

ITACA (ITalian ACcelerometric Archive): a Web Portal for the Dissemination of the Italian Strong Motion Data

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Data base structure

INDEX

| | |
|--|----|
| 1. INTRODUCTION..... | 3 |
| 2. TECHNICAL REQUIREMENTS FOR WAVEFORM STORAGE..... | 3 |
| 2.1 RULES FOR FILES NAMING..... | 3 |
| 2.2 RECORD HEADER..... | 5 |
| 3. DATA BASE TABLES..... | 7 |
| 3.1 DESCRIPTION OF THE SEISMIC EVENTS | 8 |
| General description | 8 |
| Magnitude | 9 |
| Focal mechanisms | 10 |
| 3.2 RECORDING SITE CHARACTERISTICS | 11 |
| General description | 11 |
| Networks | 12 |
| Installation typology | 13 |
| Soil class description according to the European code (EC8)..... | 14 |
| Morphology description | 15 |
| Site stratigraphy | 15 |
| Velocity profile and geotechnical parameters | 16 |
| Site transfer function..... | 18 |
| Dispersion curve | 19 |
| Dictionary tables | 19 |
| 3.3 INSTRUMENT DESCRIPTION..... | 20 |
| General description | 20 |
| Single channel description | 21 |
| Dictionary tables | 22 |
| 3.4 INFORMATION ON THE INSTITUTIONS MANAGING NETWORKS, STATIONS OR DATA BASES | 23 |
| 3.5 RECORDING CHARACTERISTICS..... | 23 |
| Characteristics of the unprocessed and processed recordings | 23 |
| Data dictionary | 26 |
| 3.6 ADDITIONAL DATA DICTIONARIES | 27 |
| References | 27 |
| Administrative data | 27 |
| Cartographic projections | 28 |
| Networks | 28 |
| Coordinates | 28 |
| 4. OUTLINE OF THE EXISTING RELATIONS INSIDE THE DATA BASE..... | 30 |

1. INTRODUCTION

The Italian strong motion data base (Italian Strong Motion Data Base) is a joint product of the agreement between the *Dipartimento della Protezione Civile – Ufficio Valutazione Prevenzione e Mitigazione del Rischio Sismico ed Attività ed Opere Post-Emergenza* (Department of Civil Protection – Evaluation, Prevention and Mitigation of Seismic Risk and Post-Emergency Works) and the *Istituto Nazionale di Geofisica e Vulcanologia* (National Institute of Geophysics and Volcanology). The data base is handled through two different relational data base management system: Ms Access® 2003, of major use among research institutions and public administrations, for CD-ROM release, and MySQL for the web distribution. The selection of the former product is driven by the simplicity of the software, the worldwide diffusion and the possibility of being linked to software's for the management of spatial data, such as ESRI ArcGis® and Arcview®, and software for the scientific calculation such as Matlab ®. The data base will store the information regarding the seismic events, the recording stations, the installed instruments, the main features of the recordings and the engineering parameters. The structure is based on a previous version of the Italian strong-motion data base created by ENEA in collaboration with Department of Civil Protection, which stores the information regarding the accelerometric recordings in the time span 1972-1993.

This manuscript will explain the structure of the tables containing the information, the data base architecture, the relationships existing among tables and the technical features for data input.

2. TECHNICAL REQUIREMENTS FOR WAVEFORM STORAGE

2.1 RULES FOR FILES NAMING

The file name should make easier the data retrieval based on date, time, station name and component through simple OS commands. It should be therefore composed by:

YYYYMMDD + _ + HHMMSS + NETWORK CODE + _ + STATION CODE + COMPONENT +
PROCESSING FLAG . FORMAT

for a total length of 33 characters. The single segments are described in Table 1.

Example: the acceleration recorded by the *Department of Civil Protection network* (ITDPC) at *S. Giuliano di Puglia scuola* (SGIB), NS component, on 2002/11/12 at 09:27:00 GMT, unprocessed, ASCII format with header, will have the following name:

20021112_092700ITDPC_SGIB_NSX.DAT

Table 1: description of the segments forming the file name.

