OPEN EXPOSURE DATA (OED)

Version 2.1.0

(January 2022)

CONTENTS

The OED GitHub repository is also where you can report errors or submit feature requests.

PREAMBLE

Revision history

DOCUMENT VERSION	CHANGES FROM PRIOR VERSION
1.0	Original version
1.1	Includes changes related to OED 1.0.1
1.2	Includes changes related to OED 1.0.2
1.3	Correction of minor typos
1.4	Includes changes related to OED 1.0.4
1.5	Includes changes related to OED 1.1.0
1.6	Re-branded to Oasis Loss Modelling Framework and minor changes related to OED 1.1.2
2.0	Includes major changes related to OED v2.0.0. Mainly around additions to RI files
2.1	Includes minor changes to OED

License agreement

The content of the Open Exposure Data (OED) format itself is licensed under the CC0 1.0 Universal license.

Scope of document

This document provides a description of the OED scheme. It does not provide every field or input value, but instead focuses on the main OED areas and concepts. It should be read in conjunction with the specification in the Open Exposure Data Spec spreadsheet on:

https://github.com/OasisLMF/OpenDataStandards

This document does not describe the scope of functionality implemented within any particular Oasis-based platform.

In general, **the scope of OED will be wider than the scope of Oasis functionality** – the Oasis user should consult their platform specific documentation to understand exactly which features of OED work in a particular version of Oasis.

BACKGROUND TO OPEN EXPOSURE DATA (OED)

Rationale

The need for a new (re)insurance industry exposure data standard arose from the lack of such an existing standard for Oasis based models. Exposure data is the starting point for catastrophe risk analysis, and without such a standard in place it is impossible to give users guidance and documentation on how to prepare their input data and enable appropriate validation within Oasis based modelling platforms.

The Oasis financial model (FM) enables a wide variety of model developers to use one consistent financial model: it is a key part of the utility of the Oasis framework. However, it is important that financial fields in the exposure data correspond well with the financial model to enable the full scope of the financial model to be used. The OED has been designed from the outset to work well with, and enable the full functionality of, the Oasis FM.

The OED also provides companies with a starting point for implementing a model-developer-independent exposure data repository, which is strategically beneficial as it prevents firms being locked in to any one particular model developer.

Formation & acknowledgments

The work to create OED was carried out by a working group of industry practitioners chaired by Matthew Jones with the technical work led by Aiste Kalinauskaite both of NASDAQ (formerly Simplitium). We are very grateful to this group for their time commitment and support.

The openness of the CEDE code-set was extremely helpful to the development of OED. We thank AIR Worldwide for opening up their CEDE schema to the industry.

Scope

OED consists of an input format designed to enable data entry to catastrophe risk models.

Although OED is designed to work well with Oasis based models, **the scope of OED is wider than Oasis**. For example, financial fields exist in OED which are not implemented in Oasis yet and secondary modifiers exist in OED which are not currently used by any Oasis based model at the time this document is being written. **It is very important to bear in mind that just because an exposure data field is available, this does not mean it will be used by the Oasis framework or the particular Oasis based model being used.** Users should consult their platform / model specific documentation to understand which elements within OED are being used by a certain model at a particular time.

Documentation, access, governance

NASDAQ (formerly Simplitium) instigated the creation of OED and was the custodian of the OED format. However, as of 1st May 2020, this has migrated over to Oasis LMF.

The main location of OED documentation is now the Oasis LMF Github repository:

https://github.com/OasisLMF/OpenDataStandards

The full specification of fields, data types and permitted values is contained within the spreadsheet 'OED_DataSpec_v1.1.1'.xlsx in this repository.

Errors will be resolved as quickly as possible but any queries about OED can be submitted to info@oasislmf.org.

Terminology, assumptions, abbreviations

This document assumes a basic level of knowledge about catastrophe modelling. For example, it is assumed that the reader understands standard insurance, reinsurance and catastrophe modelling terminology. If this is not the case we recommend chapter 1 of *Natural Catastrophe Risk Management and Modelling: A Practitioner's Guide* as a good starting point.

Whilst creating OED we have tried, wherever possible, to stick to standard industry terminology. For example, ground-up loss refers to loss with no financial structures applied, gross loss refers to the loss to the insurer net of primary financial structures. Net loss refers to the loss to the insurer net of primary and reinsurance financial structures.

When we refer to an OED field name in the text this is indicated by using blue font.

When we refer to a standard OED value (within a field) this is indicated using red font.

The following abbreviations are used in OED field names:

Abbreviation	Description
Acc	Account
Agg	Aggregate
BI	Business interruption, but also used to denote other time-based coverage insurable values such as alternative living expenses
Cond	Condition (as in special condition such as sub-limit or sub-deductible)
Cov	Coverage
Ded	Deductible
Def	Defined (as in user defined)
FX	Exchange rate
LOB	Line of business
Loc	Location
Max	Maximum
Min	Minimum
Occ	Occurrence
Org	Original
PD	Property damage
POI	Period of indemnity
Pol	Policy
Port	Portfolio
Reins	Reinsurance
TIV	Total insurable value
Vuln	Vulnerability

OVERVIEW OF OED

The OED comprises four input files and over 20 relational tables.

The input files are designed to allow the user to enter data in a manageable way without needing to populate, and understand the relationship between, a large number of tables. This does mean that there are areas of inefficiency and duplication in the input tables: this is inevitable when trying to balance between practicality and efficiency. The four input files are described in the Input Format section.

The relational tables are designed to be an efficient representation of the exposure data. This allows users with database skills to access and query the data and ensures data storage requirements are kept to a minimum. This database schema section illustrates the relationship between the database tables.

Details about the input format and back-end table fields in OED are provided in the Open Exposure Data Spec spreadsheet within the OED GitHub repository: https://github.com/OasisLMF/OpenDataStandards

Hierarchy

OED follows an organisational and financial structure hierarchy that most users of catastrophe models will be familiar with. Specifically:

A **coverage** type represents the lowest structure within the OED hierarchy and constitutes the specific type of coverage within an insurance policy. Within OED this is defined as:

- Buildings

- Other (e.g. outbuildings – 'appurtenant' structures or motor)

- Contents

- Business Interruption (BI) or time element coverage

Primary financial structures such as limits and deductibles can be attached at coverage level as well as across property damage (PD = Buildings +Other Buildings + Contents) and across all coverages.

A **location,** or site, comprises a group of coverages at one particular location. Primary financial structures, such as limits or deductibles can be

applied at location level. Reinsurance financial structures, such as facultative reinsurance, can also be attached at location level.

Sometimes an individual location record will actually represent a number of buildings (but perhaps because of poor data quality only the main location is known). This can be represented using the NumberOfBuildings field.

Occasionally an insurer will have details about a number of individual locations that they wish to link in some way, for example a number of buildings on a university campus or on an industrial site. This can be achieved using the LocGroup field.

A **policy** is a specific type of financial structure that applies to a set of locations. The unique aspect of a policy is that multiple policies can exist under the same account and can apply to the same set of locations. An example of this is an insurance layer, where several layers can apply to the same underlying set of locations. Reinsurance can also apply at policy level.

Within a policy there is a hierarchy of financial terms as follows:

- A **special condition** is a type of policy level financial structure where financial conditions (such as sub-limits and sub-deductibles) apply to a subset of locations.

- **Standard policy level** financial structures apply after special conditions but before layers.

- **Layers** apply after special conditions and standard policy level financial structures.

Since multiple policies can apply to the same set of locations care must be taken when summing exposure or ground-up loss at policy level to avoid overcounting these metrics.

An **account** comprises a group of policies and locations (both are needed: you cannot have a policy without a location or a location without a policy). Primary and reinsurance financial structures can apply at account level.

An **account group** can also be specified (using the AccGroup field) which provides a means of grouping accounts together for reporting purposes. Financial structures cannot apply at account group level.

A **portfolio** comprises a number of accounts. Primary financial structures cannot apply at portfolio level, however reinsurance structures can.

The table below shows the different hierarchical levels in OED.

