model, and data dictionary, following current TxDOT data architecture standards and findings from recent research and implementation projects.

Risk-Based Framework Using Geographic Information Systems to Identify Transportation Corridors Vulnerable to Development

J. Lambert, A. Linthicum, E. Kim, L. Kincaid, S. Rash, G. Schmidt (2008), Risk-Based Framework Using Geographic Information Systems to Identify Transportation Corridors Vulnerable to Development, Federal Highway Administration Technical Report, FHWA/VTRC-08-CR8, NTIS, Springfield, VA.

Web page: http://www.virginiadot.org/vtrc/main/online_reports/pdf/08-cr8.pdf

Category of ROW functions:	Other: Corridor Preservation
Information Management:	GIS-based framework
Type of article/study:	Technical Report
Type of system:	GIS Application
Survey results:	No
Benefit/cost information:	No
Lessons learned:	Yes
Data elements:	Yes
Contact information:	Yes

Applicability:

This report presents the results of a project to develop a GIS system to evaluate transportation corridors.

Summary:

The Virginia Department of Transportation (VDOT) is increasingly involved with the land development process in evolving transportation corridors. This process includes consideration of real estate interests, rezoning and permitting approvals, site plans, public utilities, right of way, access management, and the transportation facilities themselves. Localities may compete with one another for economic development and withhold plans for developing corridors or may simply be unaware of development intentions. It is therefore important that VDOT transportation planners anticipate and proactively address future development along corridors to avoid surprise, regret, and belated action. With many thousands of miles of undeveloped corridors across the Commonwealth, VDOT must prioritize the corridors and corridor sections most in need of immediate attention. This study developed a comprehensive approach using geographic information systems (GIS) to identify and prioritize the needs for protection strategies in countywide corridors. Over eighty GIS data layers sourced from VDOT, Fauquier County, and others were evaluated to determine appropriate factors for the analysis.

Streamlining and Integrating Right-of-Way and Utility Processes With Planning, Environmental, and Design Processes in Australia and Canada

J. Campbell, G. Solomon, G. Fawver, R. Lorello, D. Mathis, C. Quiroga, B. Rhinehart, B. Ward, J. Zaharewicz, N. Zembillas (2009), Streamlining and Integrating Right-of-Way and Utility Processes With Planning, Environmental, and Design Processes in Australia and Canada, Federal Highway Administration Scan Report, FHWA-PL-09-011, NTIS, Springfield, VA.

Web page: http://international.fhwa.dot.gov/pubs/pl09011/rowu_web.pdf

Category of ROW functions:	All
Information Management:	GIS
Type of article/study:	Scan Report
Type of system:	GIS Application, Visualization
Survey results:	No
Benefit/cost information:	No
Lessons learned:	Yes
Data elements:	No
Contact information:	Yes

Applicability:

This report reports the results of an international scan on practices related to land acquisition in Australia and Canada.

Summary:

Many transportation projects require acquisition of land and accommodation of utility facilities in the right-of-way. The Federal Highway Administration, American Association of State Highway and Transportation Officials, and National Cooperative Highway Research Program sponsored a scanning study of Australia and Canada to learn about innovative practices for right-of-way and utility processes. The study complemented a 2000 study of European countries. The scan team identified nine priorities for U.S. implementation: promote incentive-based reimbursement for utility relocations, pursue corridor preservation strategies, use an alliance contract approach to integrate right-of-way acquisition and utility coordination, enhance cooperative relationships with property owners to facilitate timely property acquisition, develop geographic information system (GIS)-based right-of-way project and asset management systems, promote visualization techniques to communicate project impacts, promote use of multiple-level memorandum of understanding (MOU) structures, promote use of utility coordination best practices during construction, and develop a framework to establish proficiency of right-of-way and utility professionals.

System Planning to Support Spatially Enabled Business Process: Research of an Enterprise Geographic Information System for Transportation

Cambridge Systematics Inc and Data Transfer Solutions (2008), System Planning to Support Spatially Enabled Business Process: Research of an Enterprise Geographic Information System for Transportation, Florida Department of Transportation, Tallahassee, Fl.

Web page:

http://www.dot.state.fl.us/research-center/Completed_Proj/Summary_Map/FDOT_BDI40_rpt.pdf

Category of ROW functions:	Other
Information Management:	GIS
Type of article/study:	Final Technical Report
Type of system:	Enterprise GIS
Survey results:	No
Benefit/cost information:	Yes
Lessons learned:	Yes
Data elements:	Yes
Contact information:	Yes

Applicability:

This report presents the results of implementing an enterprise GIS within Florida DOT .

