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# 2.0 DATABASE STRUCTURE

This chapter defines the physical structure of each table, as it exists within the ORACLE data dictionary and as it can exist as a flat file. The name of the relation appears in **bold** print at the top. Key attributes are shown first, convenience attributes next, followed by data fields. This hierarchy is described in the introduction to Chapter 3. Formats for "external" files specify fixed field widths and precisions in the style of FORTRAN. Exactly one blank separates fields in these files. This improves readability and makes it easier for C programs to scan the records. All numeric entries are right justified and all character strings are left justified. Having the field number quickly accessible is useful when dealing with flat files (e.g. *awk* and shell scripts).

| *Relation:* | **affiliation** | | | | |
|---|---|---|---|---|---|
| *Description:* | Network station affiliations | | | | |
| attribute name | field no. | storage type | external format | character positions | attribute description |
| net | 1 | c8 | a8 | 1-8 | unique network identifier |
| sta | 2 | c6 | a6 | 10-15 | station identifier |
| lddate | 3 | date | a17 | 17-33 | load date |

| *Relation:* | **arrival** | | | | |
|---|---|---|---|---|---|
| *Description:* | Summary information on a seismic arrival | | | | |
| attribute name | field no. | storage type | external format | character positions | attribute description |
| sta | 1 | c6 | a6 | 1-6 | station code |
| time | 2 | f8 | f17.5 | 8-24 | epoch time |
| arid | 3 | i4 | i8 | 26-33 | arrival id |
| jdate | 4 | i4 | i8 | 35-42 | julian date |
| stassid | 5 | i4 | i8 | 44-51 | stassoc id |
| chanid | 6 | i4 | i8 | 53-60 | instrument id |
| chan | 7 | c8 | a8 | 62-69 | channel code |
| iphase | 8 | c8 | a8 | 71-78 | reported phase |
| stype | 9 | c1 | a1 | 80-80 | signal type |
| deltim | 10 | f4 | f6.3 | 82-87 | delta time |
| azimuth | 11 | f4 | f7.2 | 89-95 | observed azimuth |
| delaz | 12 | f4 | f7.2 | 97-103 | delta azimuth |
| slow | 13 | f4 | f7.2 | 105-111 | observed slowness (s/deg) |
| delslo | 14 | f4 | f7.2 | 113-119 | delta slowness |
| ema | 15 | f4 | f7.2 | 121-127 | emergence angle |
| rect | 16 | f4 | f7.3 | 129-135 | rectilinearity |
| amp | 17 | f4 | f10.1 | 137-146 | amplitude, instrument corrected, nm |
| per | 18 | f4 | f7.2 | 148-154 | period |
| logat | 19 | f4 | f7.2 | 156-162 | log(amp/per) |
| clip | 20 | c1 | a1 | 164-164 | clipped flag |
| fm | 21 | c2 | a2 | 166-167 | first motion |
| snr | 22 | f4 | f10.2 | 169-178 | signal to noise ratio |
| qual | 23 | c1 | a1 | 180-180 | signal onset quality |
| auth | 24 | c15 | a15 | 182-196 | source/originator |
| commid | 25 | i4 | i8 | 198-205 | comment id |
| lddate | 26 | date | a17 | 207-223 | load date |

| Relation: | | **assoc** | | | |
|---|---|---|---|---|---|
| Description: | | Data associating arrivals with origins | | | |
| attribute name | field no. | storage type | external format | character positions | attribute description |
| arid | 1 | i4 | i8 | 1-8 | arrival id |
| orid | 2 | i4 | i8 | 10-17 | origin id |
| sta | 3 | c6 | a6 | 19-24 | station code |
| phase | 4 | c8 | a8 | 26-33 | associated phase |
| belief | 5 | f4 | f4.2 | 35-38 | phase confidence |
| delta | 6 | f4 | f8.3 | 40-47 | station to event distance |
| seaz | 7 | f4 | f7.2 | 49-55 | station to event azimuth |
| esaz | 8 | f4 | f7.2 | 57-63 | event to station azimuth |
| timeres | 9 | f4 | f8.3 | 65-72 | time residual |
| timedef | 10 | c1 | a1 | 74-74 | time = defining, non-defining |
| azres | 11 | f4 | f7.1 | 76-82 | azimuth residual |
| azdef | 12 | c1 | a1 | 84-84 | azimuth = defining, non-defining |
| slores | 13 | f4 | f7.2 | 86-92 | slowness residual |
| slodef | 14 | c1 | a1 | 94-94 | slowness = defining, non-defining |
| emares | 15 | f4 | f7.1 | 96-102 | incidence angle residual |
| wgt | 16 | f4 | f6.3 | 104-109 | location weight |
| vmodel | 17 | c15 | a15 | 111-125 | velocity model |
| commid | 18 | i4 | i8 | 127-134 | comment id |
| lddate | 19 | date | a17 | 136-152 | load date |

| Relation: | | **event** | | | |
|---|---|---|---|---|---|
| Description: | | Event identification | | | |
| attribute name | field no. | storage type | external format | character positions | attribute description |
| evid | 1 | i4 | i8 | 1-8 | event id |
| evname | 2 | c15 | a15 | 10-24 | event name |
| prefor | 3 | i4 | i8 | 26-33 | preferred origin |
| auth | 4 | c15 | a15 | 35-49 | source/originator |
| commid | 5 | i4 | i8 | 51-58 | comment id |
| lddate | 6 | date | a17 | 60-76 | load date |

| Relation: | | **gregion** | | | |
|---|---|---|---|---|---|
| Description: | | Geographic region | | | |
| attribute name | field no. | storage type | external format | character positions | attribute description |
| grn | 1 | i4 | i8 | 1-8 | geographic region number |
| grname | 2 | c40 | a40 | 10-49 | geographic region name |
| lddate | 3 | date | a17 | 51-67 | load date |

| attribute name | field no. | storage type | external format | character positions | attribute description |
|---|---|---|---|---|---|
| *Relation:* **instrument** | | | | | |
| *Description:* Generic (default) calibration information about a station | | | | | |
| inid | 1 | i4 | i8 | 1-8 | instrument id |
| insname | 2 | c50 | a50 | 10-59 | instrument name |
| instype | 3 | c6 | a6 | 61-66 | instrument type |
| band | 4 | c1 | a1 | 68-68 | frequency band |
| digital | 5 | c1 | a1 | 70-70 | (d,a) analog |
| samprate | 6 | f4 | f11.7 | 72-82 | sampling rate in samples/second |
| ncalib | 7 | f4 | f16.6 | 84-99 | nominal calibration |
| ncalper | 8 | f4 | f16.6 | 101-116 | nominal calibration period |
| dir | 9 | c64 | a64 | 118-181 | directory |
| dfile | 10 | c32 | a32 | 183-214 | data file |
| rsptype | 11 | c6 | a6 | 216-221 | response type |
| lddate | 12 | date | a17 | 223-239 | load date |

| attribute name | field no. | storage type | external format | character positions | attribute description |
|---|---|---|---|---|---|
| *Relation:* **lastid** | | | | | |
| *Description:* Counter values (Last value used for keys) | | | | | |
| keyname | 1 | c15 | a15 | 1-15 | id name (arid, orid, etc.) |
| keyvalue | 2 | i4 | i8 | 17-24 | last value used for that id |
| lddate | 3 | date | a17 | 26-42 | load date |

| attribute name | field no. | storage type | external format | character positions | attribute description |
|---|---|---|---|---|---|
| *Relation:* **netmag** | | | | | |
| *Description:* Network magnitude | | | | | |
| magid | 1 | i4 | i8 | 1-8 | network magnitude identifier |
| net | 2 | c8 | a8 | 10-17 | unique network identifier |
| orid | 3 | i4 | i8 | 19-26 | origin id |
| evid | 4 | i4 | i8 | 28-35 | event id |
| magtype | 5 | c6 | a6 | 37-42 | magnitude type (ml, ms, mb, etc.) |
| nsta | 6 | i4 | i8 | 44-51 | number of stations used |
| magnitude | 7 | f4 | f7.2 | 53-59 | magnitude |
| uncertainty | 8 | f4 | f7.2 | 61-67 | magnitude uncertainty |
| auth | 9 | c15 | a15 | 69-83 | source/originator |
| commid | 10 | i4 | i8 | 85-92 | comment id |
| lddate | 11 | date | a17 | 94-110 | load date |

Database Structure

| Relation: | | **network** | | | |
|---|---|---|---|---|---|
| Description: | | Network description and identification | | | |
| attribute name | field no. | storage type | external format | character positions | attribute description |
| net | 1 | c8 | a8 | 1-8 | unique network identifier |
| netname | 2 | c80 | a80 | 10-89 | network name |
| nettype | 3 | c4 | a4 | 91-94 | network type, array, local, world-wide, etc. |
| auth | 4 | c15 | a15 | 96-110 | source/originator |
| commid | 5 | i4 | i8 | 112-119 | comment id |
| lddate | 6 | date | a17 | 121-137 | load date |

| Relation: | | **origerr** | | | |
|---|---|---|---|---|---|
| Description: | | Summary of errors in origin estimations | | | |
| attribute name | field no. | storage type | external format | character positions | attribute description |
| orid | 1 | i4 | i8 | 1-8 | origin id |
| sxx | 2 | f4 | f15.4 | 10-24 | covariance matrix element |
| syy | 3 | f4 | f15.4 | 26-40 | covariance matrix element |
| szz | 4 | f4 | f15.4 | 42-56 | covariance matrix element |
| stt | 5 | f4 | f15.4 | 58-72 | covariance matrix element |
| sxy | 6 | f4 | f15.4 | 74-88 | covariance matrix element |
| sxz | 7 | f4 | f15.4 | 90-104 | covariance matrix element |
| syz | 8 | f4 | f15.4 | 106-120 | covariance matrix element |
| stx | 9 | f4 | f15.4 | 122-136 | covariance matrix element |
| sty | 10 | f4 | f15.4 | 138-152 | covariance matrix element |
| stz | 11 | f4 | f15.4 | 154-168 | covariance matrix element |
| sdobs | 12 | f4 | f9.4 | 170-178 | std err of obs |
| smajax | 13 | f4 | f9.4 | 180-188 | semi-major axis of error |
| sminax | 14 | f4 | f9.4 | 190-198 | semi-minor axis of error |
| strike | 15 | f4 | f6.2 | 200-205 | strike of the semi-major axis |
| sdepth | 16 | f4 | f9.4 | 207-215 | depth error |
| stime | 17 | f4 | f8.2 | 217-224 | origin time error |
| conf | 18 | f4 | f5.3 | 226-230 | confidence |
| commid | 19 | i4 | i8 | 232-239 | comment id |
| lddate | 20 | date | a17 | 241-257 | load date |

| attribute name | field no. | storage type | external format | character positions | attribute description |
|---|---|---|---|---|---|
| *Relation:* | **origin** | | | | |
| *Description:* | | Data on event location and confidence bounds | | | |
| lat | 1 | f4 | f9.4 | 1-9 | estimated latitude |
| lon | 2 | f4 | f9.4 | 11-19 | estimated longitude |
| depth | 3 | f4 | f9.4 | 21-29 | estimated depth |
| time | 4 | f8 | f17.5 | 31-47 | epoch time |
| orid | 5 | i4 | i8 | 49-56 | origin id |
| evid | 6 | i4 | i8 | 58-65 | event id |
| jdate | 7 | i4 | i8 | 67-74 | julian date |
| nass | 8 | i4 | i4 | 76-79 | number of associated phases |
| ndef | 9 | i4 | i4 | 81-84 | number of locating phases |
| ndp | 10 | i4 | i4 | 86-89 | number of depth phases |
| grn | 11 | i4 | i8 | 91-98 | geographic region number |
| srn | 12 | i4 | i8 | 100-107 | seismic region number |
| etype | 13 | c7 | a7 | 109-115 | event type |
| depdp | 14 | f4 | f9.4 | 117-125 | estimated depth from depth phases |
| dtype | 15 | c1 | a1 | 127-127 | depth method used |
| mb | 16 | f4 | f7.2 | 129-135 | body wave magnitude |
| mbid | 17 | i4 | i8 | 137-144 | mb magid |
| ms | 18 | f4 | f7.2 | 146-152 | surface wave magnitude |
| msid | 19 | i4 | i8 | 154-161 | ms magid |
| ml | 20 | f4 | f7.2 | 163-169 | local magnitude |
| mlid | 21 | i4 | i8 | 171-178 | ml magid |
| algorithm | 22 | c15 | a15 | 180-194 | location algorithm used |
| auth | 23 | c15 | a15 | 196-210 | source/originator |
| commid | 24 | i4 | i8 | 212-219 | comment id |
| lddate | 25 | date | a17 | 221-237 | load date |