| SEGMENT | DESCRIPTION | LENGTH | REQUIREMENTS |
|-----------------|--|--------|---|
| YYYYMMDD_HHMMSS | Origin time | 15 | The origin time of the selected localisation. When no events are listed in seismic catalogues, it is assumed the record start time |
| NETCODE | Network code | 5 | If the Network code has less than 5 characters, the rest is replaced by one or more underscores |
| STACODE | Station code | 5 | If the station code has less than 5 characters, the rest is replaced by one or more underscores |
| COMP | Component of the motion | 2 | <i>NS</i> = north-south <i>WE</i> = east-west <i>UP</i> = vertical <i>FC</i> = fixed trace |
| CORRECTION_FLAG | This flag specifies whether or not the record has been processed | 1 | <i>C</i> = processed <i>X</i> = unprocessed |
| FORMAT | Flag indicating the format type | 4 | <i>SAC</i> = acceleration (SAC format) <i>DAT</i> = acceleration (ASCII with header) <i>ASC</i> = acceleration (ASCII-XY) <i>VEL</i> = velocity (ASCII with header) <i>DIS</i> = displacement (ASCII with header) <i>SPE</i> = 5% damped acceleration response spectrum (ASCII-XY with header) |

2.2 RECORD HEADER

The ASCII-with-header records (acceleration, velocity, displacement or acceleration response spectrum) will be characterised by a header of 43 rows, containing the following information, in order to make the record self-consistent:

1. Name of the seismic event
2. GMT event date (YYYYMMDD)
3. GMT event origin time (hhmmss)
4. Event Latitude (decimal degrees)
5. Event Longitude (decimal degrees)
6. Event depth (km)
7. Local magnitude M_l
8. Surface wave magnitude M_s
9. Moment magnitude M_w
10. Focal mechanism
11. Station code
12. Station name
13. Station Latitude (decimal degrees)
14. Station Longitude (decimal degrees)
15. Station elevation (m.a.s.l.)
16. Geotechnical classification (EC8)
17. Morphologic classification
18. Epicentral distance (km)
19. Earthquake backazimuth
20. Time (GMT) of the first sample (hhmmss.dec)
21. Sampling interval (s)
22. Number of points
23. Duration (s)
24. Component (NS, WE, UP, FC)
25. Units (cm/s^2 , cm/s , cm , cm/s^2)
26. Instrument type
27. Instrument Frequency (Hz)
28. Instrument Damping
29. Sensitivity (cm/g , V/g)
30. Fullscale (g)
31. Number of bits of the Analog to Digital Converter
32. P_{ga} , P_{gv} , P_{gd} (cm/s^2 , cm/s , cm)
33. Time corresponding to the P_{ga} , P_{gv} , P_{gd}
34. Owner of the record
35. Epicentral intensity
36. Baseline correction (REMOVED/NOT REMOVED)
37. Filter type (Butterworth, Cosine,)
38. Filter order
39. LP1 (low-cut frequency)

40. LP2 (roll-on frequency)
41. HP1 (roll-off frequency)
42. HP2 (high-cut frequency)
43. Data type (unprocessed acceleration, processed acceleration, velocity, displacement, acceleration response spectrum)

The SAC files are stored in binary format, with little-endian byte order, to be used with Linux OS.

The binary SAC format contains a fixed length header section followed by one or two data sections. The header contains floating point, integer, logical, and character fields. Details on the SAC header are defined at <http://www.llnl.gov/sac/>.

Some of the 43 row ASCII header metadata were stored in the unused spaces of the SAC header.

In particular the instrument characteristics were stored in the floating point part of the header (numbers refer to the position inside the header):

- #22 instrument frequency
- #23 instrument damping
- #24 instrument sensitivity
- #25 instrument full scale
- #41 low pass frequency 1
- #42 low pass frequency 2
- #43 high pass frequency 1
- #44 high pass frequency 2
- #67 epicentral macroseismic intensity
- #68 surface wave magnitude
- #69 local magnitude
- #70 moment magnitude

In the integer part of the header the following information has been stored (numbers refer to the position inside the header):

- #26 number of bit of ADC
- #27 1 = BASELINE REMOVED, 0 = BASELINE NOT REMOVED
- #28 1 = BUTTERWORTH, 0 = COSINE filter
- #29 1 = PROCESSED ACCELERATION, 0 = UN PROCESSED ACCELERATION

The instrument type information, contained in the character header KINST, is stored as DIGITAL or ANALOG, due to the limitation to 8 characters.

3. DATA BASE TABLES

In order to store the information and reduce the data redundancy, the following tables have been created:

1. *Channel* (recording channel)
2. *Dispersion_curve* (dispersion curve description for the recording site)
3. *Dispersion_curve_values* (values of the dispersion curve)
4. *Events* (seismic events)
5. *Fdt* (transfer function description for the recording site)
6. *Fdt_values* (transfer function values)
7. *Generic_instr* (characteristic of the instrument)*Magnitude* (magnitude)
8. *Installation* (instrument installation description)
9. *Instrument* (instrument description)
10. *Log_Cu_layer* (log undrained cohesion)
11. *Log_geotec* (master table of the geotechnical-geophysical data)
12. *Log_nspt_layer* (log standard penetration test)
13. *Log_vs_layer* (log wave velocity)
14. *Magnitude* (magnitude values)
15. *Mag_type* (magnitude type description)
16. *Municipality* (list of the Italian municipality)
17. *Nation* (list of the countries)
18. *Networks* (networks description)
19. *Owners* (record owner description)
20. *Pole* (pole and zeros of the instrument)
21. *Province* (list of the Italian districts)
22. *Reference* (references)
23. *Region* (list of the Italian regions)
24. *Station* (recording sites)
25. *Stratigraphy* (master table of the stratigraphy of the recording site)
26. *Stratigraphy_layer* (stratigraphy of the recording site)
27. *Waveform* (unprocessed and processed record parameters)
28. *d_coordinate_sources* (sources of coordinates)
29. *d_dispersion_curve_method* (description of the methods used to estimate the dispersion curve)
30. *d_EC8* (EC8 classification description)
31. *d_EC8_estimate* (type of estimation of EC8 code)
32. *d_FDT_type* (site transfer function typology)
33. *d_flag_digit* (digitalization type description)
34. *d_fm_method* (focal mechanism determination)
35. *d_fm_type* (type of focal mechanism)
36. *d_housing* (housing of the instrument)
37. *d_instrument_type* (instrument type description)
38. *d_lithography* (description of the lithotechnical units)
39. *d_located* (flag indicating located/not located)

- 40. *d_mag_method* (magnitude calculation description)
- 41. *d_morph_code* (morphology description)
- 42. *d_orientation* (sensor orientation description)
- 43. *d_permanent_flag* (station typology description)
- 44. *d_pole_type* (pole/zero description)
- 45. *d_projection* (cartographic projection description)
- 46. *d_proximity_flag* (proximity to building description)
- 47. *d_units_sensitivity* (units used for instrument sensitivity)
- 48. *d_yes_no* (logical fields)

3.1 DESCRIPTION OF THE SEISMIC EVENTS

General description

Table name: EVENTS

| FIELD | LENG | TYPE | N.DEC | NOTE |
|------------------|-------------|--------------|--------------|---|
| EV_TIME | 19 | Varchar(19) | | YYYY-MM-DD hh:mm:ss date and time of the event (GMT) |
| EVENT_NAME | 100 | Varchar(100) | | Event name |
| NATION_CODE | 3 | Long | | UN country code |
| REGION_CODE | 2 | Long | | Link to table <i>REGION</i> |
| PROVINCE_CODE | 3 | Long | | Link to table <i>PROVINCE</i> |
| COMUNE_CODE | 6 | Long | | Link to table <i>MUNICIPALITY</i> |
| LATITUDE | 9 | Decimal(9,4) | 4 | Event latitude in decimal degrees (N of equator) |
| ERR_LAT | 9 | Decimal(9,4) | 4 | Latitude error (in km) |
| LONGITUDE | 9 | Decimal(9,4) | 4 | Event longitude in decimal degrees East of Greenwich meridian |
| ERR_LON | 9 | Decimal(9,4) | 4 | Longitude error (in km) |
| DEPTH_M | 8 | Decimal(8,3) | 3 | Hypocentral depth (km) |
| ERR_DEPTH | 8 | Decimal(8,3) | 3 | Depth error (in km) |
| HYP_REFERENCE | 6 | Long | | link to table <i>REFERENCE</i> |
| OTHER_HYPOCENTER | | MEMO | | Other hypocentral estimation |
| I0 | 4 | Decimal(4,1) | 1 | Epicentral intensity |
| I0_REFERENCE | 6 | Long | | link to table <i>REFERENCE</i> |
| OTHER_I0 | | MEMO | | Other intensity estimations |
| FM_METHOD_CODE | 5 | Varchar(5) | | Method for focal mechanism assessment |
| FM_TYPE_CODE | 2 | Varchar(2) | | Focal mechanism type |

| | | | | |
|-----------------|---|--------------|---|--|
| FM_REFERENCE | 6 | Long | | link to table <i>REFERENCE</i> |
| FAULT_FLAG | | Long | | Flag indicating fault geometry availability <i>1</i> = available <i>0</i> = not available |
| STRIKE | 6 | Decimal(6,1) | 1 | Angle between the N direction and the projection of the fault surface, measured clockwise |
| DIP | 6 | Decimal(6,1) | 1 | Angle between the fault surface and the horizontal |
| RAKE | 6 | Decimal(6,1) | 1 | Angle of the hanging wall slip-vector measured in the fault plane (between -180 and 180 decimal degrees) |
| FAULT_REFERENCE | 6 | Long | | Link to table <i>REFERENCE</i> |
| LOCATED | | Varchar(5) | | Flag indicating the location |
| SURFACE_FLAG | 1 | Long | | Flag of surface faulting <i>1</i> = true <i>0</i> = false |
| OTHER_FAULTS | | MEMO | | Other fault surface assessments |