Hierarchy	Description	Primary financial terms	Reinsurance financial terms
Location coverage	Building, contents, business interruption (BI), other	Yes	No
Location	Defined through the LocNumber field; location level financial field names start with 'Loc'	Yes	Yes
Location group	Defined through the LocGroup field	No	Yes
Policy	Defined through the PolNumber field; within the policy level there is a hierarchy of financial terms: Special conditions apply first; field names start with 'Cond' Standard policy conditions apply after special conditions; field start with 'Pol'. Layers apply after special conditions; field names start with 'Layer'.	Yes	Yes
Account	Defined through the AccNumber field; account level financial term field names all start with 'Acc'	Yes	Yes

Account group	Defined through the AccGroup field	No	No
Portfolio	Defined by the PortNumber field	No	Yes

IMPORT FORMAT

The import format for OED is defined by four tables or files (we use the terms interchangeably):

- Location
- Account
- Reinsurance info
- Reinsurance scope

The fields in each table, whether each field is optional or required, and the data type for each field is described in the 'OED Input Fields' sheet in the OED specification spreadsheet. These details are not repeated in full in this document. Instead, the intention of this document is to describe the concepts behind each input file as well as highlighting some of the most important fields.

These tables are not the most efficient way to represent exposure data, however they aim to strike the right balance between efficiency and practicality when facilitating the input of exposure data into catastrophe models. They are described in turn in the following sections.

Location import table

This table contains details relating to each location. This includes details relating to the value and type of asset (including primary and secondary modifiers), geographical information, the perils covered and the financial structures within the insurance contract relating to the location.

This table is always required.

For simple cases, one location is represented by one row in the file. However, for cases with location level financial structures that vary by peril, or where multiple special conditions associated with a particular location exist, **one location can be represented by multiple rows.** This is necessary to allow the full complexity of financial contracts to be represented in a limited number of input tables.

For example, a simple location covering wind (WW1 – see the Perils section) and flood (OO1) with a 100 deductible for buildings (which applies to the combined loss from both perils if both perils happen in a single event) could be represented as follows:

LocNumber	BuildingTIV	LocPerilsCovered	LocPeril	LocDedType1Building	LocDed1Building
1	100,000	OO1;WW1	OO1;WW1	0	100

If the same location had a 100 deductible for wind but a 1000 deductible for flood, applying to losses from each peril separately, this would be represented in the location input file as shown below:

LocNumber	BuildingTIV	LocPerilsCovered	LocPeril	LocDedType1Building	LocDed1Building
1	100,000	OO1;WW1	WW1	0	100
1	100,000	OO1;WW1	OO1	0	1000

The field names in the example above are described further in the assets, geography and perils and financial structures sections.

The minimum set of fields in a location table is LocNumber, AccNumber, PortNumber, CountryCode, LocPerilsCovered, LocCurrency, BuildingTIV, ContentsTIV, BITIV and OtherTIV.

The full set of fields in a location import table can be found by filtering on 'Loc' in the InputFile column of the OED Input Fields sheet within the Open Exposure Data Spec spreadsheet. There are over 200 potential fields that could be used within the location table. However, it is not mandatory to use a field if there is no data to populate the field and so most OED location input files will contain far fewer than 200 columns.

Account import table

The account table contains details of the policies and accounts that exist within the import portfolios. Most of the fields in this table relate to financial structures, including special conditions.

This table is always required.

An account may contain multiple policies. Typically, each row will represent one policy. However, for cases with policy level financial structures that vary by peril or where a policy contains multiple special conditions, **one policy may have multiple rows** in the account file.

The minimum set of fields in an account table is AccNumber, AccCurrency, PolNumber, PortNumber and PolPerilsCovered.

The full set of fields in an account import table can be found by filtering on 'Acc' in the InputFile column of the OED Input Fields sheet within the OED specification spreadsheet. There are over 200 potential fields that could be used within the account table. However, it is not mandatory to use a field if there is no data to populate the field and so most OED account input files will contain far fewer than 200 columns. For example, if account level financial terms are not needed (i.e. financial terms that apply across groups of policies) then all the financial fields starting with 'Acc' can be omitted (removing the need for 48 fields). If special conditions are not needed another 48 fields can be excluded.

See the section on financial structures along with the examples for details of how the financial structure fields operate together.

Reinsurance info import table

The reinsurance info table contains details of the reinsurance contracts that relate to the underlying portfolios, accounts and locations. There must be exactly one entry per reinsurance contract in this table.

Any financial terms relating to reinsurance contracts should be entered in this table with the exception of the CededPercent for a surplus treaty (which should be entered in the reinsurance scope table).

For a list of the reinsurance financial terms available and examples about how to specify such terms see the reinsurance section and associated examples.

If there is no reinsurance, this import file is not required. If there is reinsurance, the minimum set of fields required is ReinsNumber, ReinsPeril, ReinsCurrency, InuringPriority, ReinsType, PlacedPercent.

ReinsNumber must be unique, as this links with the reinsurance scope file.

The full set of fields in a reinsurance info import table can be found by filtering on 'ReinsInfo' in the InputFile column of the OED Input Fields sheet within the OED specification spreadsheet. There are over 20 potential fields that could be used within the reinsurance info table.

However, it is not mandatory to use a field if there is no data to populate the field.

Reinsurance scope import table

The reinsurance scope file contains details of three different but related pieces of information:

- The scope of the reinsurance contract: i.e. which portfolios, accounts, locations are covered by a particular reinsurance contract

- The risk level of the reinsurance contract: i.e. for reinsurance contracts with financial structures relating to a 'risk', the definition of what risk means

- The CededPercent for a surplus treaty: which can vary for each risk covered by the treaty

The above three points are discussed in turn below.

The **scope** of what a reinsurance contract applies to is defined by the ten 'filter fields' available in the reinsurance scope file: PortNumber, AccNumber, PolNumber, LocGroup, LocNumber, CedantName, ProducerName, LOB, CountryCode, ReinsTag.

For example:

If a reinsurance contract applies to a particular portfolio 'A' then the value 'A' would be entered in the PortNumber field.

If reinsurance applies only to account B in portfolio A, then 'A' would be entered in the PortNumber field and 'B' would be entered **in the same row** in the AccNumber field. In other words, entering criteria in the same row essentially applies an AND condition.

Scope information relating to the same reinsurance contract can also be applied in separate rows: in this case each row would act like an OR condition for the filter. For example:

If PortNumber = 'A' is entered in one row and AccNumber = 'B' is entered in a separate row, then this means that the scope of the reinsurance policy would apply to all records that match the condition: all records in portfolio 'A' OR any records in account number 'B'.

If LocNumber is used as a scope filter then AccNumber and PortNumber must be specified too (otherwise LocNumber does not uniquely identify a location).

If PolNumber is used as a scope filter then AccNumber and PortNumber must be specified too (otherwise PolNumber does not uniquely identify a policy).

The RiskLevel of a reinsurance contract refers to the level at which 'risk' terms apply. A 'risk' can either be defined at Location 'LOC', Location Group 'LGR', Policy 'POL' or Account level 'ACC'. If a reinsurance contract does not contain risk specific terms then the RiskLevel field should be left blank. Note that it is not only per-risk treaties that have risk level terms. A facultative contract, a quota share treaty or even a catastrophe XL may also have risk level terms and thus require a risk level to be defined.

Although the reinsurance scope and the risk level are two different concepts, for facultative contracts and surplus treaties the OED format requires that the risk level for a particular contract also be used to define the scope of the contract. This is because these contracts, by their nature, either apply to individual risks (facultative) or have a ceded percent that varies by risk (surplus) and so to have scope defined by fields different to the risk level would cause ambiguity and confusion.

Surplus treaties require entry of CededPercent at the risk level. For example, if the risk level within a surplus treaty is location (LOC) then the user must list every location covered by the treaty in the LocNumber field (along with AccNumber and PortNumber to uniquely identify the location within the file) as well as the CededPercent for each location.

If there is no reinsurance, the reinsurance scope import file is not required. If there is reinsurance each reinsurance entry in the reinsurance info file must have at least one entry in the reinsurance scope file; some contracts will have multiple entries in the scope file.

The minimum set of fields required is: ReinsNumber and RiskLevel, at least one of the ten filter fields, and CededPercent for surplus treaties.