| attribute name | field no. | storage type | external format | character positions | attribute description |
|---|---|---|---|---|---|
| *Relation:* | **remark** | | | | |
| *Description:* | | Comments | | | |
| commid | 1 | i4 | i8 | 1-8 | comment id |
| lineno | 2 | i4 | i8 | 10-17 | comment line number |
| remark | 3 | c80 | a80 | 19-98 | free format comment |
| lddate | 4 | date | a17 | 100-116 | load date |

| Relation: | | **sensor** | | | |
|---|---|---|---|---|---|
| Description: | | Specific calibration information for physical channels | | | |
| attribute name | field no. | storage type | external format | character positions | attribute description |
| sta | 1 | c6 | a6 | 1-6 | station code |
| chan | 2 | c8 | a8 | 8-15 | channel code |
| time | 3 | f8 | f17.5 | 17-33 | epoch time of start of recording period |
| endtime | 4 | f8 | f17.5 | 35-51 | epoch time of end of recording period |
| inid | 5 | i4 | i8 | 53-60 | instrument id |
| chanid | 6 | i4 | i8 | 62-69 | channel id |
| jdate | 7 | i4 | i8 | 71-78 | julian date |
| calratio | 8 | f4 | f16.6 | 80-95 | calibration |
| calper | 9 | f4 | f16.6 | 97-112 | calibration period |
| tshift | 10 | f4 | f6.2 | 114-119 | correction of data processing time |
| instant | 11 | c1 | a1 | 121-121 | (y,n) discrete/continuing snapshot |
| lddate | 12 | date | a17 | 123-139 | load date |

| Relation: | | **site** | | | |
|---|---|---|---|---|---|
| Description: | | Station location information | | | |
| attribute name | field no. | storage type | external format | character positions | attribute description |
| sta | 1 | c6 | a6 | 1-6 | station identifier |
| ondate | 2 | i4 | i8 | 8-15 | Julian start date |
| offdate | 3 | i4 | i8 | 17-24 | Julian off date |
| lat | 4 | f4 | f9.4 | 26-34 | latitude |
| lon | 5 | f4 | f9.4 | 36-44 | longitude |
| elev | 6 | f4 | f9.4 | 46-54 | elevation |
| staname | 7 | c50 | a50 | 56-105 | station description |
| statype | 8 | c4 | a4 | 107-110 | station type: single station, virt. array, etc. |
| refsta | 9 | c6 | a6 | 112-117 | reference station for array members |
| dnorth | 10 | f4 | f9.4 | 119-127 | offset from array reference (km) |
| deast | 11 | f4 | f9.4 | 129-137 | offset from array reference (km) |
| lddate | 12 | date | a17 | 139-155 | load date |

| Relation: | | **sitechan** | | | |
|---|---|---|---|---|---|
| Description: | | Station-channel information | | | |
| attribute name | field no. | storage type | external format | character positions | attribute description |
| sta | 1 | c6 | a6 | 1-6 | station identifier |
| chan | 2 | c8 | a8 | 8-15 | channel identifier |
| ondate | 3 | i4 | i8 | 17-24 | Julian start date |
| chanid | 4 | i4 | i8 | 26-33 | channel id |
| offdate | 5 | i4 | i8 | 35-42 | Julian off date |
| ctype | 6 | c4 | a4 | 44-47 | channel type |
| edepth | 7 | f4 | f9.4 | 49-57 | emplacement depth |
| hang | 8 | f4 | f6.1 | 59-64 | horizontal angle |
| vang | 9 | f4 | f6.1 | 66-71 | vertical angle |
| descrip | 10 | c50 | a50 | 73-122 | channel description |
| lddate | 11 | date | a17 | 124-140 | load date |

| Relation: | | **sregion** | | | |
|---|---|---|---|---|---|
| Description: | | Seismic region | | | |
| attribute name | field no. | storage type | external format | character positions | attribute description |
| srn | 1 | i4 | i8 | 1-8 | seismic region number |
| srname | 2 | c40 | a40 | 10-49 | seismic region name |
| lddate | 3 | date | a17 | 51-67 | load date |

| Relation: | | **stamag** | | | |
|---|---|---|---|---|---|
| Description: | | Station magnitude | | | |
| attribute name | field no. | storage type | external format | character positions | attribute description |
| magid | 1 | i4 | i8 | 1-8 | magnitude id |
| sta | 2 | c6 | a6 | 10-15 | station code |
| arid | 3 | i4 | i8 | 17-24 | arrival id |
| orid | 4 | i4 | i8 | 26-33 | origin id |
| evid | 5 | i4 | i8 | 35-42 | event id |
| phase | 6 | c8 | a8 | 44-51 | associated phase |
| magtype | 7 | c6 | a6 | 53-58 | magnitude type (ml, ms, mb, etc.) |
| magnitude | 8 | f4 | f7.2 | 60-66 | magnitude |
| uncertainty | 9 | f4 | f7.2 | 68-74 | magnitude uncertainty |
| auth | 10 | c15 | a15 | 76-90 | source/originator |
| commid | 11 | i4 | i8 | 92-99 | comment id |
| lddate | 12 | date | a17 | 101-117 | load date |

| Relation: | | **stassoc** | | | |
|---|---|---|---|---|---|
| Description: | | Arrivals from a single station grouped into an event | | | |
| attribute name | field no. | storage type | external format | character positions | attribute description |
| stassid | 1 | i4 | i8 | 1-8 | stassoc id |
| sta | 2 | c6 | a6 | 10-15 | station code |
| etype | 3 | c7 | a7 | 17-23 | event type |
| location | 4 | c32 | a32 | 25-56 | apparent location description |
| dist | 5 | f4 | f7.2 | 58-64 | estimated distance |
| azimuth | 6 | f4 | f7.2 | 66-72 | observed azimuth |
| lat | 7 | f4 | f9.4 | 74-82 | estimated latitude |
| lon | 8 | f4 | f9.4 | 84-92 | estimated longitude |
| depth | 9 | f4 | f9.4 | 94-102 | estimated depth |
| time | 10 | f8 | f17.5 | 104-120 | estimated origin time |
| imb | 11 | f4 | f7.2 | 122-128 | initial estimated mb |
| ims | 12 | f4 | f7.2 | 130-136 | initial estimated ms |
| iml | 13 | f4 | f7.2 | 138-144 | initial estimated ml |
| auth | 14 | c15 | a15 | 146-160 | source/originator |
| commid | 15 | i4 | i8 | 162-169 | comment id |
| lddate | 16 | date | a17 | 171-187 | load date |

| attribute name | field no. | storage type | external format | character positions | attribute description |
|---|---|---|---|---|---|
| *Relation:* | **wfdisc** | | | | |
| *Description:* | | Waveform file header and descriptive information | | | |
| sta | 1 | c6 | a6 | 1-6 | station |
| chan | 2 | c8 | a8 | 8-15 | channel |
| time | 3 | f8 | f17.5 | 17-33 | epoch time of first sample in file |
| wfid | 4 | i4 | i8 | 35-42 | waveform id |
| chanid | 5 | i4 | i8 | 44-51 | channel operation id |
| jdate | 6 | i4 | i8 | 53-60 | julian date |
| endtime | 7 | f8 | f17.5 | 62-78 | time+(nsamp-1)/samprate |
| nsamp | 8 | i4 | i8 | 80-87 | number of samples |
| samprate | 9 | f4 | f11.7 | 89-99 | sampling rate in samples/sec |
| calib | 10 | f4 | f16.6 | 101-116 | nominal calibration |
| calper | 11 | f4 | f16.6 | 118-133 | nominal calibration period |
| instype | 12 | c6 | a6 | 135-140 | instrument code |
| segtype | 13 | c1 | a1 | 142-142 | indexing method |
| datatype | 14 | c2 | a2 | 144-145 | numeric storage |
| clip | 15 | c1 | a1 | 147-147 | clipped flag |
| dir | 16 | c64 | a64 | 149-212 | directory |
| dfile | 17 | c32 | a32 | 214-245 | data file |
| foff | 18 | i4 | i10 | 247-256 | byte offset |
| commid | 19 | i4 | i8 | 258-265 | comment id |
| lddate | 20 | date | a17 | 267-283 | load date |

| attribute name | field no. | storage type | external format | character positions | attribute description |
|---|---|---|---|---|---|
| *Relation:* | **wftag** | | | | |
| *Description:* | | Waveform mapping file | | | |
| tagname | 1 | c8 | a8 | 1-8 | key (arid, orid, evid, etc.) |
| tagid | 2 | i4 | i8 | 10-17 | tagname value |
| wfid | 3 | i4 | i8 | 19-26 | waveform id |
| lddate | 4 | date | a17 | 28-44 | load date |

| attribute name | field no. | storage type | external format | character positions | attribute description |
|---|---|---|---|---|---|
| *Relation:* | **wftape** | | | | |
| *Description:* | Waveform tape file header and descriptive information | | | | |
| sta | 1 | c6 | a6 | 1-6 | station |
| chan | 2 | c8 | a8 | 8-15 | channel |
| time | 3 | f8 | f17.5 | 17-33 | epoch time of first sample in file |
| wfid | 4 | i4 | i8 | 35-42 | waveform id |
| chanid | 5 | i4 | i8 | 44-51 | channel operation id |
| jdate | 6 | i4 | i8 | 53-60 | julian date |
| endtime | 7 | f8 | f17.5 | 62-78 | time+(nsamp-1)/samprate |
| nsamp | 8 | i4 | i8 | 80-87 | number of samples |
| samprate | 9 | f4 | f11.7 | 89-99 | sampling rate in samples/sec |
| calib | 10 | f4 | f16.6 | 101-116 | nominal calibration |
| calper | 11 | f4 | f16.6 | 118-133 | nominal calibration period |
| instype | 12 | c6 | a6 | 135-140 | instrument code |
| segtype | 13 | c1 | a1 | 142-142 | indexing method |
| datatype | 14 | c2 | a2 | 144-145 | numeric storage |
| clip | 15 | c1 | a1 | 147-147 | clipped flag |
| dir | 16 | c64 | a64 | 149-212 | directory |
| dfile | 17 | c32 | a32 | 214-245 | data file |
| volname | 18 | c6 | a6 | 247-252 | tape name |
| tapefile | 19 | i4 | i5 | 254-258 | tape file number |
| tapeblock | 20 | i4 | i5 | 260-264 | block number in tape file |
| commid | 21 | i4 | i8 | 266-273 | comment id |
| lddate | 22 | date | a17 | 275-291 | load date |

Database Structure

# 3.0 DATABASE RELATIONS

This chapter describes the ORACLE relations that comprise the Version 3.0 Schema. The information given here, along with that in Chapter 4, *Database Attributes*, constitutes the data dictionary. There is an entry for each relation. Within the entry, the relation's name appears first, followed by a list of its attributes. A brief description completes the entry. The attributes of the relation are arranged in the following order: Keys, Convenience, Data. Key attributes link relations. Convenience attributes are redundant data whose real home is another relation, but are included in this table for the sake of convenience. Data attributes, the reason this table exists, are split into three categories: Descriptive, Measurement and Administrative. The following tableau explains the format used in the entries.