Magnitude

Table name: MAGNITUDE

| FIELD | LENG | TYPE | N.DEC | NOTE |
|----------------|------|--------------|-------|---|
| EVENT_CODE | 6 | Long | | Event code |
| MAG_TYPE_CODE | 20 | Varchar(20) | | Link to table <i>MAG_TYPE</i> |
| MAG_VALUE | 4 | Decimal(4,1) | 1 | Magnitude value |
| ERR_MAG | 4 | Decimal(4,1) | 1 | Error in the magnitude determination |
| METHOD_CODE | 16 | Varchar(16) | | Link to a detailed description of the evaluation method |
| REFERENCE_CODE | 6 | Long | | Link to table <i>REFERENCE</i> |

Table name: MAG_TYPE

| FIELD | LENG | TYPE | N.DEC | NOTE |
|---------------|------|-------------|-------|--|
| MAG_TYPE_CODE | 6 | Varchar(6) | | Magnitude type |
| DESCRIPTION | 64 | Varchar(64) | | classical brief definition (e.g. Ml: local magnitude) |

Table name: D_MAG_METHOD

| FIELD | LENG | TYPE | N.DEC | NOTE |
|------------------|------|-------------|-------|---|
| METHOD_CODE | 16 | Varchar(16) | | Magnitude code |
| DESCRIPTION | 64 | Varchar(64) | | Brief description |
| LONG_DESCRIPTION | | MEMO | | Detailed description of the method (if known, includes also the institution) |

Focal mechanisms

Table name: D_FM_TYPE

| FIELD | LENG | TYPE | N.DEC | NOTE |
|--------------|------|--------------|-------|--|
| FM_TYPE_CODE | 2 | Varchar(2) | | Focal mechanism code |
| DESCRIPTION | 100 | Varchar(100) | | Description of the focal mechanism type |

Table name: D_FM_METHOD

| FIELD | LENG | TYPE | N.DEC | NOTE |
|----------------|------|--------------|-------|--|
| FM_METHOD_CODE | 5 | Varchar(5) | | Code of the method used for estimating the focal mechanism |
| DESCRIPTION | 100 | Varchar(100) | | Description of the method used for estimating the focal mechanism |

3.2 RECORDING SITE CHARACTERISTICS

*General description***Table name: STATION**

| FIELD | LENG | TYPE | N.DEC | NOTE |
|---------------------------|------|---------------|-------|---|
| STATION_CODE | 5 | Varchar(5) | | Site code |
| NET_CODE | 2 | Varchar(2) | | Link to table <i>NETWORK</i> |
| NATION_CODE | 3 | Varchar(3) | | UN country code |
| COMUNE_CODE | 6 | Varchar(6) | | ISTAT municipality code |
| PROVINCE_CODE | 3 | Varchar(3) | | ISTAT district code |
| REGION_CODE | 3 | Varchar(3) | | ISTAT region code |
| INST_CODE | 5 | Varchar(5) | | Link to table <i>D_INSTALLATION_TYPE</i> |
| EC8_CODE | 2 | Varchar(2) | | Link to table <i>D_EC8</i> |
| EC8_ESTIMATE_CODE | 10 | Varchar(10) | | Method of EC8 class estimate. Link to table <i>D_EC8_ESTIMATE</i> |
| f0 | 9 | Decimal(9,5) | | Fundamental frequency |
| DC_CODE | 5 | Long | | Link to table <i>D_DISPERSION_CURVE</i> |
| MORPH_CODE | 2 | Varchar(2) | | Link to table <i>MORPH_CODE</i> |
| STATION_NAME | 100 | Varchar(100) | | Extended name of the station (generally it coincides with the locality in which the station is installed) |
| LATITUDE | 9 | Decimal (9,5) | 5 | Latitude N from the Equator (decimal degrees) |
| LONGITUDE | 9 | Decimal(9,5) | 5 | Longitude E from the zero meridian (decimal degrees) |
| COORDINATE_REFERENCE_CODE | 10 | Long | | Reference to coordinates |
| PROJECTION_CODE | 10 | CHAR(10) | | Cartographic projection code |
| ALLEGATO | | Varchar(255) | | Link to external documents |
| ALTITUDE | 6 | Long | | Elevation (m.a.s.l.) |