The full set of fields in a reinsurance scope import table can be found by filtering on 'ReinsScope' in the InputFile column of the OED Input Fields sheet within the OED specification spreadsheet. There are over 10 potential fields that could be used within the reinsurance scope table.

However, it is not mandatory to use a field if there is no data to populate the field.

For a list of the reinsurance financial terms available and examples about how to specify such terms see the [reinsurance](#) section and associated [examples](#).

ASSET RELATED DETAILS

The following sections describe the OED specification for the asset value, usage, construction, and other modifiers that can influence the susceptibility of an asset to damage from a peril.

Coverage total insurable value (TIV)

Total insurable value (TIV) for each property is captured in four location level fields:

- BuildingTIV: The total insurable value of the buildings.

- ContentsTIV: The total insurance value of contents and stock.

- BITIV: The total business interruption, or other time related, total insurable value.

- OtherTIV: The total insurable value for elements other than the main building / contents / time elements. Typically used to represent the TIV for outbuildings / appurtenant structures or motor TIV.

Total insurable value is not peril dependent. The currency of the TIV is specified in the LocCurrency field.

Occupancy type

Occupancy codes are stored in the OccupancyCode field. The occupancy type list is predominantly a one to one mapping from the AIR CEDE occupancy codes, although some extra codes have been added. The broad categories of code and the number ranges are shown in the table below.

OED OccupancyCode Range	Broad Category of Occupancy
1000	Unknown
1050 – 1099	Residential
1100 – 1149	Commercial
1150 – 1199	Industrial
1200 – 1249	Religion / Government / Education
1250 – 1299	Transportation
1300 – 1349	Utilities
1350 – 1399	Miscellaneous
2000 – 2799	Industrial Facility
3000 – 3999	Offshore

Although the code ranges above infer an extremely long list of codes there are less than 200 distinct occupancy codes in total. Yachts and automobiles are included under construction type codes rather than occupancy codes.

Some users may have translated from a different (original) occupancy code to the OED occupancy code but would like to store the original occupancy code information. This can be done using the OrgOccupancyScheme and OrgOccupancyCode fields.

Construction type

Construction codes are stored in the ConstructionCode field. The construction type list is predominantly a one to one mapping from the AIR CEDE construction codes, although some extra codes have been added. The broad categories of code and the number ranges are shown in table below.

OED ConstructionCode Range	Broad Category of Construction
5000	Unknown
5050 – 5099	Wood
5100 – 5149	Masonry
5150 – 5199	Concrete
5200 – 5249	Steel
5250 – 5299	Composite
5300 – 5349	Special
5350 – 5399	Mobile Homes
5400 – 5449	Bridges
5450 – 5499	Roads, Railroads, Runways
5500 – 5549	Dams
5550 – 5599	Tunnels
5600 – 5649	Storage Tanks
5650 – 5699	Pipelines
5700 – 5749	Chimneys
5750 – 5799	Towers
5800 – 5849	Equipment
5850 – 5899	Automobiles
5900 – 5949	Yachts
5950 – 5999	Miscellaneous
6000 – 6099	Marine Cargo General
6100 – 6149	Marine Cargo Combustible
6150 – 6199	Marine Cargo Non-Combustible
7000 - 7999	Offshore

Although the code ranges above infer a very long list of codes there are less than 200 construction codes in total.

Some users may have translated from a different (original) construction code scheme to the OED construction code scheme but would like to store the original construction code information. This can be done using the OrgConstructionScheme and OrgConstructionCode fields.

Other common modifiers

While different catastrophe models will use different modifiers to adjust the vulnerability of an asset, the following are the most commonly used modifiers:

- YearBuilt: the year the building was built. YearUpgraded, RoofYearBuilt are also modifiers that allow the user to add additional information.

- NumberOfStoreys: The total number of storeys in a building. BuildingHeight is also available for the user to add in the precise height of the building if this is known. FloorsOccupied allows the specific floors in the building that are occupied to be specified.

- NumberOfBuildings: The number of buildings represented by this location. This is commonly used to indicate the presence of aggregated data. If, instead, a user has specific details about different locations, but wants to denote a linkage of some kind between each location then the LocGroup field can be used to link individual locations (either for reporting purposes or to define a reinsurance 'risk' level). CorrelationGroup can be used to denote a correlation in secondary uncertainty between groups of locations.

- FloorArea & FloorAreaUnit: The total floor area occupied, summing the area of multiple floors.

Other modifiers, either peril specific or less commonly used by models, are available and are listed in the specification spreadsheet. They can be identified by filtering on the SecMod column in the 'OED Input Fields' sheet in the specification spreadsheet.

Flexi-tables

Despite the wide range of fields available in OED, there is always the possibility that a user needs to enter or store information without a corresponding OED field. This can be achieved through the flexi-table functionality within OED, which essentially provides a key-value pair back end table at the main hierarchical levels.

To enter additional field / values, a user can enter additional columns: FlexiLocZZZ, FlexPolZZZ, FlexiAccZZZ, where 'ZZZ' contains the name of the new field.

For example, if a user wants to store information on house colour, they could add an additional column to the location input file with the fieldname FlexiLocHouseColour.

The backend database location level flexi-table would then contain the following:

FlexiLocID	LocID	ModifierName	ModifierValue
1	1	HouseColour	Green
2	2	HouseColour	Blue
3	3	HouseColour	Red
4	4	HouseColour	Red

GEOGRAPHY AND PERILS

There are several aspects to geographical information in OED:

- Country codes

- Address information fields

- Geocoding information

These are discussed in the subsequent sections.

Country codes

Country codes are stored in the CountryCode field and are based on the ISO3166 alpha-2 codes with the following additions:

- XB = Bonaire

- XS = Saba

- XE = St Eustatius

- XW = Worldwide exposure (not used for modelling)

- Offshore regions have been added as a direct one to one mapping from AIR's CEDE offshore codes (the AIR three letter codes have been mapped to two-character codes for storage efficiency e.g. A1 for Alaska offshore)

Full details of the permitted code values are in the OED specification spreadsheet.

Standardised geographical fields

The following fields are available for capturing geographical information in OED:

- StreetAddress: The building number and street

- PostalCode: The predominant full resolution postal code used (e.g. 5-digit zip code in the US)

- City: City name

- AreaCode: Code representing typically the largest geographical division in a country (e.g. State code). See the Open Exposure Data Spec spreadsheet for a list of values.

- AreaName: Description of the AreaCode (e.g. State name)

Flexible geographical fields

The OED format caters for a wide variety of models from different model developers. In order to allow sufficient flexibility to cope with different user and model developer requirements, there are flexible geographical fields: GeogSchemeXX / GeogName1XX. The 'XX' need to be replaced by an integer so the name pairs become Geogscheme1/GeogName1 and OED can support up to ninety-nine pairs. These pairs allow model developers and users to define their own geographical schemes (defined by an appropriate *GeogScheme* code) each with a corresponding set of *GeogName* values.

For example, a model developer may want to split each country up into four equal areas 'A', 'B', 'C', 'D'. In this case they would define a new GeogScheme code e.g. 'QUAD'. They would communicate to users of their model that they must specify GeogName values 'A', 'B', 'C' or 'D' for their new 'QUAD' GeogScheme. The model user would then populate one of the GeogScheme / GeogName pairs with 'QUAD' and 'A', 'B', 'C' or 'D' respectively.

This provides a large amount of flexibility to cope with different user and model developer requirements.

GeogScheme codes are up to five characters (no special characters). The latest codes can be found in the Open Exposure Data Spec spreadsheet on the OED GitHub repository in https://github.com/OasisLMF/OpenDataStandards

Users can also specify their own schemes (e.g. for reporting purposes). The only requirement here is that any user defined scheme codes **must start with 'X'** in order to avoid a potential code clash with future model developer schemes.

Geocoding

Latitude and Longitude fields are available within OED. However, a latitude and longitude pair in isolation gives no indication as to the resolution of the geocode, the confidence in the geocode or the geocoder used to derive the latitude and longitude.

AddressMatch allows information about the resolution of the geocode to be captured. For example, whether the latitude / longitude pair represents the centroid of a large area (e.g. a State) or the centre of an individual building.