---

Name:          This is the name of the relation.

Keys:          Primary.         These are the attributes which, taken together, uniquely iden-
tify a
               row in the table.
Alternate.     These are other attributes which also uniquely identify a row and
               may be used as primary keys.
Foreign.       These attributes are primary keys in another table.

Convenience:   Attributes in this class, if any, are data-attributes in another table.

Data:          Descriptive.     Qualitative attributes are listed under this heading.
Measurement.   This class contains a list of quantitative attributes.
Administrative.                 This class lists attributes used for database administration.

Description:   This paragraph describes the relation.

---

Keys provide the links by which tables are joined. The following definitions explain the several types of keys.

> A primary key (which often is the concatenation of several attributes) uniquely identifies a row in the table. For example, each **origin** record is unique by *lat, lon, depth*, and *time.*

> An alternate key also uniquely identifies a row in the table and may be used as the primary key. For example, *orid* may also be used as the primary key for the **origin** table.

> A foreign key is another table's primary key. Thus, *evid* is a foreign key in the **origin** table, but is the primary key in the **event** table. Similarly, *commid* is a foreign key in many of the tables and the primary key in **remark**.

Entity-relationship (E-R) diagrams are a powerful way of describing a database schema. In this methodology, a rectangle is drawn to represent a table, its attributes are shown inside, and lines between the rectangles show how the tables are joined. The E-R model of the Version 3.0 schema is shown in Figures 3.1, 3.2, and 3.3. Figure 3.1 shows the terminology and the iconology used in the two succeeding figures. Note particularly the bottom half of Figure 3.1 which shows the symbols employed to depict the kinds of relationships that can exist between tables.

The entire schema is modeled in Figures 3.2 and 3.3, except that only key attributes for each table are shown. The full listing of attributes, and a formal definition of the structures was previously given in Chapter 2, *Database Structure*. Chapter 4, *Database Attributes*, gives a detailed description of each attribute. One key attribute, *chanid*, is left out entirely, since it appears in the schema only as a foreign key, never a primary key.

Insert Figure 3.1 - Anatomy of an NMRD Table -- on this page.

Insert Figure 3.2 - Version 3.0 CORE TABLES (Primary) - on this page.

Database Relations

Insert Figure 3.3 - Version 3.0 CORE TABLES (Lookup) - on this page.

Name:        **affiliation**

Keys:        Primary.        *net, sta*

Data:        Administrative.*lddate*

Description:    Network-Station affiliations. This is an intermediate relation by which seismic stations may be clustered into networks.

---

Name:        **arrival**

Keys:        Primary.        *sta, time*
Alternate.   *arid*
Foreign.     *stassid, chanid, commid*

Convenience:  *jdate*

Data:        Descriptive.   *chan, iphase, stype*
Measurement. *deltim, azimuth, delaz, slow, delslo, ema, rect, amp, per, logat, clip, fm, qual*
Administrative.         *auth, lddate*

Description:    Summary information on a seismic arrival. Information characterizing a "seismic phase" observed at a particular station is saved here. Many of the attributes conform to seismological convention and are listed in earthquake catalogs.

---

Name:        **assoc**

Keys:        Primary.        *arid, orid*
Foreign.     *commid*

Convenience:  *sta*

Data:        Descriptive.   *phase, belief*
Measurement. *delta, seaz, esaz, timeres, timedef, azres, azdef, slores, slodef, emares, wgt*
Administrative.         *vmodel, lddate*

Description:    Data associating arrivals with origins. This table has information that connects arrivals (i.e., entries in the **arrival** relation) to a particular origin. It has a composite key made of *arid* and *orid*. There are two kinds of measurement data: three attributes are related to the station (*delta, seaz, esaz*), and the remaining measurement attributes are jointly determined by the measurements made on the seismic wave (**arrival**), and the inferred event's origin (**origin**). The attribute *sta* is intentionally duplicated in this table to eliminate the need for a join with **arrival** when doing a lookup on station.

---

Name:        **event**

Keys:        Primary.        *evid*
Foreign.     *commid*

Data:        Descriptive.   *evname, prefor*
Administrative.         *auth, lddate*

Description:    Event to origin connection. The purpose of this relation is to allow the connection of multiple origins to one *event*. *Prefor* points to the preferred origin.

---

---

Name:       **gregion**

Keys:        Primary.     *grn*

Data:        Descriptive.   *grname*
Administrative.            *lddate*

Description:    Geographic regions.  This static relation contains geographic region numbers and their equivalent English representation.  (See Flinn et al., BSSA, v64, p2, July, 1974.)

---

Name:       **instrument**

Keys:        Primary.     *inid*

Data:        Descriptive.   *insname, instype, band, digital, dir, dfile, rsptype*
Measurement.  *samprate, ncalib, ncalper*
Administrative.            *lddate*

Description:    Ancillary calibration information.  This table serves three purposes. It holds nominal one-frequency calibration factors for each instrument. It holds pointers to the nominal frequency-dependent calibration for an instrument.  Finally, it holds pointers to the exact calibrations obtained by direct measurement on a particular instrument.  See **sensor**.

---

Name:       **lastid**

Keys:        Primary.     *keyname*

Data:        Descriptive.   *keyvalue*
Administrative.            *lddate*

Description:    Counter values (last value used for keys).  This relation is a reference table from which programs may retrieve the last sequential value of one of the numeric keys. Unique keys are required before inserting a record in numerous tables.  The table has exactly one row for each *keyname*. In the core schema there are just 9 distinct identifier keys: *arid, chanid, commid, evid, inid, magid, orid, stassid, wfid*.  This table will also support application-specific keys as needed.  Users are encouraged to use the dbgetcounter library routine to obtain a counter value.

---

Name:       **netmag**

Keys:        Primary.     *magid*
Foreign.      *evid, net, orid, commid*

Data:        Descriptive.   *magtype, nsta*
Measurement.  *magnitude, uncertainty*
Administrative.            *auth, lddate*

Description:    Network magnitude. This table summarizes estimates of network magnitudes of different types for an event.  Each network magnitude has a unique *magid*. Station magnitudes used to compute the network magnitude are in the relation **stamag**.

---

Name:        **network**

Keys:        Primary.        *net*
Foreign.        *commid*

Data:        Descriptive.        *netname, nettype*
Administrative.        *auth, lddate*

Description:        Network description and identification.  This relation gives general information about seismic networks.  See **affiliation**.

---

Name:        **origerr**

Keys:        Primary.        *orid*
Foreign.        *commid*

Data:        Descriptive.        *sdobs, smajax, sminax, strike, sdepth, stime, conf*
Measurement.  *sxx, syy, szz, stt, sxy, sxz, syz, stx, sty, stz*
Administrative.        *lddate*

Description:        Summary of confidence bounds in origin estimations.  The error estimates associated with the parameters in the **origin** relation are saved in this table.  The measurement attributes are the elements of the location covariance matrix.  The descriptive attributes, which are more meaningful, describe the uncertainities in location, depth and origin time.  These quantities are calculated from the covariance matrix, assuming gaussian errors and a confidence level *conf.*

---

Name:        **origin**

Keys:        Primary.        *lat, lon, depth, time*
Alternate.        *orid*
Foreign.        *evid, commid*

Convenience:        *jdate*

Data:        Descriptive.        *nass, ndef, ndp, grn, srn, etype*
Measurement.  *depdp, dtype, mb, mbid, ms, msid, ml, mlid*
Administrative.        *algorithm, auth, lddate*

Description:        Summary of hypocentral parameters.  Information describing a derived or reported origin for a particular event is stored in this table.

---

Name:        **remark**

Keys:        Primary.        *commid, lineno*

Data:        Descriptive.        *remark*
Administrative.        *lddate*

Description:        Comments. This relation may be used to store free-form comments that embellish records of other relations.  The *commid* field in many relations refers to a tuple in the **remark** table.  If *commid* is null (-1) in a tuple of any other relation, there are no comments stored for that tuple.

---

---

Name:         **sensor**

Keys:         Primary.         *sta, chan, time, endtime*
Foreign.      *inid*

Convenience:  *chanid, jdate*

Data:         Descriptive.     *instant*
Measurement.  *calratio, calper, tshift*
Administrative.                *lddate*

Description:     Calibration information for specific sensor channels. This table provides a record of updates in the calibration factor or clock error of each instrument, and links a *sta/chan/time* to a complete instrument response in the relation **instrument**.
Waveform data are converted into physical units through multiplication by the *calib* attribute located in **wfdisc**. It can happen that the correct value of *calib* is not accurately known when the **wfdisc** record is entered into the data base. The **sensor** relation provides the mechanism ( *calratio* and *calper*) to "update" *calib*, without requiring that possibly hundreds of **wfdisc** records be updated.
Through the foreign key *inid* this table is linked to **instrument** which has fields pointing to flat files holding detailed calibration information in a variety of formats. See **instrument**.

---

Name:         **site**

Keys:         Primary.         *sta, ondate*

Data:         Descriptive.     *staname, statype, refsta*
Measurement.  *offdate, lat, lon, elev, dnorth, deast*
Administrative.                *lddate*

Description:     Station location information. **Site** names and describes a point on the earth where seismic measurements are made ( e.g. the location of a seismic instrument or array). It contains information that normally changes infrequently, such as location. In addition, **site** contains fields to describe the offset of a station relative to an array reference location. Global data integrity implies that the *sta/ondate* in **site** be consistent with the *sta/chan/ondate* in **sitechan**.

---

Name:         **sitechan**

Keys:         Primary.         *sta, chan, ondate*
Alternate.    *chanid*

Data:         Descriptive.     *offdate, ctype*
Measurement.  *edepth, hang, vang, descrip*
Administrative.                *lddate*

Description:     Station-Channel information. This relation describes the orientation of a recording channel at the site referenced by *sta*. This relation provides information about the various channels (e.g. sz, lz, iz ) that are available at a station and maintains a record of the physical channel configuration at a site.

---

Name:          **sregion**

Keys:          Primary.          *srn*

Data:          Descriptive.          *srname*
Administrative.          *lddate*

Description:     Seismic regions.  This is a static relation containing seismic region numbers and their equivalent English names.  (See Flinn et al., BSSA, v64, p2, July, 1974.)

---

Name:          **stamag**

Keys:          Primary.          *magid, sta*
Foreign.          *arid, orid, evid, commid*

Data:          Descriptive.          *phase, magtype*
Measurement.  *magnitude, uncertainty*
Administrative.          *auth, lddate*

Description:     Station magnitude.  This table summarizes station magnitude estimates based upon measurements made on specific seismic phases. See **netmag**.

---

Name:          **stassoc**

Keys:          Primary.          *stassid*
Foreign.          *commid*

Data:          Descriptive.          *sta, etype, location*
Measurement.  *dist, azimuth, lat, lon, depth, time, imb, ims, iml*
Administrative.          *auth, lddate*

Description:     Summary information on groups of related arrivals.  This table defines the group of phases seen at a single station from the same event.

---

Name:          **wfdisc**

Keys:          Primary.          *sta, chan, time*
Alternate.     *wfid*
Foreign.          *chanid, commid*

Convenience:   *jdate, endtime*

Data:          Descriptive.          *nsamp, samprate, calib, calper, instype, segtype, datatype, clip, dir,*

          *dfile, foff*
Administrative.          *lddate*

Description:     Waveform header file and descriptive information.  This relation provides a pointer (or index) to waveforms stored on disk.  The waveforms themselves are stored in ordinary disk files called wfdisc or .w files, containing only a sequence of sample values (usually in binary representation).