| | | | | |
|-------------------------|-----|--------------|--|--|
| HORIZ_ERR | 6 | Long | | Expected error on the horizontal coordinates (m) |
| FOGLIO_100MILA_IGM | 64 | Varchar(64) | | 1:100.000 IGM sheet |
| IGM_TABLE | 16 | Varchar(16) | | Frame |
| IGM_ORIENTATION | 32 | Varchar(32) | | Orientation |
| START_TIME | 19 | Varchar(19) | | Installation date (YYYY-MM-DD hh:mm:ss) |
| END_TIME | 19 | Varchar(19) | | Removal date (YYYY-MM-DD hh:mm:ss) |
| ADDRESS | 255 | Varchar(255) | | Site address |
| PERMANENT_FLAG | 1 | Long | | Purpose of the installation 1 = permanent 0 = temporary 999 = no information |
| PROXIMITY_FLAG | 1 | Long | | Flag of proximity to buildings 1 = close to buildings 0 = far from buildings 999 = no information |
| HOUSING_CODE | 10 | Varchar(10) | | Link to table <i>D_HOUSING</i> |
| IMG1 | | IMMAGINE | | Link to station report |
| OWNER_CODE | 10 | Long | | Link to table <i>OWNER</i> |
| FDT_CODE | 6 | Long | | Link to table <i>FDT</i> |
| LOCATION_REFERENCE_CODE | 6 | Long | | Link to table <i>REFERENCE</i> |
| NOTE | | MEMO | | Notable data from other sources |

Networks

Table name: NETWORKS

| FIELD | LENG | TYPE | N.DEC | NOTE |
|------------|------|--------------|-------|--|
| NET_CODE | 2 | Varchar(2) | | Univocal Network code |
| NET_NAME | 50 | Varchar(50) | | Network name |
| OWNER_CODE | 10 | Long | | Link to table <i>OWNER</i> |
| START_TIME | 19 | Varchar(19) | | Date of opening of the Network (YYYY-MM-DD hh:mm:ss) |
| END_TIME | 19 | Varchar(19) | | Date of closing of the Network (YYYY-MM-DD hh:mm:ss) |
| MIN_LAT | 9 | Decimal(9,5) | 5 | Minimum latitude covered by the net |

| | | | | |
|---------|---|--------------|---|--------------------------------------|
| MAX_LAT | 9 | Decimal(9,5) | 5 | Maximum latitude covered by the net |
| MIN_LON | 9 | Decimal(9,5) | 5 | Minimum longitude covered by the net |
| MAX_LON | 9 | Decimal(9,5) | 5 | Maximum longitude covered by the net |

Installation typology

Table name: INSTALLATION

| FIELD | LENG | TYPE | N.DEC | NOTE |
|-------------|------|--------------|-------|--------------------------------------|
| INST_CODE | 5 | Varchar(5) | | Installation type code |
| DESCRIPTION | 255 | Varchar(255) | | Description of the installation type |

It contains the information on the installation type. Typical record will be:

P, pillar

PS, floor of the structure

T, directly on the ground

Table name: D_HOUSING

| FIELD | LENG | TYPE | N.DEC | NOTE |
|--------------|------|--------------|-------|---------------------|
| HOUSING_CODE | 10 | Varchar(10) | | Housing Code |
| DESCRIPTION | 255 | Varchar(255) | | Housing description |

Notes:

DAM = Dam

BUI = building

BRI = bridge

BOX = BOX

CAB = ENEL BOX

HIS = Historical building

CAV = Cave

Soil class description according to the European code (EC8)

Table name: D_EC8

| FIELD | LENG | TYPE | N.DEC | NOTE |
|----------|------|--------------|-------|------------------|
| EC8_CODE | 2 | Varchar(2) | | EC8 code |
| EC8_DESC | 255 | Varchar(255) | | Soil description |

EC8 soil classes:

A = Rock or other rock-like geological formation, including at most 5 m of weaker material at the surface ($V_{s30} > 800$ m/s)

B = Deposits of very dense sand, gravel, or very stiff clay, at least several tens of m in thickness, characterised by a gradual increase of mechanical properties with depth ($V_{s30} = 360 - 800$ m/s; NSPT > 50 ; $c_u > 250$ kPa)

C = Deep deposits of dense or medium dense sand, gravel or stiff clay with thickness from several tens to many hundreds of m ($V_{s30} = 180 - 360$ m/s; NSPT = 15 – 50; $c_u = 70 - 250$ kPa)

D = Deposits of loose-to-medium cohesionless soil (with or without some soft cohesive layers), or of predominantly soft-to-firm cohesive soil ($V_{s30} < 180$; NSPT < 15 ; $c_u < 70$ kPa)

E = A soil profile consisting of a surface alluvium layer with V_s values of type C or D and thickness varying between about 5m and 20m, underlain by stiffer material with ($V_s > 800$ m/s)