GeocodeQuality allows the capture of a number between 0 and 1 representing a confidence score associated with the geocode (1 denoting perfect confidence, 0 denoting zero confidence).

Geocoder is a free text field that allows capture of the name and version of the geocoding engine used.

Peril codes

The system for capturing which perils apply to different exposure elements and financial structures is designed to be flexible and extensible. Each peril is assigned a code. The way peril codes are represented in OED differs between the input files and the back-end tables as shown in the table below.

Peril	Input format peril code	Back-end table peril code
Earthquake - Shake only	QEQ	1
Fire Following	QFF	2
Tsunami	QTS	4
Sprinkler Leakage	QSL	8
Landslide	QLS	16
Liquefaction	QLF	32
Tropical Cyclone	WTC	64
Extra Tropical Cyclone	WEC	128
Storm Surge	WSS	256
River / Fluvial Flood	ORF	512
Flash / Surface / Pluvial Flood	OSF	1024
Straight-line / other convective wind	XSL	2048
Tornado	XTD	4096
Hail	XHL	8192
Snow	ZSN	16384
Ice	ZIC	32768
Freeze	ZFZ	65536
NonCat	BFR	131072
Wildfire / Bushfire	BBF	262144
NBCR Terrorism	MNT	524288
Conventional Terrorism	MTR	1048576
Lightning	XLT	2097152
Winterstorm Wind	ZST	4194304

Smoke	BSK	8388608
Drought Induced Subsidence	SSD	16777216
Crop Hail (from Convective Storm)	XCH	33554432
Cyber Security Data and Privacy Breach	CSB	67108864
Cyber Security Property Damage	CPD	134217728
Pandemic Flu	PNF	268435456
Volcanic Ash Cloud	VVA	536870912
Volcanic lava flow/eruption	VVE	107374182
Volcanic landslide/mudslide	VVL	2147483648

The back-end table codes are designed so that the code from each peril can be added to form a unique composite code which identifies which perils are covered – essentially using the binary system. For example, if both Earthquake and Fire Following are covered, the composite code is 1 + 2 = 3. Other examples of combinations are shown in the table below. This is an efficient way of storing information about perils. Bitwise operators (e.g. within SQL) can be used to quickly identify which perils are covered.

The input format codes are designed to be easier to populate and recognize by an analyst. The reason for the slightly counterintuitive form of some of the abbreviations is that they are designed so that a predominant peril can quickly be identified by searching for one particular character in the abbreviations: 'B' for Fire, 'O' for Flood, 'Q' for Quake, 'X' for Convective storm, 'Z' for Winter storm, 'W' for Wind, 'M' for Terrorism.

As well as the individual peril codes in the above table, there are also codes for common groupings of perils as shown in the table below.

Peril Group	Input Code	Back-end Code
Earthquake perils	QQ1	63
Windstorm with storm surge	WW1	448
Windstorm w/o storm surge	WW2	192
Flood w/o storm surge	OO1	1536

Winter storm	ZZ1	4308992
Convective storm	XX1	2111488
Convective storm incl. winter storm (for RMS users)	XZ1	6420480
Terrorism	MM1	1572864
Wildfire with smoke	BB1	8650752
Pandemic	PP1	
Crop	GG1	
Cyber	CC1	
All perils	AA1	16777215

There are several fields in the OED input tables for storing the peril codes.

Firstly, there are two fields that indicate whether or not a peril is covered for a particular location or policy: LocPerilsCovered and PolPerilsCovered respectively. These can be used to exclude a certain peril completely from a location or a particular policy.

Secondly, there are fields that indicate the perils that a particular level of financial structure covers: LocPeril, CondPeril, PolPeril, AccPeril and ReinsPeril. These indicate the perils that the financial terms (limits or deductibles) in that particular row of data apply to.

Note that this means there are two peril code fields at location and policy level (LocPerilsCovered / LocPeril and PolPerilsCovered / PolPeril). The LocPerilsCovered and PolPerilsCovered fields define the overall coverage for a location or policy irrespective of financial fields. This makes it much easier for the analyst to filter locations or policies that cover specific perils.

For all of these peril fields, the peril codes (either individual or peril-group codes) are entered separated by semi-colons. So for example, if a location covered wind (including all wind sub-perils) and earthquake (including all EQ sub-perils) then the users would enter 'QQ1;WW1' in the LocPerilsCovered field. If there is a policy level limit that only applies to wind, then the user would enter 'WW1' in the PolPerils field.

The way these peril codes have been designed means there is great flexibility in indicating the coverage or exclusion of perils and allowing different limits and deductibles to apply to different perils. Some examples of this are shown in the examples part of the next section.

FINANCIAL DETAILS – PRIMARY INSURANCE

OED is designed to allow a wide variety of complex financial structures – beyond that currently possible in Oasis or any other catastrophe modelling platform. To encompass such a variety of financial structures (e.g. different limits for different perils, or multiple policy special conditions) within a limited set of input files (two for primary insurance) it is necessary to allow multiple rows within each file for the same location or policy. The need for this will become clearer in the examples that follow.

The OED hierarchy is described in the overview section. Primary financial structures in OED can apply at the following levels:

- Location 'Loc'

- Special Conditions 'Cond'

- Policy 'Pol'

- Account 'Acc'

The above abbreviations are used consistently throughout OED (for example in the field names).

Limits, deductibles and minimum and maximum deductibles can be defined at each of these levels and can apply to different combinations of coverages at each of these levels as described in the next section.

Coverage values

Coverage values to describe which combination of coverage types a financial structure apply to are as follows:

Coverage Value	Description
0	No deductible / limit
1	Building
2	Other (typically appurtenant structures)
3	Contents
4	Business Interruption (BI)
5	Property Damage (PD: Building + Other + Contents)
6	All (PD + BI)

These coverage values (1 to 6) are embedded in the input field names (as shown in the examples). They are also used as values (0 to 6) in the back-end tables.

Deductible and limit types

The deductible and limit type fields describe whether the deductibles and limits are flat monetary amounts, or percentages of TIV, or percentages of loss:

Type	Description
0	Deductible / limit is flat monetary amount
1	Deductible / limit is a percentage of loss
2	Deductible / limit is a percentage of TIV

There are multiple 'Type' fields containing the values in the table above, each representing a different combination of hierarchy, financial structure kind and coverage.

Deductible and limit codes

The deductible and limit code fields describe how the deductibles and limits operate.

The options for deductible codes are as follows:

Deductible Code	Description
0	Regular: applies to an individual loss (or the sum of losses from an individual event depending on the hierarchy level of application)
1	Annual aggregate: applies to the sum of losses over a year
2	Franchise deductible: disappears when the franchise level is reached
3	Non-ranking deductible: a deductible that does not count (or 'rank') towards a maximum annual aggregate deductible
4	Residual deductible: A deductible (normally lower than the regular deductible) that applies after a maximum annual aggregate deductible amount is reached
5	CEA Homeowners: A specific type of deductible applying in a California Earthquake Authority (CEA) Homeowners policy
6	CEA Homeowners Choice: A specific type of deductible applying in a California Earthquake Authority (CEA) Homeowners Choice policy

The options for limit codes are as follows:

| Limit Code	Description
0	Regular: applies to an individual loss (or the sum of losses from an individual event depending on the hierarchy level of application)
1	Annual aggregate: applies to the sum of losses over a year

Structure of financial field names

There are multiple financial fields to store the 'Type', 'Code' and actual values for the different deductible and limits reflecting the different variations of:

- What hierarchy the financial structure applies at: 'Loc', 'Cond', 'Pol' or 'Acc'

- Whether the financial structure is a limit or deductible or maximum or minimum deductible: 'Ded', 'Limit', 'MaxDed' or 'MinDed'

- The coverage that the financial structure applies to ('1Building' to '6All')

This is illustrated below:
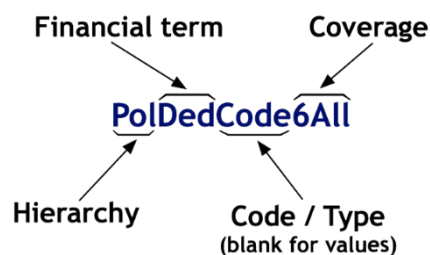
For example:

LocDedCode1Building is the field in the location input file that contains the code for the deductible applicable to losses from building coverages.