---

---

Name:         **wftag**

Keys:         Primary.          *tagname, tagid, wfid*

Data:         Administrative.*lddate*

Description:    Waveform mapping file.  The **wftag** relation links various identifiers, e.g. origin id, arrival id, stassoc id, to waveform id.  All of the linkages could be determined indirectly using *sta*, *chan* and *time*. However, it is more efficient to predetermine them.

---

Name:         **wftape**

Keys:         Primary.          *sta, chan, time*
Alternate.    *wfid*
Foreign.      *chanid, commid*

Convenience:   *jdate, endtime*

Data:         Descriptive.      *nsamp, samprate, calib, calper, instype, segtype, datatype, clip, dir,*

              *dfile*
Administrative.                 *volname, tapefile, tapeblock, lddate*

Description:    Waveform header file and descriptive information.  This relation provides a pointer or index to waveforms that have been archived on official Center archive tapes.  This is a companion relation to **wfdisc**.

---

# 4.0 DATABASE ATTRIBUTES

This chapter describes each of the attributes used in the Version 3.0 Schema. Descriptions of the relations are found in Chapter 3, *Database Relations*. Attributes are presented as follows:

---

Name:          *This is the name of the attribute.*

Relation:      **These are the database relations which contain the attribute.**

Description:    This paragraph describes the attribute.

ORACLE:        This identifies the ORACLE data type.

NA Value:       This is a value used to indicate that information is not available for this attribute. Many attributes in this schema are optional. The NA value is defined for these attributes and should be used when the actual value is not known. Essential attributes must always be given a value; they are documented as NA Value NOT ALLOWED.

Units:          This lists the unit of measurement for the attribute, if applicable.

Range:          This is the range of permissible or recommended values for this attribute, if such a range exists. For most strings, the range indicates the recommended values, but is not restricted to those values.

---

The following conventions are applied throughout.

## Dates and Times

The *time* attribute throughout the database is stored as epochal time, the number of seconds since January 1, 1970. Epochal time has a precision of 1 millisecond. Often *time* is matched by the more readable attribute, *jdate*. This so called "Julian date" represents a day in the form, for example, 1981231 where 1981 is the year (YYYY) and 231 is the day of year (DOY).

## Units of Measurement

Attribute descriptions also include the unit of measurement, if applicable. Here are some quantities with their corresponding measurement units:

| | | |
|---|---|---|
| period, time | seconds | *calper*, *time*, *endtime*, etc. |
| julian date | YYYYDOY | *jdate* |
| amplitude | nanometers | Note that long-period measurements are frequently reported in microns so conversion is required. |
| angular measurements | degrees | *delta*, *azimuth*, etc. |
| depth, errors in location | kilometers | *deast*, *depdp*, *depth*, etc. |

**NA Values**

Whenever possible, explicit ranges are defined for each attribute. This is important for data integrity and prepares us for future database management systems which will perform range checking automatically. When the range consists of some element in a finite set, we use the notation {e1 | e2 | ... | en } where "|" denotes the logical OR operation. No range is documented for attributes whose value may be any floating point number.

Sometimes no information is available for an attribute. In that case, an NA (NOT AVAILABLE) value is assigned. An NA value is outside the range of permissible or recommended values for the attribute. This special NA value alerts users and applications that the desired attribute was not available when the record was created. For example, in the **origin** relation, the attribute *ms*, surface wave magnitude, may be unknown for a given record, since it often can't be measured. Then the NA value for magnitudes (–999.0) should be assigned to *ms* and *msid* should be set to –1, the NA value for *msid*. Some attributes are essential to defining a meaningful record and they must be specified; the NA value is not allowed. For example, the attribute *time* in **arrival** must be given a value in the valid range, not an NA value. Another example is *magnitude* in **netmag** and **stamag**. *Magnitude* must be given a meaningful value for each record, so there is no NA value defined.

Some general guidelines and specific examples of NA values are given in the following table.

> Representative NA Values:

> | | |
> |---|---|
> | character fields | - (a dash) |
> | non-negative integer numbers | –1 |
> | non-negative real numbers | –1.0 |
> | negative real numbers | –999.0 |
> | *conf* | 0.0 |
> | *deast, dnorth* | 0.0 |
> | *endtime* | +9999999999.999 |
> | *time* | –9999999999.999 |

In Versions 2.7 and 2.8 of the schema, the underscore "_" was used to denote an unavailable character string. Since the underscore "_" represents the ANSI SQL "match any single character" wildcard, Version 3.0 uses the dash "-" to denote an unknown character string.

**ORACLE NULL**

An NA value should not be confused with an ORACLE NULL. NA values are supplied by users, while ORACLE inserts the database NULL when no value is specified. An attribute containing a database NULL appears blank when selected within SQL*Plus. When creating a table, an attribute may be constrained as NOT NULL to require the user to supply a value. The ORACLE DESCRIBE command will identify such fields as NOT NULL. There is no intended correlation between ORACLE NOT NULL requirements and Center Version 3.0 requirements that an attribute must be specified.

**Format of Character Data**

Most character fields are lowercase. The following two lists of attributes define the exceptions:

> | | |
> |---|---|
> | Uppercase: | *auth, instype, grname, srname, sta, staname, volname* |
> | Mixed Case: | *phase, iphase, remark* |

**ORACLE Data Types**

The Version 3.0 database uses four of the available ORACLE data types:

VARCHAR   All character data in the database is defined to be VARCHAR(n) where "n" is the number of characters in the string (not including a null terminator as in C strings).

NUMBER   All integer fields in the database are defined to be NUMBER(n) where "n" is the number of digits allowed in the number.

FLOAT   ORACLE supports the FLOAT(n) data type where "n" is the number of binary digits. FLOAT allows the approximation of single and double precision floats commonly used in scientific programming. The decimal point may be specified anywhere from the first to the last digit (or not at all). All real numbers in the database are single precision FLOAT(24), except for *time* and *endtime* which are double precision FLOAT(53).

DATE   The only field in the database which is declared to be the ORACLE DATE data type is the *lddate* field which stores the day and time a record was inserted into the database.

Name:  *algorithm*

Relation:  **origin**

Description: Location algorithm used. This is a brief textual description of the algorithm used for computing a seismic origin.

ORACLE: VARCHAR(15)

NA Value: - (a dash)

Range:  Any string up to 15 characters long

---

Name:  *amp*

Relation:  **arrival**

Description: Signal amplitude. This is the zero-to-peak amplitude of the earth's displacement for a seismic phase. *Amp* is assumed to be corrected for the response of the instrument.

ORACLE: FLOAT(24)

NA Value: −1.0

Units:  Nanometers

Range:  *amp* > 0.0

---

Name:  *arid*

Relations: **arrival, assoc, stamag**

Description: Arrival identifier. Each arrival is assigned a unique positive integer identifying it with a unique *sta, chan* and *time*. This number is used in the **assoc** relation along with the origin identifier to link **arrival** and **origin**.

ORACLE: NUMBER(8)

NA Value: −1 Allowed only in **stamag**. A valid entry is required for **arrival** and **assoc**.

Range:  *arid* > 0

---

Name:  *auth*

Relations: **arrival, event, netmag, network, origin, stamag, stassoc**

Description: Author. This records the originator of an arrival (in **arrival** relation) or origin (in **origin** relation). Possibilities include externally supplied arrivals identified according to their original source, such as WMO, NEIS, CAN(adian), UK(array), etc. This may also be an identifier of an application generating the attribute, such as an automated interpretation or signal processing program.

ORACLE: VARCHAR(15)

NA Value: - (a dash)

Range:  Any string with no more than 15 upper case characters.

---

Name:            *azdef*

Relation:        **assoc**

Description:      Azimuth defining code. This is a one character flag that indicates whether or not the azimuth of a phase was used to determine the event's origin. It is defining (*azdef* = d) if used to help locate the event or non-defining (*azdef* = n) if it is not used.

ORACLE:          VARCHAR(1)

NA Value:        - (a dash)

Range:           {d | n}, lower case

---

Name:            *azimuth*

Relations:       **arrival, stassoc**

Description:      Observed azimuth. This is the estimated station-to-event azimuth measured clockwise from north. Azimuth is estimated from f-k or polarization analysis. In **stassoc**, the value may be an analyst estimate.

ORACLE:          FLOAT(24)

NA Value:        −1.0

Units:           Degrees

Range:           $0.0 \leq azimuth < 360.0$

---

Name:            *azres*

Relation:        **assoc**

Description:      Azimuth residual. This is the difference between the measured station-to-event azimuth for an arrival and the true azimuth. The "true" azimuth is the bearing to the inferred event origin.

ORACLE:          FLOAT(24)

NA Value:        −999.0

Units:           Degrees

Range:           $−180.0 \leq azres \leq 180.0$

---

Name:            *band*

Relation:        **instrument**

Description:      Frequency band. This is a qualitative indicator of frequency pass-band for an instrument. Values should reflect the response curve rather than just the sample rate. Recommended values are s (short-period), m (mid-period), i (intermediate-period), l (long-period), b (broad-band), h (high frequency, very short-period), and v (very long-period). For a better notion of the instrument characteristics, see the instrument response curve.

ORACLE:          VARCHAR(1)

NA Value:        - (a dash)

Range:           {s | m | i | l | b | h | v}, lower case.

---

---

Name:         *belief*

Relation:     **assoc**

Description:   Phase identification confidence level. This is a qualitative estimate of the confidence that a seismic phase is correctly identified.

ORACLE:       FLOAT(24)

NA Value:     −1.0

Range:        $0.0 \le belief \le 1.0$

---

Name:         *calib*

Relations:    **wfdisc, wftape**

Description:   Calibration factor. This is the conversion factor that maps digital data to earth displacement. The factor holds true at the oscillation period specified by the attribute *calper*. A positive value means ground motion increasing in component direction (up, north, east) is indicated by increasing counts. A negative value means the opposite. *Calib* generally reflects the best calibration information available at the time of recording, but refinement may be given in **sensor** reflecting a subsequent recalibration of the instrument. See *calratio*.

ORACLE:       FLOAT(24)

NA Value:     NOT ALLOWED. A valid entry is required.

Units:        Nanometers/digital count

Range:        Any non-zero floating point number.

---

Name:         *calper*

Relations:    **sensor, wfdisc, wftape**

Description:   Calibration period. This gives the period for which *calib*, *ncalib* and *calratio* are valid.

ORACLE:       FLOAT(24)

NA Value:     NOT ALLOWED. A valid entry is required.

Units:        Seconds

Range:        $calper > 0.0$

---

Name: *calratio*

Relation: **sensor**

Description: Calibration conversion ratio. This is a dimensionless calibration correction factor which permits small refinements to the calibration correction made using *calib* and *calper* from the **wfdisc** relation. Often, the **wfdisc** *calib* contains the nominal calibration assumed at the time of data recording. If the instrument is recalibrated, *calratio* provides a mechanism to update calibrations from **wfdisc** with the new information without modifying the **wfdisc** relation. A positive value means ground motion increasing in component direction (up, north, east) is indicated by increasing counts. A negative value means the opposite. *Calratio* is meant to reflect the most accurate calibration information for the time period for which the **sensor** record is appropriate, but the nominal value may appear until other information is available.

ORACLE: FLOAT(24)

NA Value: NOT ALLOWED. A valid entry is required.

Range: Any non-zero floating quantity.

---

Name: *chan*

Relations: **arrival, sensor, sitechan, wfdisc, wftape**

Description: Channel identifier. This is an eight-character code, which, taken together with *sta*, *jdate* and *time*, uniquely identifies the source of the seismic data, including the geographic location, spatial orientation, sensor and subsequent data processing.

ORACLE: VARCHAR(8)

NA Value: "-" (a dash) Allowed only in **arrival**. A valid entry is required in **sensor, sitechan, wfdisc** and **wftape**.

Range: Any sequence of up to 8 lower case characters.