S1 = Deposits consisting – or containing a layer at least 10m thick – of soft clays/silts with high plasticity index ($PI > 40$) and high water content ($V_{s30} < 100$; $c_u = 10 - 20$ kPa)

S2 = Deposits of liquefiable soils, of sensitive clays, or any other soil profile not included in types A – E or S1

Table name: D_EC8_ESTIMATE

| FIELD | LENG | TYPE | N.DEC | NOTE |
|-------------------|------|--------------|-------|---|
| EC8_ESTIMATE_CODE | 10 | Varchar(10) | | EC8 estimation code |
| EC8_ESTIMATE_DESC | 255 | Varchar(255) | | Description of the method used to assign EC8 code |

CH = from cross-hole measurement

DH = from Downhole measurement

SASW = from SASW measurement

REMI = from Refraction Microtremors test

EST = qualitative estimate

LITO = from stratigraphy

SPT = from Standard Penetration Test

C_u = from undrained cohesion test

REFR = from seismic refraction measurement

REFL = from seismic reflexion measurement

Morphology description**Table name: D_MORPH_CODE**

| FIELD | LENG | TYPE | N.DEC | NOTE |
|--------------|-------------|--------------|--------------|------------------------|
| MORPH_CODE | 2 | Varchar(2) | | Morphology Code |
| DESCRIPTION | 255 | Varchar(255) | | Morphology description |

Note:

C = crest
P = slope
V = valley
VE = peak
SE = saddle
PI = plain

Site stratigraphy**Table name: STRATIGRAPHY**

| FIELD | LENG | TYPE | N.DEC | NOTE |
|-------------------|-------------|--------------|--------------|---|
| NET_CODE | 2 | Varchar(2) | | Link to table NETWORKS |
| STATION_CODE | 5 | Varchar(5) | | Link to table <i>STATION</i> |
| STRATIGRAPHY_CODE | 6 | Long | | Stratigraphy code |
| LATITUDE | 9 | Decimal(9,5) | 5 | Latitude of the survey point |
| LONGITUDE | 9 | Decimal(9,5) | 5 | Longitude of the survey point |
| PROJECTION_CODE | 10 | Varchar(10) | | Cartographic projection code |
| ELEVATION | 6 | Decimal(6,1) | 1 | Elevation of the reference point (m.a.s.l.) |
| REFERENCE_CODE | 6 | Long | | Link to table <i>REFERENCE</i> |

Table name: STRATIGRAPHY_LAYER

| FIELD | LENG | TYPE | N.DEC | NOTE |
|-------------------|------|--------------|-------|--|
| STRATIGRAPHY_CODE | 6 | Long | | Link to table <i>STRATIGRAPHY</i> |
| NET_CODE | 2 | Varchar(2) | | Univocal Network code |
| STATION_CODE | 5 | Varchar(5) | | Link to table <i>STATION</i> |
| LITHOGRAPHY_CODE | 5 | Varchar(5) | | Link to table <i>LITOGRAHY</i> |
| SEQUENCE NUMBER | 3 | Long | | Progressive number of the layer |
| TOP | 6 | Decimal(6,1) | 1 | Top of the layer (meters from the ground level) |
| BOTTOM | 6 | Decimal(6,1) | 1 | Base of the layer (meters from the ground level) |
| DESCRIPTION | 255 | Varchar(255) | | Layer description |

Table name: D_LITHOGRAPHY

| FIELD | LENG | TYPE | N.DEC | NOTE |
|------------------|------|--------------|-------|--------------------------------------|
| LITHOGRAPHY_CODE | 5 | Varchar(5) | | Code of the lithography class |
| DESCRIPTION | 255 | Varchar(255) | | Description of the lithography class |

*Velocity profile and geotechnical parameters***Table name: LOG_GEOTEC**

| FIELD | LENG | TYPE | N.DEC | NOTE |
|-----------------|------|--------------|-------|---|
| NET_CODE | 2 | Long | | Network code |
| STATION_CODE | 5 | Varchar(5) | | Link to table <i>STATION</i> |
| LOG_GEOTEC_CODE | 6 | Long | | Geotechnical log code |
| LATITUDE | 9 | Decimal(9,5) | 5 | Latitude of the survey point |
| LONGITUDE | 9 | Decimal(9,5) | 5 | Longitude of the survey point |
| PROJECTION_CODE | 10 | Varchar(10) | | Cartographic projection code |
| ELEVATION | 9 | Decimal(9,5) | 5 | Elevation of the reference point (m.a.s.l.) |
| REFERENCE_CODE | 6 | Long | | Link to table <i>REFERENCE</i> |