AccLimitCode6All is the field in the account input file that contains the code for the limit applicable to losses from all coverages at account level.

PolDed6All is the field in the account input file that contains the value of the deductible applicable to losses from all coverages at policy level.

LocMaxDed1Building is the field in the location input file that contains the value of the maximum deductible applicable to losses from the building coverage.

CondLimitType6All is the field in the account input file that contains the type of limit applicable to losses from all coverages for a special condition.

The reason for having both the coverage value (1 to 6) as well as spelling out the coverage kind in the input field names is so that the users of OED can easily associate the value numbers with the coverage types. In the back-end tables only the values are stored.

Policy special conditions

Policy special conditions are financial structures that apply to only a subset of locations within a policy. They apply after all location terms, but before any blanket policy terms or layer terms.

These require four types of information: (1) the scope of the condition telling us which locations are included, (2) the financial terms of the condition, (3) the classification of the condition and (4) the order in which the special conditions apply – i.e. does a special condition apply before or after other special conditions that apply to the same locations.

The scope of each special condition is specified using a CondTag on each location (in the location input file) that corresponds with the CondTag in the account input file.

A unique set of financial terms and a classification is identified by the CondNumber field in the account file.

The specification of the financial details of the condition is done in the same way as any other financial structure within OED but using the field names starting with 'Cond'. All of the coverage values deductible and limit types and codes can be used for a special condition to specify how the special condition financial structures work.

Furthermore, there are two classifications of special conditions which are identified by the CondClass field in the account file. A value of 0 means 'Sublimit' and a value of 1 means 'Policy restriction'. The difference between them is what happens to losses for locations under the account that are not under the scope of the condition.

- When the condition is a sublimit - the locations that are outside of scope of the condition will contribute loss to the policy on the account.

- When the condition is a policy restriction - the locations outside of scope of the condition **will not** contribute loss to the policy on the account.

Policy restrictions can be used to vary the locations that contribute loss to each policy under the same account, by having a different condition for each policy.

Special conditions are defined in the OED account input file and must have a CondNumber and CondTagin this input file. If multiple special conditions apply within the same policy, then multiple rows (with the same PortNumber, AccNumber and PolNumber but different CondNumber and CondTag) must be used. The same CondNumber may be applied to more than one CondTag, if the financial terms are identical.

If the special condition financial terms vary by policy, then a different CondNumber should be used for each unique set of terms. However, the CondTag should not vary for each CondNumber, and the locations should be tagged with CondTag only once per location in the location file.

There is one exception to this rule where there are multiple heirarchal conditions on the same location. The order in which special conditions apply is specified through the CondPriority field in the account input file: if multiple special conditions **at different priorities** apply to the same location then multiple rows must be used in the location input file. Each location row will be identical apart from CondTag and which denote the special conditions grouping applying to the location for each condition.

See example 4 in the financial structures' examples section for an illustration of how special conditions are specified.

Participation fields

The following fields are available to reflect that an insurer may only have a share of a primary policy or location:

LayerParticipation represents the share that an insurer has in a policy.

LocParticipation represents the share that an insurer has in a particular location. Occasionally there are cases when this can vary within a policy (e.g. binders or offshore) and so this field is provided to allow flexibility in these circumstances.

Currencies

Three currency fields are available:

- **LocCurrency** contains the currency in the location file and specifies the currency for TIV and location level financial terms.

- **AccCurrency** contains the currency in the account file and specifies the currency for special condition, policy and account level financial terms.

- **ReinsCurrency** contains the currency in the reinsurance file and specifies the currency for reinsurance financial terms.

The currency code values are predominantly those contained within the ISO4217 standard although older (for example pre-euro) codes are also allowed.

Examples of specifying primary financial structures

The following examples illustrate the principles discussed in the previous sections. Not all required fields are shown in the examples below – only those needed to illustrate the principles highlighted.

Example 1 – Personal lines with coverage deductibles

Personal lines data often has one location per policy / account, with financial terms only applying at location-coverage or location level. There are two ways that this could be represented in OED, either using one account / policy per location or using an account / policy to represent multiple locations reflecting some natural grouping of personal lines policies. The latter approach is more space efficient. Both approaches are described below.

The tables below show 3 locations, all with the same 100,000 buildings TIV and deductibles that apply at the building's coverage level. Location 1 has a monetary (DedType = 0) deductible of 200, location 2 has a 1% of TIV deductible (DedType = 2) and location 3 has a 5% of loss deductible (DedType = 1).

The OED Account and Location tables using the first approach are as follows:

OED Account table:

AccNumber	PolNumber
PolRef1	PolRef1
PolRef2	PolRef2
PolRef3	PolRef3

OED Location table:

LocNumber	AccNumber	BuildingTIV	LocDedType1Building	LocDedCode1Building	LocDed1Building
1	PolRef1	100,000	0	0	200
2	PolRef2	100,000	2	0	0.01
3	PolRef3	100,000	1	0	0.05

Note that LocDedCode1Building = 0 which means the deductible is a standard type (not an annual aggregate or franchise etc.) This field is not actually required for standard deductibles – it would default to 0 if not provided.

Not all required fields are shown in the tables above; specifically, PortNumber, AccCurrency and PolPerilsCovered are required in the account table, and PortNumber, LocPerilsCovered, CountryCode, OtherTIV, ContentsTIV, BITIV and LocCurrency are required in the location table.

The second way of representing personal lines data is to group all locations under one 'policy' but provide the true policy reference in the LocNumber field, as shown below:

OED Account table:

AccNumber	PolNumber
1	1

OED Location table:

LocNumber	AccNumber	BuildingTIV	LocDedType1Building	LocDedCode1Building	LocDed1Building
PolRef1	1	100,000	0	0	200
PolRef2	1	100,000	2	0	0.01
PolRef3	1	100,000	1	0	0.05

This is a more efficient approach as the size of the account table is much smaller which is relevant since personal lines portfolios can easily contain several million locations.

Example 2 – Commercial lines – multiple locations per policy with location and policy deductibles and a policy limit

The tables below show an example of a commercial portfolio with 3 accounts, each with 2 locations. Each location has a coverage deductible and there is an overall policy deductible and an overall policy limit.

OED Account table:

AccNumber	PolNumber	PolDedType6All	PolDed6All	PolLimitType6All	PolLimit6All
1	1	0	50,000	0	1,500,000
2	1	2	0.05	0	1,500,000
3	1	1	0.10	2	0.80

OED Location table:

LocNumber	AccNumber	BuildingTIV	LocDedType1Building	LocDed1Building
1	1	1,000,000	0	10,000
2	1	1,000,000	2	0.01
3	2	1,000,000	1	0.05
4	2	2,000,000	0	15,000
5	3	2,000,000	0	10,000
6	3	2,000,000	2	0.10

In the account table above, there are two options for specifying the policy limit: either using the PolLimit6All field (as shown) or using the LayerLimit field (not shown). If a limit is specified as anything other than a monetary amount (e.g. as a percentage of sum insured) then the PolLimit6All field must be used. If there are underlying limits before a policy layer (e.g. perhaps a sublimit for storm surge that applies to all locations) then PolLimit6All must be used. If there is only one monetary policy limit, then the user has a choice of whether to use LayerLimit or PolLimit6All. Our recommendation in this case is to use LayerLimit rather than PolLimit6All, as this may prove more efficient downstream when reporting out on main policy limits.

Example 3 – Commercial lines – multiple locations per policy with different policy level deductibles and limits for different perils

The tables below show an example of a commercial portfolio with 3 accounts, each with 2 locations. Each account has one policy and each policy covers earthquake (peril code = QQ1), wind (WW1) and flood (OO1). Each location has a coverage deductible which applies to all perils. Each policy has deductibles and limits that apply across all coverages; however the policy flood deductibles are higher than those for wind and earthquake and the flood limits are lower than those for wind and earthquake.