---

Name: *chanid*

Relations: **arrival, sensor, sitechan, wfdisc, wftape**

Description: Channel recording identifier. This is a surrogate key used to uniquely identify a specific recording. *Chanid* duplicates the information of the compound key *sta, chan, time*. As a single identifier it is often convenient. *Chanid* is very database dependent and is included only for backward compatibility with historical databases. *Sta, chan* and *time* is more appropriate to the human interface.

ORACLE: NUMBER(8)

NA Value: −1

Range: *chanid* > 0

---

---

| | |
|---|---|
| Name: | *clip* |
| Relations: | **arrival, wfdisc, wftape** |
| Description: | Clipped data flag. This is a single-character flag to indicate whether (c) or not (n) the data were clipped. Typically, this flag is derived from status bits supplied with GDSN or RSTN data, but could also be supplied as a result of analyst review. |
| ORACLE: | VARCHAR(1) |
| NA Value: | - (a dash) |
| Range: | {c | n}, lower case |

---

| | |
|---|---|
| Name: | *commid* |
| Relations: | **arrival, assoc, event, network, netmag, origerr, origin, remark, stamag, stassoc, wfdisc, wftape** |
| Description: | Comment identification. This is a key used to point to free-form comments entered in the **remark** relation. These comments store additional information about a tuple in another relation. Within the **remark** relation, there may be many tuples with the same *commid* and different *lineno*, but the same *commid* will appear in only one other tuple among the rest of the relations in the database. See *lineno*. |
| ORACLE: | NUMBER(8) |
| NA Value: | −1  NOT ALLOWED in **remark** where a valid entry is required. |
| Range: | *commid* > 0 |

---

| | |
|---|---|
| Name: | *conf* |
| Relation: | **origerr** |
| Description: | Error confidence. This attribute denotes the confidence attached to the event attributes *smajax*, *sminax*, *sdepth* and *stime*. |
| ORACLE: | FLOAT(24) |
| NA Value: | 0.0 |
| Range: | $0.0 < conf \le 1.0$ |

---

| | |
|---|---|
| Name: | *ctype* |
| Relation: | **sitechan** |
| Description: | Channel type. This attribute specifies the type of data channel: n (normal, a normal instrument response), b (beam, a coherent beam formed with array data), or i (an incoherent beam or energy stack). |
| ORACLE: | VARCHAR(4) |
| NA Value: | - (a dash) |
| Range: | {n | b | i}, lower case |

---

Name: *datatype*

Relations: **wfdisc, wftape**

Description: Numeric data storage. This attribute specifies the format of a data series in the file system. Datatypes i4, f4 and s4 are typical values. Datatype i4 denotes a 4-byte integer and f4 denotes a 32-bit real number in DEC/VAX format. s4 is an integer where the most significant byte is in the low address position in memory (used by Motorola and Sun chipsets) and is opposite to the order used on DEC and Intel chipsets. Machine dependent formats are supported for common hardwares to allow data transfer in native machine binary formats. ASCII formats have also been defined to retain full precision of any binary data type. ASCII may be used when exchanging data between computer systems with incompatible binary types. See the "wfport" command manual page for information about converting formats. *Datatype* can only describe single values or arrays of one data type.

ORACLE: VARCHAR(2)

NA Value: - (a dash)

Range: The currently recognized types (lower case is mandatory) are:

| legal datatype values | | |
|---|---|---|
| datatype value | size (bytes) | description |
| a0 | 15 | ASCII single precision |
| b0 | 24 | ASCII double precision |
| c0 | 12 | ASCII integer |
| a# | 15 | ASCII single precision |
| b# | 24 | ASCII double precision |
| c# | 12 | ASCII integer |
| t4 | 4 | SUN IEEE single precision real |
| t8 | 8 | SUN IEEE double precision real |
| s4 | 4 | SUN IEEE integer |
| s2 | 2 | SUN IEEE short integer |
| f4 | 4 | VAX IEEE single precision real |
| f8 | 8 | VAX IEEE double precision real |
| i4 | 4 | VAX IEEE integer |
| i2 | 2 | VAX IEEE short integer |
| g2 | 2 | NORESS gain-ranged |

Name: *deast*

Relation: **site**

Description: Distance east. This attribute gives the "easting" or relative position of an array element, east of the location of the array center specified by the value of *refsta*. See *dnorth*.

ORACLE: FLOAT(24)

NA Value: 0.0

Units: Kilometers

Range: $-20{,}000.0 \leq deast \leq 20{,}000.0$

---

Name:          *delaz*

Relation:      **arrival**

Description:    Delta azimuth.  This attribute gives the standard deviation of the azimuth of a signal.

ORACLE:        FLOAT(24)

NA Value:      −1.0

Units:         Degrees

Range:         *delaz* > 0.0

---

Name:          *delslo*

Relation:      **arrival**

Description:    Delta slowness.  This attribute gives the standard deviation of the slowness of a signal.

ORACLE:        FLOAT(24)

NA Value:      −1.0

Units:         Seconds (of time)/degree

Range:         *delslo* > 0.0

---

Name:          *delta*

Relation:      **assoc**

Description:    Source-receiver distance.  This attribute is the arc length, over the earth's surface, of the path the seismic phase follows from source to receiver.  The location of the origin is specified in the **origin** record referenced by the attribute *orid*.  The attribute *arid* points to the record in the **arrival** relation that identifies the receiver.  The value of the attribute can exceed 180 degrees, it can even exceed 360 degrees.  The geographic distance between source and receiver is *delta* mod(180).

ORACLE:        FLOAT(24)

NA Value:      −1.0

Units:         Degrees

Range:         *delta* ≥ 0.0

---

Name:          *deltim*

Relation:      **arrival**

Description:    Delta time.  This attribute gives the standard deviation of a detection time.

ORACLE:        FLOAT(24)

NA Value:      −1.0

Units:         Seconds

Range:         *deltim* > 0.0

---

Name: *depdp*

Relation: **origin**

Description: Depth as estimated from depth phases. This is a measure of event depth estimated from a depth phase or an average of several depth phases. Depth is measured positive in a downwards direction starting from the earth's surface. See *ndp*.

ORACLE: FLOAT(24)

NA Value: −999.0

Units: Kilometers

Range: $0.0 \leq depdp < 1000.0$

---

Name: *depth*

Relations: **origin, stassoc**

Description: Source depth. This attribute gives the depth of the event origin. In **stassoc** this may be an analyst estimate.

ORACLE: FLOAT(24)

NA Value: −999.0 **origin**.

Units: Kilometers

Range: $0.0 \leq depth < 1000.0$

---

Name: *descrip*

Relation: **sitechan**

Description: Channel description. This is a description of the data channel. For non-instrument channels (e.g. beams) this can be the only quantitative description of channel operations in the core tables.

ORACLE: VARCHAR(50)

NA Value: - (a dash)

Range: Any free-format string up to 50 characters

---

Name: *dfile*

Relations: **instrument, wfdisc, wftape**

Description: Data file. In **wfdisc**, this is the file name of a disk-based waveform file. In **instrument**, this points to an instrument response file. See *dir*.

ORACLE: VARCHAR(32)

NA Value: NOT ALLOWED. A valid entry is required.

Range: Any free-format string up to 32 characters long

---

Name:              *digital*

Relation:          **instrument**

Description:        Digital/Analog. This attribute is a single character flag denoting whether this instrument record describes an analog or digital recording system.

ORACLE:            VARCHAR(1)

NA Value:          - (a dash)

Range:             {d | a}, lower case

---

Name:              *dir*

Relations:          **instrument, wfdisc, wftape**

Description:        Directory. This attribute is the directory-part of a path name. Relative path names or "." (dot), the notation for the current directory, may be used.

ORACLE:            VARCHAR(64)

NA Value:          NOT ALLOWED. A valid entry is required.

Range:             Any string up to 64 characters long

---

Name:              *dist*

Relation:          **stassoc**

Description:        Estimated distance. This attribute gives the approximate source-receiver distance as calculated from slowness (array measurements only), incident angle, or (S-P) times.

ORACLE:            FLOAT(24)

NA Value:          −1.0

Units:             Degrees

Range:             $0.0 \leq dist \leq 180.0$

---

Name:              *dnorth*

Relation:          **site**

Description:        Distance north. This attribute gives the "northing" or relative position of array element north of the array center specified by the value of *refsta*. See *deast*.

ORACLE:            FLOAT(24)

NA Value:          0.0

Units:             Kilometers

Range:             $-20,000.0 \leq dnorth \leq 20,000.0$

---

Name:        *dtype*

Relation:    **origin**

Description: Depth determination flag.  This single-character flag indicates the method by which the depth was determined or constrained during the location process. The recommended values are f (free), d (from depth phases), r (restrained by location program) or g (restrained by geophysicist).  In cases r or g, either the *auth* field should indicate the agency or person responsible for this action, or the *commid* field should point to an explanation in the **remark** relation.

ORACLE:      VARCHAR(1)

NA Value:    - (a dash)

Range:       {f | d | r | g}, lower case

---

Name:        *edepth*

Relation:    **sitechan**

Description: Emplacement depth.  This attribute gives the depth at which the instrument is positioned, relative to the value of *elev* in the **site** relation.

ORACLE:      FLOAT(24)

NA Value:    NOT ALLOWED. A valid entry is required.

Units:       Kilometers

Range:       *edepth* ≥ 0.0

---

Name:        *elev*

Relations:   **site**

Description: Elevation.  This attribute is the elevation of a seismic station relative to mean sea level.

ORACLE:      FLOAT(24)

NA Value:    −999.0

Units:       Kilometers

Range:       −10.0 ≤ *elev* ≤ 10.0

---

Name:        *ema*

Relation:    **arrival**

Description: Emergence angle.  This attribute is the emergence angle of an arrival, as observed at a three-component station or array.  The value increases from the vertical direction towards the horizontal.

ORACLE:      FLOAT(24)

NA Value:    −1.0

Units:       Degrees

Range:       0.0 ≤ *ema* ≤ 90.0

---

---

Name:            *emares*

Relation:       **assoc**

Description:     Emergence angle residual. This attribute is the difference between an observed emergence angle and the theoretical prediction for the same phase, assuming an event location as specified by the accompanying *orid*.

ORACLE:       FLOAT(24)

NA Value:      −999.0

Units:            Degrees

Range:           $-90.0 \leq emares \leq 90.0$

---

Name:            *endtime*

Relations:      **sensor, wfdisc, wftape**

Description:     Time of last datum. In **wfdisc** and **wftape**, this attribute is the time of the last sample in the waveform file. *Endtime* is equivalent to *time* + (*nsamp* − 1)/*samprate.* In **sensor**, this is the last time the data in the record are valid.

ORACLE:       FLOAT(53)

NA Value:      +9999999999.999

Units:            Epochal seconds

Range:           *endtime > time*

---

Name:            *esaz*

Relation:       **assoc**

Description:     Event to station azimuth. This attribute is the calculated event-to-station azimuth, measured in degrees clockwise from North.

ORACLE:       FLOAT(24)

NA Value:      −999.0

Units:            Degrees

Range:           $0.0 \leq esaz \leq 360.0$

---

Name:        *etype*

Relations:      **origin, stassoc**

Description:    Event type. This attribute is used to identify the type of seismic event, when known. For *etypes* l, r, t the value in **origin** will be the value determined by the station closest to the event.

ORACLE:      VARCHAR(7)

NA Value:     - (a dash)

Range:         The recommended codes (all lower case) are:

| etype values | |
|---|---|
| etype code | meaning of code |
| qb | Quarry blast or mining explosion |
| eq | Earthquake |
| me | Marine explosion |
| ex | Other explosion |
| o | Other source of known origin |
| l | Local event of unknown origin |
| r | Regional event of unknown origin |
| t | Teleseismic event of unknown origin |

Name:        *evid*

Relations:      **event, netmag, origin, stamag**

Description:    Event identifier. Each event is assigned a unique positive integer which identifies it in a database. It is possible for several records in the **origin** relation to have the same *evid*. This indicates there are several opinions about the location of the event.