Table name: LOG_VS_LAYER

| FIELD | LENG | TYPE | N.DEC | NOTE |
|-------------------|------|--------------|-------|--|
| LOG_VS_LAYER_CODE | 6 | Long | | Log code |
| LOG_GEOTECH_CODE | 6 | Long | | Link to table <i>LOG_GEOTECH</i> |
| STATION_CODE | 5 | Varchar(5) | | Link to table <i>STATION</i> |
| NET_CODE | 2 | Varchar(2) | | Network code |
| TOP | 6 | Decimal(6,1) | 1 | Upper bound (meters from the ground level) |
| BOTTOM | 6 | Decimal(6,1) | 1 | Lower bound (meters from the ground level) |
| VS | 6 | Decimal(6,2) | 2 | Shear-wave velocity value (m/s) |
| VP | 6 | Decimal(6,2) | 2 | Longitudinal-wave velocity value (m/s) |

Table name: LOG_NSPT_LAYER

| FIELD | LENG | TYPE | N.DEC | NOTE |
|---------------------|------|--------------|-------|--|
| LOG_NSPT_LAYER_CODE | 6 | Long | | Log code |
| LOG_GEOTECH_CODE | 6 | Long | | Link to table <i>LOG_GEOTECH</i> |
| NET_CODE | 2 | Varchar(2) | | Network code |
| STATION_CODE | 5 | Varchar(5) | | Link to table <i>STATION</i> |
| TOP | 6 | Decimal(6,1) | 1 | Upper bound (meters from the ground level) |
| BOTTOM | 6 | Decimal(6,1) | 1 | Lower bound (meters from the ground level) |
| NSPT | 4 | Long | | NSPT value |

Table name: LOG_Cu_LAYER

| FIELD | LENG | TYPE | N.DEC | NOTE |
|-------------------|------|--------------|-------|---|
| LOG_CU_LAYER_CODE | 6 | Long | | Univocal Log code |
| LOG_GEOTECH_CODE | 6 | Long | | Link to table <i>LOG_GEOTECH</i> |
| NET_CODE | 2 | Varchar(2) | | Network code |
| STATION_CODE | 5 | Varchar(5) | | Link to table <i>STATION</i> |
| TOP | 6 | Decimal(6,1) | 1 | Upper bound (meters from the ground level) |
| BOTTOM | 6 | Decimal(6,1) | 1 | Lower bound (meters from the ground level) |
| Cu | 6 | Decimal(6,1) | | Cohesion (undrained shear strength) value (kPa) |

Site transfer function

Table name: FDT

| FIELD | LENG | TYPE | N.DEC | NOTE |
|----------------|------|------------|-------|--------------------------------|
| NET_CODE | 2 | Varchar(2) | | Network code |
| STATION_CODE | 5 | Varchar(5) | | Link to table <i>STATION</i> |
| FDT_TYPE_CODE | 7 | Varchar(7) | | Link to table <i>FDT_TYPE</i> |
| REFERENCE_CODE | 6 | Long | | Link to table <i>REFERENCE</i> |

Table name: FDT_VALUES

| FIELD | LENG | TYPE | N.DEC | NOTE |
|---------------|------|---------------|-------|-------------------------------|
| NET_CODE | 2 | Varchar(2) | | Network code |
| STATION_CODE | 5 | Varchar(5) | | Link to table <i>STATION</i> |
| FDT_TYPE_CODE | 7 | Varchar(7) | | Link to table <i>FDT_TYPE</i> |
| FDT_SEQUENCE | 5 | I | | |
| FREQ | 6 | Decimal (6,1) | 1 | Frequency |
| AMPLITUDE | 6 | Decimal (6,1) | 1 | Transfer function amplitude |
| STD | 6 | Decimal (6,1) | 1 | Standard deviation |

Table name: D_FDT_TYPE

| FIELD | LENG | TYPE | N.DEC | NOTE |
|---------------|------|------------|-------|--|
| FDT_TYPE_CODE | 7 | Varchar(7) | | Type of FDT determination: <i>GIT</i> = generalized inversion <i>NHVSR</i> = H/V from microtremors <i>SMHVSR</i> = H/V from strong motions <i>WMHVSR</i> = H/V from weak motions <i>WMSSR</i> = standard spectral ratio from weak motion <i>SMSSR</i> = standard spectral ratio from strong motion <i>1DMOD</i> = 1D model <i>2DMOD</i> = 2D model |
| DESCRIPTION | | MEMO | | Description of the method |