OED Account table:

AccNumber	PolNumber	PolPeril	PolDedType6All	PolDed6All	PolLimitType6All	PolLimit6All
1	1	QQ1;WW1	0	50,000	0	1,500,000
1	1	OO1	0	100,000	0	500,000
2	1	QQ1;WW1	2	0.05	0	1,500,000
2	1	OO1	0	500,000	0	1,000,000
3	1	QQ1;WW1	1	0.10	2	0.80
3	1	OO1	1	0.20	2	0.60

OED Location table:

LocNumber	AccNumber	BuildingTIV	LocDedType1Building	LocDed1Building
1	1	1,000,000	0	10,000
2	1	1,000,000	2	0.01
3	2	1,000,000	1	0.05
4	2	2,000,000	0	15,000
5	3	2,000,000	0	10,000
6	3	2,000,000	2	0.10

The account table above shows one of the flexible features of the OED – the possibility of having multiple rows for the same policy in the account table. This allows different terms to be specified for different perils as indicated by the PolPeril field.

Example 4 – Commercial lines – multiple locations per policy with location and policy deductibles but with a sublimit for tier 1 wind

The tables below show an example of a commercial portfolio with 1 account containing 6 locations. The policy covers earthquake and wind with the same overall policy limit for both perils. However, for *certain locations* two different sub-limits apply for wind. We show two examples of this below, firstly where the sub-limits are not nested (e.g. Florida wind sub-limit and Texas wind sub-limit), and secondly where the sub-limits are nested (e.g. Texas tier 1 wind sub-limit and Texas overall wind sub-limit).

OED Account table:

AccNumber	PolNumber	PolPeril	PolLimit6All	Cond Tag	Cond Number	Cond Priority	Cond Peril	CondLimit6All
1	1	QQ1;WW1	1,500,000	1	1	1	WW1	250,000
1	1	QQ1;WW1	1,500,000	2	2	1	WW1	500,000

OED Location table:

LocNumber	AccNumber	BuildingTIV	LocDedType1 Building	LocDed1Building	CondNumber
1	1	1,000,000	0	10,000	1
2	1	1,000,000	2	0.01	1
3	1	1,000,000	1	0.05	2
4	1	2,000,000	0	15,000	2
5	1	2,000,000	0	10,000	
6	1	2,000,000	2	0.10	

In the tables above, special condition 1 (CondNumber = 1 in the account table) applies to CondTag = 1 which is the group of locations 1 and 2

(CondTag = 1 on the location table) whereas special condition 2 applies to locations 3 and 4.

In the account table, note again the use of a second row for the same account and policy to specify a second special condition. This feature of OED means that essentially an unlimited number of special conditions are possible. The CondPeril field in the account table indicates the peril (or perils) to which the special condition financial terms apply. In this example the special conditions are not nested – meaning that each location has no more than one special condition. In this situation the special conditions do not need an order and so the CondPriority should be the same for both conditions.

In the location table, CondTag denotes the scope of the special condition (or conditions) which is a group of locations. CondTag must match with CondTag in the account table.

If two special conditions are nested or overlap – meaning that some locations have two applicable special conditions (e.g. Texas tier 1 wind sub-limit of 250,000 (CondNumber = 1) and Texas overall wind sub-limit of 500,000 (CondNumber = 2)), the tables would be specified as shown below. The example below assumes that locations 1 and 2 are in the Texas tier 1 region, locations 3 and 4 are within Texas but not in the Tier 1 wind region, and locations 5 and 6 are outside Texas.

OED Account table:

AccNumber	PolNumber	PolPeril	PolLimit6All	CondTag	CondNumber	CondPriority	CondPeril	CondLimit6All
1	1	QQ1; WW1	1,500,000	1	1	1	WW1	250,000
1	1	QQ1; WW1	1,500,000	2	2	2	WW1	500,000

OED Location table:

LocNumber	AccNumber	BuildingTIV	LocDedType 1Building	LocDed1Building	CondNumber
1	1	1,000,000	0	10,000	1
1	1	1,000,000	0	10,000	2
2	1	1,000,000	2	0.01	1
2	1	1,000,000	2	0.01	2
3	1	1,000,000	1	0.05	2
4	1	2,000,000	0	15,000	2
5	1	2,000,000	0	10,000	
6	1	2,000,000	2	0.10	

The location table now has two extra rows for locations 1 and 2 to specify a second special condition applying to these locations, with two distinct values of CondTag. The CondPriority field in the account file is used to specify the order in which these special conditions apply. The method of adding an extra location row to specify an extra hierarchy of special condition means that the OED design can cope with an unlimited number of nested special conditions. Overlapping special conditions (e.g. Texas wind sublimit and multi-State tier 1 wind sublimit) can also be specified in this way.

Although not shown in the examples above, the field CondName can also be specified in the account table to provide a text description of each special condition.

Example 5 – Policy layers

The tables below show an example of a commercial portfolio with 1 account containing 6 locations and two policy layers. Each location has a coverage deductible and each policy has an underlying deductible applying across all coverage types.

OED Account table:

AccNumber	PolNumber	PolDedType6All	PolDed6All	LayerAttachment	LayerLimit	LayerParticipation
1	1	0	50,000	0	1,500,000	0.1
1	2	0	50,000	1,500,000	3,500,000	0.5

OED Location table:

LocNumber	AccNumber	BuildingTIV	LocDedType 1Building	LocDed1 Building
1	1	1,000,000	0	10,000
2	1	1,000,000	2	0.01
3	1	1,000,000	1	0.05
4	1	2,000,000	0	15,000
5	1	2,000,000	0	10,000
6	1	2,000,000	2	0.10

The two different layers in the example above have different policy numbers within the same account. The insurer has a 10% share of the first layer and a 50% share of the second layer specified within LayerParticipation. The policy level deductible specified in PolDedType6All and PolDed6All applies to losses before the layer terms apply.

Although not shown in the example above, it is possible to specify a layer number for each layer using the LayerNumber field.

If a policy has a limit that covers all perils and coverage types, then either PolLimit6All or LayerLimit can be used to represent this limit. In this case the recommendation is to use LayerLimit rather than PolLimit6All, as this then results in a consistent field containing the ultimate policy limit that can ease subsequent reporting.

REINSURANCE

There are many different types of reinsurance available and many different combinations of financial terms that can apply within each type of reinsurance. The scope of each reinsurance contract, and the definition of risk level that applies within a contract (if there are per-risk terms), are also important considerations that are discussed in the following sections.

Reinsurance types and terms

OED has been designed to allow capture of a broad range of reinsurance terms without the need to enter any information directly through a user interface. The range of reinsurance types that are currently considered within OED are as follows.

Type of Reinsurance	Value in ReinsType field	Notes
Facultative	FAC	Excess of loss (or sometimes proportional) contract applicable at location, location group, policy or account level. The risk level must be consistent with the field used to define the scope. RiskLimit, RiskAttachment and PlacedPercent are typically the fields used.
Quota Share	QS	A proportional contract applicable to a tranche of exposure defined using the reinsurance scope filter fields. PlacedPercent, and sometimes RiskLimit and OccLimit are typically the fields used.
Surplus Share	SS	A proportional contract where the proportion ceded varies by risk. The risk level must be consistent with the field used to define the scope. CededPercent must be specified for each risk in the reinsurance scope table. OccLimit is sometimes also used.
Per Risk Treaty	PR	An excess of loss contract applying per-risk to a tranche of exposure defined using the reinsurance scope filter fields. RiskLimit, RiskAttachment and sometimes PlacedPercent and OccLimit are the fields typically used.

Catastrophe Excess of Loss	CXL	An excess of loss contract applying per-event to a tranche of exposure defined using the reinsurance scope filter fields. OccLimit, OccAttachment and sometimes PlacedPercent are the fields typically used.
Aggregate Excess of Loss	AXL	An aggregate excess of loss contract applying per-period to a tranche of exposure defined using the reinsurance scope filter fields. AggLimit, AggAttachment and sometimes PlacedPercent are the fields typically used.

The fields used to define reinsurance financial terms are given in the table below. These are all specified in the reinsurance info table, although for surplus treaties note that CededPercent must be specified in the reinsurance scope table.