ORACLE:      NUMBER(8)

NA Value:     $-1$ Allowed in **netmag, origin** and **stamag**. A valid entry is required in **event**.

Range:         $evid > 0$

Name:        *evname*

Relation:       **event**

Description:    Event name. This is the common name of the event identified by *evid*.

ORACLE:      VARCHAR(15)

NA Value:     - (a dash)

Range:         Any free-format string up to 15 characters long.

Name:         *fm*

Relation:     **arrival**

Description:   First motion.  This is a two-character indication of first motion. The first character describes first motion seen on short-period channels and the second holds for long-period instruments.  Compression (dilation) on a short-period sensor is denoted by c(d) and compression (dilation) on a long-period sensor is denoted by u(r).  Empty character positions will be indicated by dots (e.g., ".r").

ORACLE:       VARCHAR(2)

NA Value:     - (a dash)

Range:        All two-letter permutations of {c ǀ d ǀ . }, {u ǀ r ǀ . }, lower case

---

Name:         *foff*

Relation:     **wfdisc**

Description:   File offset.  This is the byte offset of a waveform segment within a data file.  It is used when data are multiplexed.  See *dir* and *dfile.*

ORACLE:       NUMBER(8)

NA Value:     NOT ALLOWED. A valid entry is required.

Range:        $foff \geq 0$

---

Name:         *grn*

Relations:    **gregion, origin**

Description:   Geographic region number.  This is a geographic region number, as defined by Flinn, Engdahl and Hill  (Bull. Seism. Soc. Amer. vol 64, pp. 771-992, 1974).  See *grname.*

ORACLE:       NUMBER(4)

NA Value:     −1  Allowed only in **origin**. A valid entry is required in **gregion**.

Range:        $grn > 0$

---

Name:         *grname*

Relation:     **gregion**

Description:   Geographic region name.  This attribute is the common name of a geographic region, as given in Flinn, Engdahl and Hill (Bull. Seism. Soc.  Amer., vol 64, pp 771-992, 1974).  Names may have changed due to changing political circumstances (e.g., old RHODESIA = new ZIMBABWE).  See *grn* and *srname.*

ORACLE:       VARCHAR(40)

NA Value:     NOT ALLOWED. A valid entry is required.

Range:        Any upper-case string up to 40 characters long

---

| | |
|---|---|
| Name: | *hang* |
| Relation: | **sitechan** |
| Description: | Horizontal orientation of seismometer. This attribute specifies the orientation of the seismometer in the horizontal plane, measured clockwise from North. For a North-South orientation with the seismometer pointing toward the north, *hang*=0.; for East-West orientation with the seismometer pointing toward the west, *hang*=270. See *vang*. |
| ORACLE: | FLOAT(24) |
| NA Value: | NOT ALLOWED. A valid entry is required. |
| Units: | Degrees |
| Range: | $0.0 \leq hang \leq 360.0$ |

| | |
|---|---|
| Name: | *imb* |
| Relation: | **stassoc** |
| Description: | Initial body wave magnitude. This is an analyst's estimate of the body wave magnitude using data from a single station. See *iml, ims, magnitude, magtype, mb, ml* and *ms*. |
| ORACLE: | FLOAT(24) |
| NA Value: | −999.0 |

| | |
|---|---|
| Name: | *iml* |
| Relation: | **stassoc** |
| Description: | Initial local magnitude. This is an analyst's estimate of the local magnitude using data from a single station. See *imb, ims, magnitude, magtype, mb, ml* and *ms*. |
| ORACLE: | FLOAT(24) |
| NA Value: | −999.0 |

| | |
|---|---|
| Name: | *ims* |
| Relation: | **stassoc** |
| Description: | Initial surface wave magnitude. This is an analyst's estimate of surface wave magnitude using data from a single station. See *magnitude, magtype, mb, ml, ms, imb* and *iml*. |
| ORACLE: | FLOAT(24) |
| NA Value: | −999.0 |

| | |
|---|---|
| Name: | *inid* |
| Relations: | **instrument, sensor** |
| Description: | Instrument identifier. This is a unique key to the **instrument** relation. *Inid* provides the only link between **sensor** and **instrument**. |
| ORACLE: | NUMBER(8) |
| NA Value: | −1 Allowed only in **sensor**. A valid entry is required for **instrument**. |
| Range: | *inid* > 0 |

---

Name:         *insname*

Relation:     **instrument**

Description:    Instrument name. This is a character string containing the name of the instrument.

ORACLE:      VARCHAR(50)

NA Value:     - (a dash)

Range:         Any free-format string up to 50 characters long.

---

Name:         *instant*

Relation:     **sensor**

Description:    Snapshot indicator. When this attribute has the value *instant* = "y", it means that the snapshot was taken at the time of a discrete procedural change, such as an adjustment of the instrument gain; n means the snapshot is of a continuously changing process, such as calibration drift. This is important for tracking time corrections and calibrations.

ORACLE:      VARCHAR(1)

NA Value:     NOT ALLOWED. If the value is unknown, default to "y".

Range:         {y | n}

---

Name:         *instype*

Relations:    **instrument, wfdisc, wftape**

Description:    Instrument type. This character string is used to indicate the instrument type. Some examples are: SRO, ASRO, DWWSSN, LRSM, and S-750.

ORACLE:      VARCHAR(6)

NA Value:     - (a dash)

Range:         Upper case and too numerous to mention, but see "Directory of World Digital Seismic Station", Ganse & Hutt, World Data Center A, Report SE-32, August, 1982.

---

Name:         *iphase*

Relation:     **arrival**

Description:    Reported phase. This eight-character field holds the name initially given to a seismic phase. Standard seismological labels for the types of signals (or phases) are used (e.g., P, PKP, PcP, pP). Both upper and lower case letters are available and should be used when appropriate, for example, pP or PcP. See *phase*.

ORACLE:      VARCHAR(8)

NA Value:     - (a dash)

Range:         Any string up to 8 characters long which conforms to seismological practice.

---

Name:     *jdate*

Relations:     **arrival, origin, sensor, wfdisc, wftape**

Description:     Julian date. This attribute is the date of an arrival, origin, seismic recording, etc. The same information is available in epoch time, but the Julian date format is more convenient for many types of searches. Dates B.C. are negative. Note: there is no year = 0000 or day = 000. Where only the year is known, day of year = 001; where only year and month are known, day of year = first day of month. Note: only the year is negated for BC, so Jan 1 of 10 BC is −0010001. See *time*.

ORACLE:     NUMBER(8)

NA Value:     −1

Range:     Julian dates of the form yyyyddd. Must be consistent with the accompanying *time* attribute.

---

Name:     *keyname*

Relation:     **lastid**

Description:     Identifier type. This attribute contains the actual name of a key whose last assigned numeric value is saved in *keyvalue*.

ORACLE:     VARCHAR(15)

NA Value:     NOT ALLOWED. A valid entry is required.

Range:     {arid | chanid | commid | evid | inid | orid | stassid | wfid}, lower case

---

Name:     *keyvalue*

Relation:     **lastid**

Description:     Current identifier value. This attribute maintains the last assigned value (a positive integer) of the counter for the specified *keyname*. The number *keyvalue* is the last counter value used for the attribute *keyname*. Key values are maintained in the database to ensure uniqueness.

ORACLE:     NUMBER(8).

NA Value:     NOT ALLOWED. A valid entry is required.

Range:     *keyvalue* > 0

---

Name:     *lat*

Relations:     **origin, site, stassoc**

Description:     Latitude. This attribute is the geographic latitude. Locations north of the equator have positive latitudes.

ORACLE:     FLOAT(24)

NA Value:     −999.0 Allowed only in **stassoc**. A valid entry is required in **origin** and **site**.

Units:     Degrees

Range:     $-90.0 \le lat \le +90.0$

---

Name:           *lddate*

Relations:      **all**

Description:     Load date.  This is the date and time the record was inserted into the database.

ORACLE:         DATE

Range:          Any valid date.

---

Name:           *lineno*

Relation:       **remark**

Description:     Comment line number.  This integer attribute is assigned as a sequence number for multiple line comments.  The combination of *commid* and *lineno* is unique.

ORACLE:         NUMBER(4)

NA Value:       NOT ALLOWED. A valid entry is required.

Range:          *lineno* > 0

---

Name:           *location*

Relation:       **stassoc**

Description:     Location description.  This character string describes the location of an event identified from data recorded at a single station.  Two examples are Fiji-Tonga and Semipalatinsk.

ORACLE:         VARCHAR(32)

NA Value:       - (a dash)

Range:          Any free-format string up to 32 characters long

---

Name:           *logat*

Relation:       **arrival**

Description:     Log of amplitude divided by period.  This measurement of signal size is often reported instead of the amplitude and period separately.  This attribute is only filled if the separate measurements are not available.

ORACLE:         FLOAT(24)

NA Value:       −999.0

Units:          Log (Nanometers/seconds)

---

Name:           *lon*

Relations:      **origin, site, stassoc**

Description:     Longitude.  This attribute is the geographic longitude in degrees.  Longitudes are measured positive east of the Greenwich meridian.

ORACLE:         FLOAT(24)

NA Value:       −999.0  Allowed only in **stassoc**. A valid entry is required in **origin** and **site**.

Units:          Degrees

Range:          −180.0 ≤ *lon* ≤ +180.0

---

Name:       *magid*

Relations:   **netmag, stamag**

Description:   Network magnitude identifier. This key is assigned to identify a network magnitude in the **netmag** relation. It is required for every network magnitude. Magnitudes given in **origin** must reference a network magnitude with *magid = mbid, mlid* or *msid*, whichever is appropriate. See *mbid, mlid,* or *msid*.

ORACLE:   NUMBER(8)

NA Value:   NOT ALLOWED. A valid entry is required.

Range:   *magid* > 0

---

Name:       *magnitude*

Relations:   **netmag, stamag**

Description:   Magnitude. This gives the magnitude value of the type indicated in attribute *magtype*. It is derived in a variety of ways, which are not necessarily linked directly to an arrival. See *imb, iml, ims, magtype, mb, ml* and *ms*.

ORACLE:   FLOAT(24)

NA Value:   NOT ALLOWED. An entry is required to define a valid record.

---

Name:       *magtype*

Relations:   **netmag, stamag**

Description:   Magnitude type. This character string is used to specify whether the *magnitude* value represents *mb* (body wave magnitude), *ms* (surface wave magnitude), *ml* (local magnitude) or other appropriate magnitude measure. See *imb, iml, ims, magnitude, mb, ml, ms*.

ORACLE:   VARCHAR(6)

NA Value:   NOT ALLOWED. A valid entry is required.

Range:   Any free-format string up to 6 characters long.

---

Name:       *mb*

Relation:   **origin**

Description:   Body wave magnitude. This is the body wave magnitude of an event. Associated with this attribute is the identifier *mbid* which points to *magid* in the **netmag** relation. The information in that record summarizes the method of analysis and data used. See *imb, iml, ims, magnitude, magtype, ml* and *ms*.

ORACLE:   FLOAT(24)

NA Value:   −999.0

---

---

Name:       *mbid*

Relation:      **origin**

Description:    Magnitude identifier for *mb*. This stores the *magid* for a record in **netmag**. *Mbid* is a foreign key joining **origin** to **netmag** where **origin**.*mbid* = **netmag**.*magid*. See *magid*, *mlid* and *msid*.

ORACLE:      NUMBER(8)

NA Value:    −1

Range:       $mbid > 0$

---

Name:       *ml*

Relation:      **origin**

Description:    Local magnitude. This is the local magnitude of an event. Associated with this attribute is the identifier *mlid*, which points to *magid* in the **netmag** relation. The information in that record summarizes the method of analysis and the data used. See *imb, iml, ims, magnitude, magtype, mb* and *ms*.