Summary:

This study formally analyzes the requirements and evaluates the business case for an enterprise system at FDOT. The project includes three tasks: 1 - Assemble and review literature germane to the concept of Enterprise GIS, including all previous work completed by the Department; 2 – Compare previous efforts against the adopted Information Systems Development Methodology (ISDM) manual, and identify missing products needed for evaluating a business case; 3 - Use pertinent information from past efforts to create or update missing products. As part of Task 3, business needs were analyzed through stakeholder interviews and data flow maps. Four implementation options were proposed: a no build case to maintain status quo (Option 1), a pseudo-Enterprise GIS for ad hoc data sharing (Option 2), a distributed Enterprise GIS with enterprise standards (Option 3), and a centralized Enterprise GIS (Option 4). These four options were evaluated using cost-benefit analysis and risk assessment. Based on the results of this analysis and considering current FDOT's environment, Option 3 was recommended as the preferred Enterprise GIS solution. Several critical success factors for successful implementation of this option were analyzed in detail, and recommendations were made.

Utility Installation Review System - 2008 Follow-Up Report

C Quiroga, J Le, and Y Li (2009), Utility Installation Review System - 2008 Follow-Up Report, FHWA/TX-09/5-2110-03-4, NTIS, Springfield, VA.

Web page: <http://tti.tamu.edu/documents/5-2110-03-4.pdf>

Category of ROW functions:	Other
Information Management:	GIS, Web application
Type of article/study:	Final Technical Report
Type of system:	GIS
Survey results:	No
Benefit/cost information:	Yes
Lessons learned:	Yes
Data elements:	No
Contact information:	Yes

Applicability:

This report presents the results of the follow-up to the implementation of the web-based GIS system for managing utility installation requests at TxDOT.

Summary:

In December 2007, the Texas Department of Transportation (TxDOT) received delivery of a web-based system that automates the submission, review, approval, construction, and archival of utility installation requests at TxDOT. The system, called Utility Installation Review (UIR), enables users to submit and process installation requests online, including supporting documentation such as design and construction drawings. The system also includes an online geographic information system (GIS)-based interface that enables users to locate and query proposed installation requests using an interactive map. This report summarizes the work completed in 2008 which consisted of maintaining the UIR software, conducting knowledge transfer, and providing technical support to district and utility company users in the five districts where UIR was active.

Washington DOT – Digital Archiving and Spatial Enabling Real Estate Management

Thompson B. S., (2008), Washington DOT – Digital Archiving and Spatial Enabling Real Estate Management, Proceedings of the American Association of State Highway and Transportation Officials, Geographic Information Systems – Transportation, 21st Annual Meeting, Houston, Texas.

Web page: <http://www.gis-t.org/files/svQmy.pdf>

Category of ROW functions:	Other
Information Management:	GIS,
Type of article/study:	GIS- T Symposium Presentation
Type of system:	Various
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

This presentation describes a web-based system proposed by the Washington- DOT which integrates all tabular and spatial databases and allows of retrieval of scanned documents.

Summary:

Washington- Department of Transportation proposed a web-based system which integrates all the tabular and spatial databases, and also allows for the retrieval of scanned documents. Methodology is provided to convert paper maps into digital maps, which are then integrated into Geographic Information Systems (GIS) and Computer Aided Design (CAD) and demonstration for same is same is provided. The role of different people involved in the development of such a system is also discussed. And finally the benefits of Real Estate Services (RES) GIS system and RES process changes are also presented.

Working GIS Miracles

T Lo, (2008), Working GIS Miracles, Planning, Volume: 74, Issue Number 2, American Planning Association.

Web page:

Category of ROW functions:	Other
Information Management:	GIS
Type of article/study:	Journal Article
Type of system:	Enterprise GIS
Survey results:	No
Benefit/cost information:	No
Lessons learned:	No
Data elements:	No
Contact information:	Yes

Applicability:

This article describes the development of a countywide enterprise GIS system for Washoe County in Nevada.

Summary:

This article describes how Washoe County in Nevada, upgraded its 20-year old geographic information system (GIS) system into a fully coordinated, countywide enterprise system. The original system was used only by the planning department and was incompatible with other departments. After a major flood in 1997 highlighted the shortcomings of the old GIS program, a new system was created. Currently, the county maintains 188 data layers in its central database, which is accessible by all GIS users and selected local agencies. The database provides seamless base mapping across jurisdiction boundaries within the county. The positional accuracy of spatial data and processing speed have both been greatly improved. Currently, 17 county departments use the GIS technology and mapping programs for a variety of uses including emergency vehicle deployments, property assessment, and defining mosquito spraying areas. Adapting the GIS to meet current needs required strong leadership, motivated technical staff, cooperation between departments and jurisdictions and an aggressive marketing plan.