Field Name	Description
RiskLevel	The definition of risk. See below for more information
RiskLimit	Limit applicable to the losses from an event at the defined RiskLevel.
RiskAttachment	Attachment applicable to the losses from an event at the defined RiskLevel.
OccLimit	Limit applicable to the sum of losses from an event.
OccAttachment	Attachment applicable to the sum of losses from an event.
OccFranchiseDed	A per-occurrence deductible that vanishes when it is exceeded.
OccReverseFranchise	The total event loss is excluded from the treaty if the reverse franchise threshold is exceeded.
AggLimit	Limit applicable to the sum of losses within an AggPeriod.
AggAttachment	Attachment applicable to the sum of losses within an AggPeriod.
AggPeriod	The period within which to sum losses (in days).
InuringPriority	Indicates the order in which reinsurance applies. 1 denotes the contract that applies first.
Reinstatement	The number of reinstatements.
CededPercent	The percentage applied to the gross loss entering the reinsurance contracts before other reinsurance terms. Predominantly used for surplus treaties. Unlike all the other terms in this table, CededPercent is specified in the

	reinsurance scope table for surplus treaties and in the reinsurance info table for all other treaty types.
PlacedPercent	The percentage applied to the reinsurance loss after other reinsurance terms. Predominantly used for all contracts other than surplus treaties.
TreatyShare	The treaty share which is applicable to the individual reinsurer.

Risk level

The term 'risk level' in the table above refers to what is defined as a 'risk' in the context of the particular reinsurance treaty. The definition of what constitutes a risk is an involved subject, but the reinsured usually defines this. For example, a risk could be one building in a large spread-out site, a number of buildings defined by such a site, a combination of sites close together, or a policy layer or account.

In the context of OED a risk-level is specified in the RiskLevel field in the reinsurance info table and can be defined as either location (LOC), location-group (LGR), policy (POL - including individual layers) or account level (ACC). Risk level is only relevant for reinsurance contracts with risk-level terms. However, this can include facultative contracts, quota share and surplus treaties and catastrophe excess of loss contracts as well as per-risk treaties.

Reinsurance percentages and calculation order

There are various percentages defined in OED that are applicable to reinsurance, and several kinds of limits and attachments so it is important to be clear about the order in which they work. The main principles are outlined below.

The loss applicable to a reinsurance contract is the gross loss (assuming no inuring reinsurance contracts). In other words the loss to which reinsurance terms are applied is the ground-up loss net of all primary insurance limits, deductibles and shares.

The order of application of reinsurance terms is then as follows:

1. CededPercent is applied to the gross loss. This applies before any other reinsurance terms including per risk terms, per occurrence terms or aggregate terms. This is typically used in surplus treaties (in the reinsurance scope table) where event limits within such treaties are always specified in terms of treaty loss (and not in terms of the gross loss). It could also be used within quota share treaties (within the reinsurance info table) if the risk or event limit terms within a quota share treaty are specified in terms of treaty loss rather than gross loss (although this is unusual).

2. Risk terms are applied.

3. Occurrence terms are applied.

4. Aggregate terms are applied.

5. PlacedPercent is applied. This applies after all other reinsurance terms. This is the percentage field that is normally used for treaty types other than surplus.

Examples of OED tables including reinsurance

The examples below demonstrate how the reinsurance info and reinsurance scope tables work and interact with the account and location tables. As with the other examples in this document, not all the required fields are shown in the tables.

Example 1 - Facultative reinsurance

The tables below demonstrate two facultative reinsurance contracts, one at location level and one at policy level.

A 0.5m xs 1m location level facultative contract applies to location 2 in account 1, and a 1.2m xs 2.0m policy level facultative reinsurance contract applies to policy 1 in account 3.

OED Account table:

PortNumber	AccNumber	PolNumber	PolDedType6All	PolDed6All	PolLimit Type6All	PolLimit6All
1	1	1	0	50,000	0	1,500,000
1	2	1	2	0.05	0	1,500,000
1	3	1	1	0.10	2	0.80

OED Location table:

PortNumber	LocNumber	AccNumber	BuildingTIV	LocDedType1Building	LocDed1Building
1	1	1	1,000,000	0	10,000
1	2	1	1,000,000	2	0.01
1	1	2	1,000,000	1	0.05
1	2	2	2,000,000	0	15,000
1	1	3	2,000,000	0	10,000
1	2	3	2,000,000	2	0.10

OED Reinsurance Info table:

ReinsNumber	ReinsType	RiskAttachment	RiskLimit	Placed Percent	InuringPriority	Risk Level
1	FAC	1,000,000	500,000	1.0	1	LOC
2	FAC	2,000,000	1,200,000	1.0	1	POL

OED Reinsurance Scope table:

ReinsNumber	PortNumber	AccNumber	PolNumber	LocNumber
1	1	1		2
2	1	3	1	

The reinsurance info table must contain one row per ReinsNumber. ReinsNumber must be unique in this table. Although not shown, the reinsurance info table must always contain the ReinsPeril field, indicating which perils the reinsurance contract covers.

Facultative contracts are typically 100% placed and so PlacedPercent is 1.0. Given that these are contracts on different accounts there is no concept of one contract inuring to the benefit of the other and so the InuringPriority is 1.

The reinsurance scope table must contain at least one entry for every ReinsNumber in the reinsurance info table. Although not the case in this example, it can contain more than one entry for a given ReinsNumber.

Only four of the ten possible filter fields are shown in the example above: PortNumber, AccNumber, PolNumber and LocNumber.

The combination of the filter fields for ReinsNumber = 1 means that the facultative contract will apply to the records where the following logical statement is true:

PortNumber = 1 AND AccNumber = 1 AND LocNumber = 2

i.e. to location 2 in account 1 in portfolio 1.

For ReinsNumber 2 the facultative contract will apply to the records where the following logical statement is true:

PortNumber = 1 AND AccNumber = 3 AND PolNumber = 1

i.e. to policy 1 in account 3 in portfolio 1.

The RiskLevel is defined as LOC for ReinsNumber 1 and POL for ReinsNumber 2.

The only filter fields that can be used for facultative (and surplus treaties) are PortNumber, AccNumber, PolNumber, LocNumber and LocGroup – i.e. portfolio plus the filter fields that correspond with the different risk levels: ACC, POL, LOC and LGR.

Example 2 – Quota share reinsurance

The example shows the OED specification for a 20% quota share reinsurance contract, applying to locations within Great Britain in portfolio 1, with a risk limit of 100,000 and an event limit of 1,000,000. 'Risk' is defined as a location, and risk and event limits are specified in terms of gross amount (i.e. the loss before the application of the 20% quota share).

OED Account table:

PortNumber	AccNumber	PolNumber	PolDedType6All	PolDed6All	PolLimitType6All	PolLimit6All
1	1	1	0	50,000	0	1,500,000
1	2	1	2	0.05	0	1,500,000
1	3	1	1	0.10	2	0.80

OED Location table:

PortNumber	LocNumber	AccNumber	CountryCode	BuildingTIV	LocDedType1Building	LocDed1Building
1	1	1	GB	1,000,000	0	10,000
1	2	1	GB	1,000,000	2	0.01
1	1	2	GB	1,000,000	1	0.05
1	2	2	GB	2,000,000	0	15,000
1	1	3	DE	2,000,000	0	10,000
1	2	3	DE	2,000,000	2	0.10

OED Reinsurance Info table:

ReinsNumber	ReinsType	RiskLimit	OccLimit	Placed Percent	Inuring Priority	Risk Level
1	QS	100,000	1,000,000	0.20	1	LOC

OED Reinsurance Scope table:

ReinsNumber	PortNumber	AccNumber	PolNumber	LocNumber	CountryCode
1	1				GB

In the reinsurance info table in the example above, PlacedPercent is used to specify the 20% quota share. This means that the risk and occurrence limits will apply before the application of the 20%. In other words, the risk and occurrence terms apply to the gross figure. This is normally the way quota share treaties are worded (so that it is clear how the risk and

occurrence limits relate to the attachments of other per-risk and per-occurrence contracts that the reinsured may have). However, some quota share treaties are worded with limits applying to the amount ceded to the treaty (i.e. after application of the 20%). If that is the case, then the user can specify 0.2 in the CededPercent field instead of PlacedPercent: CededPercent always applies to the incoming loss before any other terms (PlacedPercent always applies to the loss after all other terms). Alternatively, the user could gross up the limits to represent 100% values and continue to use PlacedPercent.