ORACLE:      FLOAT(24)

NA Value:    −999.0

---

Name:       *mlid*

Relation:      **origin**

Description:    Magnitude identifier for *ml*. This stores the *magid* for a record in **netmag**. *Mlid* is a foreign key joining **origin** to **netmag** where **origin**.*mlid* = **netmag**.*magid*. See *magid*, sid and *mbid*.

ORACLE:      NUMBER(8)

NA Value:    −1

Range:       $mlid > 0$

---

Name:       *ms*

Relation:      **origin**

Description:    Surface wave magnitude. This is the surface wave magnitude for an event. Associated with this attribute is the identifier *msid*, which points to *magid* in the **netmag** relation. The information in that record summarizes the method of analysis and the data used. See *imb, iml, ims, magnitude, magtype, mb* and *ml*.

ORACLE:      FLOAT(24)

NA Value:    −999.0

---

| | |
|---|---|
| Name: | *msid* |
| Relation: | **origin** |
| Description: | Magnitude identifier for *ms*. This stores the *magid* for a record in **netmag**. *Msid* is a foreign key joining **origin** to **netmag** where **origin**.*msid* = **netmag**.*magid*. See *magid*, mlid *and mbid.* |
| ORACLE: | NUMBER(8) |
| NA Value: | −1 |
| Range: | *msid* > 0 |

| | |
|---|---|
| Name: | *nass* |
| Relation: | **origin** |
| Description: | Number of associated arrivals. This attribute gives the number of arrivals associated with the origin. |
| ORACLE: | NUMBER(8) |
| NA Value: | −1 |
| Range: | *nass* > 0 |

| | |
|---|---|
| Name: | *ncalib* |
| Relation: | **instrument** |
| Description: | Nominal calibration factor. This is the conversion factor that maps digital data to earth displacement. The factor holds true at the oscillation period specified by *ncalper*. A positive value means ground motion increasing in component direction (up, north, east) is indicated by increasing counts. A negative value means the opposite. Actual calibration for a particular recording is determined using the **wfdisc** and **sensor** relations. See *calratio*. |
| ORACLE: | FLOAT(24) |
| NA Value: | NOT ALLOWED. A valid entry is required. |
| Units: | Nanometers/digital count |
| Range: | Any non-zero floating point number |

| | |
|---|---|
| Name: | *ncalper* |
| Relation: | **instrument** |
| Description: | Calibration period. This attribute is the period for which *ncalib* is valid. |
| ORACLE: | FLOAT(24) |
| NA Value: | NOT ALLOWED. A valid entry is required. |
| Units: | seconds |
| Range: | *ncalper* > 0.0 |

---

| | |
|---|---|
| Name: | *ndef* |
| Relation: | **origin** |
| Description: | Number of time-defining phases.  This attribute is the number of arrivals used to locate an event.  See *timedef*. |
| ORACLE: | NUMBER(4) |
| NA Value: | –1 |
| Range: | $0 < ndef \leq nass$ |

---

| | |
|---|---|
| Name: | *ndp* |
| Relation: | **origin** |
| Description: | Number of depth phases.  This attribute gives the number of depth phases used in calculating *depth* and/or *depdp*.  See *depdp*. |
| ORACLE: | NUMBER(4) |
| NA Value: | –1 |
| Range: | $ndp \geq 0$ |

---

| | |
|---|---|
| Name: | *net* |
| Relations: | **affiliation, netmag, network** |
| Description: | Unique network identifier.  This character string is the name of a seismic network.  One example is WWSSN. |
| ORACLE: | VARCHAR(8) |
| NA Value: | - (a dash) Allowed only in **netmag**. A valid entry is required in **affiliation** and **network**. |
| Range: | Any free-format string up to 8 characters |

---

| | |
|---|---|
| Name: | *netname* |
| Relation: | **network** |
| Description: | Network Name.  String containing the name of a network. |
| ORACLE: | VARCHAR(80) |
| NA Value: | - (a dash) |
| Range: | Any string up to 80 characters |

---

| | |
|---|---|
| Name: | *nettype* |
| Relation: | **network** |
| Description: | Network type.  This 4 character string specifies what type of network (ar = array), (lo = local area), (ww = world-wide) for the given value of *net*. |
| ORACLE: | VARCHAR(4) |
| NA Value: | - (a dash) |
| Range: | Any lower case string up to 4 characters |

---

| | |
|---|---|
| Name: | *nsamp* |
| Relations: | **wfdisc, wftape** |
| Description: | Number of samples. This quantity is the number of samples in a waveform segment. |
| ORACLE: | NUMBER(8) |
| NA Value: | NOT ALLOWED. A valid entry is required. |
| Range: | *nsamp* > 0 |

| | |
|---|---|
| Name: | *nsta* |
| Relation: | **netmag** |
| Description: | Number of stations. This quantity is the number of stations used to compute the magnitude of the event. |
| ORACLE: | NUMBER(8) |
| NA Value: | −1 |
| Range: | *nsta* > 0 |

| | |
|---|---|
| Name: | *offdate* |
| Relations: | **site, sitechan** |
| Description: | Turn off date. This attribute is the Julian Date on which the station or sensor indicated was turned off, dismantled, or moved. See *ondate*. |
| ORACLE: | NUMBER(8) |
| NA Value: | −1 |
| Range: | Julian date of the form yyyyddd |

| | |
|---|---|
| Name: | *ondate* |
| Relations: | **site, sitechan** |
| Description: | Turn on date. This attribute is the Julian Date on which the station or sensor indicated began operating. *Offdate* and *ondate* are not intended to accommodate temporary downtimes, but rather to indicate the time period for which the attributes of the station (*lat, lon, elev*) are valid for the given station code. Stations are often moved, but with the station code remaining unchanged. |
| ORACLE: | NUMBER(8) |
| NA Value: | NOT ALLOWED. A valid entry is required. |
| Range: | Julian date of the form yyyyddd |

Name:        *orid*

Relations:   **assoc, netmag, origerr, origin, stamag**

Description: Origin identification. Each origin is assigned a unique positive integer which identifies it in a data base. The *orid* is used to identify one of the many hypotheses of the actual location of the event.

ORACLE:      NUMBER(8)

NA Value:    NOT ALLOWED. A valid entry is required for all relations.

Range:       *orid* > **0**

---

Name:        *per*

Relation:    **arrival**

Description: Signal period. This attribute is the period of the signal described by the **arrival** record.

ORACLE:      FLOAT(24)

NA Value:    −1.0

Units:       Seconds

Range:       *per* > 0.0

---

Name:        *phase*

Relations:   **assoc, stamag**

Description: Associated phase. This field holds the identity of a seismic phase which has been associated to an event. Standard seismological labels for phases are used (e.g., P, PKP, PcP, pP, etc.). Both upper and lower case letters are available and should be used when appropriate, for example, pP or PcP. See *iphase*.

ORACLE:      VARCHAR (8)

NA Value:    - (a dash)

Range:       Any string up to **8** characters long which conforms to seismological practice.

---

Name:        *prefor*

Relation:    **event**

Description: Preferred origin. This attribute holds the origin identifier, *orid*, that points to the preferred origin for a seismic event.

ORACLE:      NUMBER(8)

NA Value:    NOT ALLOWED. A valid entry is required.

Range:       *prefor* > **0**

---

Name:         *qual*

Relation:     **arrival**

Description:  Onset quality. This single-character flag is used to denote the sharpness of the onset of a seismic phase. This relates to the timing accuracy as follows:

        i (impulsive) - accurate to +/− 0.2 seconds

        e (emergent) - accuracy between +/−(0.2 to 1.0 seconds)

        w (weak) - timing uncertain to > 1 second.

ORACLE:     VARCHAR (1)

NA Value:    - (a dash)

Range:        {i | e | w}, lower case

---

Name:         *rect*

Relation:     **arrival**

Description:  Rectilinearity. This attribute is a measure of signal rectilinearity. The value is obtained from polarization analysis of 3-component data.

ORACLE:     FLOAT(24)

NA Value:    −1.0

Range:        $0.0 \leq rect \leq 1.0$

---

Name:         *refsta*

Relation:     **site**

Description:  Reference station. This string specifies the reference station with respect to which array members are located. See *deast, dnorth*.

ORACLE:     VARCHAR (6)

NA Value:    - (a dash)

Range:        Any *sta* from **site**.

---

Name:         *remark*

Relation:     **remark**

Description:  Descriptive text. This single line of text is an arbitrary comment about a record in the database. The comment is linked to its "parent" relation only by forward reference from *commid* in the tuple of the relation of interest. See *commid* and *lineno*.

ORACLE:     VARCHAR(80)

NA Value:    - (a dash)

Range:        Any free-format string up to 80 characters long

---

Name:       *rsptype*

Relation:       **instrument**

Description:       Instrument response type. This denotes the style in which detailed calibration data are stored. The neighboring attribute *dfile* tells where the calibration data are saved. When *rsptype* = paz, it indicates the data are the poles and zeroes of the Laplace transform. *rsptype* = fap indicates they are amplitude/phase values at a range of frequencies. *rsptype* = fir indicates it is a finite impulse response table. *rsptype* = pazfir indicates a combination of poles, zeros and finite impulse response. Other codes may be defined.

ORACLE:       VARCHAR(6)

NA Value:       NOT ALLOWED. A valid entry is required.

Range:       Any lower case string up to 6 characters long

Name:       *samprate*

Relations:       **instrument, wfdisc, wftape**

Description:       Sampling rate. This attribute is the sample rate in samples/second. In the **instrument** relation this is specifically the nominal sample rate, not accounting for clock drift. In **wfdisc**, the value may vary slightly from the nominal to reflect clock drift.

ORACLE:       FLOAT(24)

NA Value:       NOT ALLOWED. A valid entry is required.

Units:       1/seconds

Range:       *samprate* > 0.0

Name:       *sdepth*

Relation:       **origerr**

Description:       Depth error. This is the maximum error of a depth estimate for a level of confidence given by *conf*. See *smajax, sminax, stx*.

ORACLE:       FLOAT(24)

NA Value:       −1.0

Units:       Kilometers

Range:       *sdepth* > 0.0

Name:       *sdobs*

Relation:       **origerr**

Description:       Standard error of one observation. This attribute is derived from the discrepancies in the arrival times of the phases used to locate an event. It is defined as the square root of the sum of the squares of the time residuals, divided by the number of degrees of freedom. The latter is the number of defining observations (*ndef* in **origin** ) minus the dimension of the system solved (4 if depth is allowed to be a free variable, 3 if depth is constrained).

ORACLE:       FLOAT(24)

NA Value:       −1.0

Range:       *sdobs* > 0.0

Name:          *seaz*

Relation:      **assoc**

Description:    Station to event azimuth. This attribute is calculated from the station and event locations. It is measured clockwise from North.

ORACLE:        FLOAT(24)

NA Value:      −999.0

Units:         Degrees

Range:         $0.0 \leq seaz \leq 360.0$

Name:          *segtype*

Relations:     **wfdisc, wftape**

Description:    Segment type. This attribute indicates if a waveform is o (original), v (virtual), s (segmented) or d (duplicate).

ORACLE:        VARCHAR (1)

NA Value:      - (a dash)

Range:         {o | v | s | d}, lower case

Name:          *slodef*

Relation:      **assoc**

Description:    Slowness defining code. This one-character flag indicates whether or not the slowness of a phase is d (defining), or n (non-defining) for this arrival. See *azdef* and *timedef*.

ORACLE:        VARCHAR (1)

NA Value:      - (a dash)

Range:         {d | n}

Name:          *slores*

Relation:      **assoc**

Description:    Slowness residual. This attribute gives the difference between an observed slowness and a theoretical prediction. The prediction is calculated for the related phase and event origin described in the record.

ORACLE:        FLOAT(24)

NA Value:      −99999.0

Units:         Seconds/degree

Name:        *slow*

Relation:    **arrival**

Description: Observed slowness.  This is the observed slowness of a wave as it sweeps across an array.