The logic in the reinsurance scope table means that only items with PortNumber = 1 AND CountryCode = GB will be covered by the quota share contract. This means that losses from locations in account 3 will not be ceded to this treaty (as the locations in account 3 are in Germany).

Example 3 - Surplus share reinsurance

The example shows how a 3-line surplus treaty with a retention of 500,000 is specified in OED. The surplus treaty has an event limit of 3,000,000 (applicable to the loss ceded to the treaty, not the gross amount), and 'risk' is defined as the location.

OED Account table:

PortNumber	AccNumber	PolNumber	PolDedType6All	PolDed6All	PolLimitType6All	PolLimit6All
1	1	1	0	50,000	0	1,500,000
1	2	1	2	0.05	0	1,500,000
1	3	1	1	0.10	2	0.80

OED Location table:

PortNumber	LocNumber	AccNumber	BuildingTIV	LocDedType1Building	LocDed1Building
1	1	1	1,000,000	0	10,000
1	2	1	1,000,000	2	0.01
1	1	2	1,000,000	1	0.05

1	2	2	2,000,000	0	15,000
1	1	3	2,000,000	0	10,000
1	2	3	2,000,000	2	0.10

OED Reinsurance Info table:

ReinsNumber	Reins Type	RiskLimit	OccLimit	PlacedPercent	InuringPriority	Risk Level
1	SS	0	3,000,000	1.0	1	LOC

OED Reinsurance Scope table:

ReinsNumber	PortNumber	AccNumber	PolNumber	LocNumber	CededPercent
1	1	1		1	0.50
1	1	1		2	0.50
1	1	2		1	0.50
1	1	2		2	0.75
1	1	3		1	0.75
1	1	4		2	0.75

For surplus treaties, CededPercent must be specified for each risk in the reinsurance scope table.

Unlike in the previous quota share example, the 3,000,000 event limit specified in the reinsurance info table applies to losses after the application of the surplus percentage. This is because CededPercent is always used for surplus treaties, and CededPercent applies before any other terms.

With surplus treaties, the following rule must be followed (they are the same as for facultative treaties):

- Only the filter fields PortNumber, AccNumber, PolNumber, LocNumber & LocGroup can be used with surplus treaties.

Example 4 - Per-risk and cat XL reinsurance

The example below shows the specification of two reinsurance treaties –
both of which apply to portfolios 1 and 2, with the per-risk contract
inuring to the benefit of the cat XL contract.

OED Account table:

PortNumber	AccNumber	PolNumber	PolDedType6All	PolDed6All	PolLimitType6All	PolLimit6All
1	1	1	0	50,000	0	1,500,000
1	2	1	2	0.05	0	1,500,000
2	1	1	1	0.10	2	0.80

OED Location table:

PortNumber	LocNumber	AccNumber	BuildingTIV	LocDedType1Building	LocDed1Building
1	1	1	1,000,000	0	10,000
1	2	1	1,000,000	2	0.01
1	1	2	1,000,000	1	0.05
1	2	2	2,000,000	0	15,000
2	1	1	2,000,000	0	10,000
2	2	1	2,000,000	2	0.10

OED Reinsurance Info table:

ReinsNumber	ReinsType	RiskAttachment	RiskLimit	OccAttachment	OccLimit	Inuring Priority	Risk Level
1	PR	500,000	1,500,000	0	0	1	LOC
2	CXL	0	0	3,000,000	3,000,000	2	

OED Reinsurance Scope table:

ReinsNumber	PortNumber	AccNumber	PolNumber	LocNumber
1	1			
1	2			
2	1			
2	2			

Note that the account and location tables now contain exposures from two portfolios.

The InuringPriority field specifies the order in which treaties apply. Here the per-risk contract applies before (i.e. inures to the benefit of) the Cat XL. This means that the losses that enter the Cat XL treaty are net of any recoveries from the Per-risk treaty. The InuringPriority values do not need to be consecutive – the treaty with the lowest number will always be applied before the treaty with the higher number.

The reinsurance scope table contains two rows per treaty. This is to indicate that the treaties apply to both portfolio 1 and portfolio 2. The scope of each reinsurance treaty is defined by those records that satisfy the logical statement: PortNumber = 1 OR PortNumber = 2. i.e. records either in portfolio 1 or 2. Essentially, within each ReinsNumber, each row of the reinsurance scope table acts as an OR operator and each filtering column acts as an AND operator. Although only four reinsurance scope fields are shown in the table above, all 10 reinsurance scope filtering fields could be used to define the scope of quota share, per-risk, cat XL or aggregate XL treaties.

The RiskLevel of the per-risk treaty is defined at location level (LOC). For the Cat XL treaty in this example there are no risk terms and so the RiskLevel is left blank.

DATABASE SCHEMA

The back-end tables in OED are linked as follows:
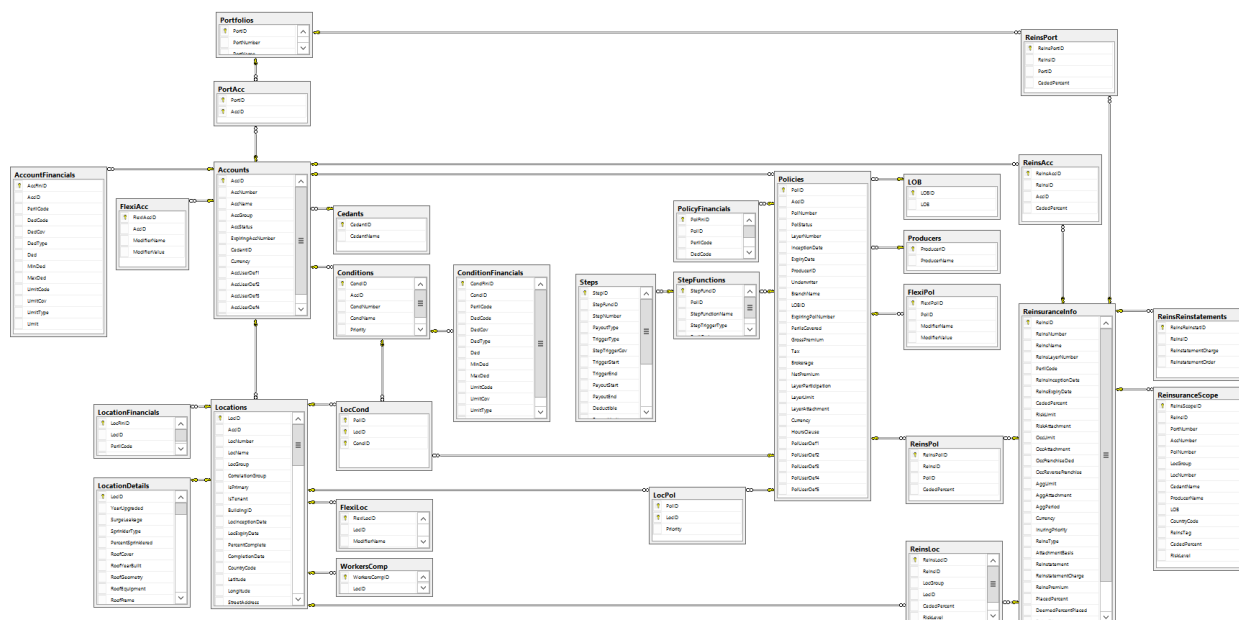
Not all the fields are shown in the diagram above. Please refer to the Open Exposure Data Spec spreadsheet, in the OED GitHub repository for the full list of fields per table.

RESOURCES

- https://github.com/OasisLMF/OpenDataStandards

- https://oasislmf.github.io/

- https://github.com/OasisLMF/ktools/blob/master/docs/pdf/ktools.pdf

- https://oasislmf.org/

- https://onlinelibrary.wiley.com/doi/book/10.1002/9781118906057

Any queries about OED or Oasis should be submitted to info@oasislmf.org

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