ORACLE:      FLOAT(24)

NA Value:    −1.0

Units:       Seconds/degree

Range:       *slow* ≥ 0.0

Name:        *smajax*

Relation:    **origerr**

Description: Semi-major axis of error ellipse for a given confidence.  This is the length of the semi-major axis of the location error ellipse.  It is found by projecting the covariance matrix onto the horizontal plane.  The level of confidence is specified by *conf.*  See *sdepth, sminax* and *stx.*

ORACLE:      FLOAT(24)

NA Value:    −1.0

Units:       Kilometers

Range:       *smajax* > 0.0

Name:        *sminax*

Relation:    **origerr**

Description: Semi-minor axis of error ellipse.  This is the length of the semi-minor axis of the location error ellipse.  It is found by projecting the covariance matrix onto the horizontal plane.  The level of confidence is specified by *conf.*  See *sdepth, smajax* and *stx.*

ORACLE:      FLOAT(24)

NA Value:    −1.0

Units:       Kilometers

Range:       *sminax* > 0.0

Name:        *snr*

Relation:    **arrival**

Description: Signal-to-noise ratio.  This is an estimate of the size of the signal relative to that of the noise immediately preceding it.

ORACLE:      FLOAT(24)

NA Value:    −1.0

Range:       *snr* > 0.0

| | |
|---|---|
| Name: | *srn* |
| Relations: | **origin, sregion** |
| Description: | Region number. This is a seismic region number, as given by Flinn, Engdahl and Hill (Bull. Seism. Soc. Amer. vol 64, pp 791-992, 1974). See *grn, grname* and *srname*. |
| ORACLE: | NUMBER(8) |
| NA Value: | –1  Allowed only in **origin**. A valid entry is required in **sregion**. |
| Range: | *srn* > 0 |

| | |
|---|---|
| Name: | *srname* |
| Relation: | **sregion** |
| Description: | Seismic region name. This attribute is the common name of a seismic region, as given in Flinn, Engdahl and Hill (Bull. Seism. Soc. Amer., vol 64, pp 771-992, 1974). Names may have changed due to changing political circumstances (e.g., old RHODESIA = new ZIMBABWE). See *srn* and *grname*. |
| ORACLE: | VARCHAR(40) |
| NA Value: | NOT ALLOWED. A valid entry is required. |
| Range: | Any upper-case string up to 40 characters long |

| | |
|---|---|
| Name: | *sta* |
| Relations: | **affiliation, arrival, assoc, sensor, site, sitechan, stamag, stassoc, wfdisc, wftape** |
| Description: | Station code. This is the common code-name of a seismic observatory. Generally only three or four characters are used. |
| ORACLE: | VARCHAR (6) |
| NA Value: | "-" (a dash)  Allowed only in **stassoc**. A valid entry is required for all other relations. |
| Range: | Any upper case string up to 6 characters long |

| | |
|---|---|
| Name: | *staname* |
| Relation: | **site** |
| Description: | Station name/description. This is the full name of the station whose code-name is in *sta*. As an example, one record in the **site** relation connects *sta* = ANMO to *staname* = ALBUQUERQUE, NEW MEXICO (SRO). |
| ORACLE: | VARCHAR (50) |
| NA Value: | - (a dash) |
| Range: | Any upper-case string up to 50 characters long |

Name: *stassid*

Relations: **arrival, stassoc**

Description: Station association identification. The wavetrain from a single event may be made up of a number of arrivals. A unique *stassid* joins those arrivals believed to have come from a common event as measured at a single station. *Stassid* is also the key to the **stassoc** relation, which contains additional signal measurements not contained within the **arrival** relation, such as station magnitude estimates and computed signal characteristics.

ORACLE: NUMBER(8)

NA Value: −1 Allowed only in **arrival**.

Range: *stassid* > 0

Name: *statype*

Relation: **site**

Description: Station type. This character string specifies the station type. Recommended entries are ss (single station) or ar (array).

ORACLE: VARCHAR (4)

NA Value: - (a dash)

Range: {ss | ar}, lower case

Name: *stime*

Relation: **origerr**

Description: Origin time error. This attribute denotes the time uncertainty that accompanies the location. The level of confidence is specified by *conf.* See *smajax, sminax,* and *sdepth*.

ORACLE: FLOAT(24)

NA Value: −1.0

Units: Seconds

Range: *stime* ≥ 0.0

Name: *strike*

Relation: **origerr**

Description: Strike of major axis of error ellipse. This attribute is the strike of the semi-major axis of the location error ellipse, measured in degrees clockwise from North. See *smajax*.

ORACLE: FLOAT(24)

NA Value: −1.0

Units: Degrees

Range: 0.0 ≤ *strike* ≤ 360.0

| | |
|---|---|
| Name: | *stx, sty, stz, sxx, sxy, sxz, syy, syz, stt, szz* |
| Relation: | **origerr** |
| Description: | Elements of the covariance matrix for the location identified by *orid*. The covariance matrix is symmetric (and positive definite) so that *sxy = syx*, etc., (x,y,z,t) refer to latitude, longitude, depth and origin time, respectively. These attributes (together with *sdobs, ndef* and *dtype*) provide all the information necessary to construct the K-dimensional (K=2,3,4) confidence ellipse or ellipsoids at any confidence limit desired. |
| ORACLE: | FLOAT(24) |
| NA Value: | −1.0 |
| Units: | *sxx,syy,szz,sxy,szx,syz* - kilometers squared, *stt* - seconds squared, *stx,sty,stz* - km/sec |
| Range: | *sxx, syy, szz, stt* > 0.0 |

| | |
|---|---|
| Name: | *stype* |
| Relation: | **arrival** |
| Description: | Signal type. This single-character flag indicates the event or signal type. The following definitions hold:<br>    l = local event<br>    r = regional event<br>    t = teleseismic event<br>    m = mixed or multiple event<br>    g = glitch (i.e., non-seismic detection)<br>    c = calibration activity upsets the date<br>l, r, and t are supplied by the reporting station, or as an output of post-detection processing. g and c come from analyst comment or from status bits from GDSN and RSTN data. |
| ORACLE: | VARCHAR(1) |
| NA Value: | - (a dash) |
| Range: | {l \| r \| t \| m \| g \| c}, lower case |

| | |
|---|---|
| Name: | *tagid* |
| Relation: | **wftag** |
| Description: | Tagname value. This contains the value of a foreign key identified in *tagname*. For example, if tagname is "arid", then **wftag** may be joined to **arrival** where **arrival**.*arid* = **wftag**.*tagid*. If tagname is "orid", then **wftag** and **origin** may be joined where **origin**.*orid* = **wftag**.*tagid*. |
| ORACLE: | NUMBER(8) |
| NA Value: | NOT ALLOWED. A valid entry is required. |
| Range: | *tagid* > 0 |

Name:       *tagname*

Relation:     **wftag**

Description:    Tagname type. This is the name of the foreign key whose value is in *tagid*.

ORACLE:      VARCHAR(8)

NA Value:     NOT ALLOWED. A valid entry is required.

Range:        {arid | evid | orid | stassid}

---

Name:       *tapeblock*

Relation:     **wftape**

Description:    Tape block number. This attribute gives the first block (in some file of an ANSI-labeled tape) at which a time series begins. The dearchiving program uses this number to skip blocks within a tape file in order to retrieve the waveform specified. See *tapefile*.

ORACLE:      NUMBER(8)

NA Value:     −1

Range:        *tapeblock* > 0

---

Name:       *tapefile*

Relation:     **wftape**

Description:    Tape file number. This attribute gives the file number (on a tape) at which a time-series is written. A tape begins with file 1. This number can be used to skip files when retrieving data from the tape. See *tapeblock*.

ORACLE:      NUMBER(8)

NA Value:     −1

Range:        *tapefile* > 1

---

Name:       *time*

Relations:    **arrival, origin, sensor, stassoc, wfdisc, wftape**

Description:    Epoch time. Epochal time given as seconds and fractions of a second since hour 0 January 1, 1970, and stored in a double precision floating number. Refers to the relation data object with which it is found. E.g., in **arrival** - arrival time; in **origin** - origin time; in **wfdisc**, - start time of data. Where date of historical events is known, time is set to the start time of that date; where the date of contemporary arrival measurements is known but no time is given, then the time attribute is set to the NA value. The double-precision floating point number allows 15 decimal digits. At 1 millisecond accuracy this is a range of $3 * 10^4$ years. Where time is unknown, or prior to Feb. 10, 1653, set to the NA value.

ORACLE:      FLOAT(53)

NA Value:     −9999999999.999    Allowed only in **stassoc**, all other relations require a valid time.

Units:        Seconds

---

Name:         *timedef*

Relation:     **assoc**

Description:   Time-defining code. This one character flag indicates whether the time of a phase is d (defining), or n (non-defining) for this arrival. See *azdef* and *slodef*.

ORACLE:       VARCHAR(1)

NA Value:     - (a dash)

Range:        {d | n}

---

Name:         *timeres*

Relation:     **assoc**

Description:   Time residual. This attribute is a travel time residual, measured in seconds. The residual is found by taking the observed arrival time (saved in the **arrival** relation) of a seismic phase and subtracting the expected arrival time. The expected arrival time is calculated by a formula based on earth velocity model (attribute *vmodel*), an event location and origin time (saved in table **origin**), the distance to the station (attribute *dist* in table **assoc**), and the particular seismic phase (attribute *phase* in table **assoc**).

ORACLE:       FLOAT(24)

NA Value:     −999.0

Units:        Seconds

---

Name:         *tshift*

Relation:     **sensor**

Description:   Correction for clock errors. This attribute is designed to accommodate discrepancies between actual time and the numerical time written by data recording systems. Actual time is the sum of the reported time plus *tshift*.

ORACLE:       FLOAT(24)

NA Value:     NOT ALLOWED. An entry is required to define a valid record.

Units:        Seconds

---

Name:         *uncertainty*

Relation:     **netmag, stamag**

Description:   Magnitude uncertainty. This is the standard deviation of the accompanying magnitude measurement.

ORACLE:       FLOAT(24)

NA Value:     −1.0

Range:        *uncertainty* > 0.0

---

Name:        *vang*

Relation:    **sitechan**

Description:    Vertical orientation of seismometer. This attribute measures the angle between the sensitive axis of a seismometer and the outward-pointing vertical direction. For a vertically oriented seismometer, *vang* = 0. For a horizontally oriented seismometer, *vang*=90. See *hang*.

ORACLE:    FLOAT(24)

NA Value:    NOT ALLOWED. A valid entry is required.

Units:    Degrees

Range:    $0.0 \leq vang \leq 90.0$

---

Name:    *vmodel*

Relation:    **assoc**

Description:    Velocity model. This character string identifies the velocity model of the earth used to compute the travel times of seismic phases. These are required for event location (if phase is defining) or for computing travel-time residuals.

ORACLE:    VARCHAR(15)

NA Value:    - (a dash)

Range:    Any free-format string up to 15 characters

---

Name:    *volname*

Relation:    **wftape**

Description:    ANSI tape label. This gives the volume label information for a tape.

ORACLE:    VARCHAR(6)

NA Value:    - (a dash)

Range:    Any upper-case tape label up to 6 characters

---

Name:    *wfid*

Relations:    **wfdisc, wftag, wftape**

Description:    Waveform identifier. The key field is a unique identifier for a segment of digital waveform data.

ORACLE:    NUMBER(8)

NA Value:    NOT ALLOWED. A valid entry is required.

Range:    $wfid > 0$

---

Name:      *wgt*

Relation:    **assoc**

Description:    Location weight. This attribute gives the final weight assigned to the allied arrival by the location program. It is used primarily for location programs that adaptively weight data by their residuals.

ORACLE:    FLOAT(24)

NA Value:    −1.0

Range:    $0.0 \leq wgt < 1.0$