*Dispersion curve***Table name: DISPERSION_CURVE**

| FIELD | LENG | TYPE | N.DEC | NOTE |
|----------------|------|------------|-------|--------------------------------|
| DC_CODE | 6 | Long | | Univocal dispersion curve code |
| NET_CODE | 2 | Varchar(2) | | Network code |
| STATION_CODE | 5 | Varchar(5) | | Link to table <i>STATION</i> |
| DC_METHOD_CODE | 5 | Varchar(5) | | Link to table <i>DC_METHOD</i> |
| REFERENCE | 6 | Long | | Link to table <i>REFERENCE</i> |

Table name: DISPERSION_CURVE_VALUES

| FIELD | LENG | TYPE | N.DEC | NOTE |
|---------------------------|------|---------------|-------|--------------------------------|
| DC_CODE | 6 | Long | | Univocal dispersion curve code |
| NET_CODE | 2 | Varchar(2) | | Network code |
| STATION_CODE | 5 | Varchar(5) | | Link to table <i>STATION</i> |
| DISPERSION_CURVE_SEQUENCE | | | | |
| FREQ | 6 | Decimal (6,1) | 1 | Frequency |
| PHASE_VEL | 6 | Decimal (6,1) | 1 | Phase velocity |

Table name: D_DISPERSION_CURVE_METHOD

| FIELD | LENG | TYPE | N.DEC | NOTE |
|----------------|------|--------------|-------|---|
| DC_METHOD_CODE | 5 | Varchar(5) | | Code of the method used for the determination of the dispersion curve |
| DESCRIPTION | 255 | Varchar(255) | | Description |

SPAC = Spatial autocorrelation

F_K = Frequency-wavenumber

*Dictionary tables***Table name: D_PERMANENT_FLAG**

| FIELD | LENG | TYPE | N.DEC | NOTE |
|----------------|------|--------------|-------|-------------------------------|
| PERMANENT_FLAG | 5 | Long | | Code of the installation type |
| DESCRIPTION | 255 | Varchar(255) | | Description |

Table name: D_PROXIMITY_FLAG

| FIELD | LENG | TYPE | N.DEC | NOTE |
|----------------|------|--------------|-------|--|
| PROXIMITY_FLAG | 5 | Long | | Code of the type of proximity to buildings |
| DESCRIPTION | 255 | Varchar(255) | | Description |

3.3 INSTRUMENT DESCRIPTION

General description

Table name: GENERIC_INSTR

| FIELD | LENG | TYPE | N.DEC | NOTE |
|-------------------------|------|-------------|-------|------------------------|
| GENERIC_INSTRUMENT_CODE | 6 | Long | | Instrument code |
| SENSOR_MANUFACTURER | 64 | Varchar(64) | | Sensor manufacturer |
| SENSOR_MODEL | 64 | Varchar(64) | | Sensor model |
| DIGITIZER_MANUFACTURER | 64 | Varchar(64) | | Digitizer manufacturer |
| DIGITIZER_MODEL | 64 | Varchar(64) | | Digitizer model |
| INSTRUMENT_TYPE_CODE | 8 | Varchar(8) | | Analog/digital |

Table name: INSTRUMENT

| FIELD | LENG | TYPE | N.DEC | NOTE |
|-------------------------|------|--------------|-------|---|
| NET_CODE | 2 | Varchar(2) | | Network code |
| STATION_CODE | 5 | Varchar(5) | | Link to table <i>STATION</i> |
| GENERIC_INSTRUMENT_CODE | 6 | Long | | Instrument code |
| SENSOR_SERIAL_NUMBER | 64 | Varchar(64) | | Sensor serial number of |
| DIGITIZER_SERIAL_NUMBER | 64 | Varchar(64) | | Digitizer serial number |
| INSTALLATION_START_TIME | 19 | Varchar(19) | | Installation date (YYYY-MM-DD hh:mm:ss) |
| INSTALLATION_END_TIME | 19 | Varchar(19) | | Removal date (YYYY-MM-DD hh:mm:ss) |
| NUMBER_BITS_ADC | 5 | Long | | Number of bits ADC |
| SAMPLES_PER_SECOND | 6 | Decimal(6,1) | 1 | Sampling rate |

*Single channel description***Table name: CHANNEL**

| FIELD | LENG | TYPE | N.DEC | NOTE |
|-------------------------|------|--------------|-------|---|
| NET_CODE | 2 | Varchar(2) | | Network code |
| ORIENTATION_CODE | 2 | Long | | Link to table <i>D-ORIENTATION</i> |
| STATION_CODE | 5 | Varchar(5) | | Link to table <i>STATION</i> |
| INSTALLATION_START_TIME | 19 | Varchar(19) | | Date of the channel opening (YYYY-MM-DD hh:mm:ss) |
| AZIMUTH | 9 | Decimal(9,6) | 6 | Direction of the sensor from the North |
| INCLINATION | 9 | Decimal(9,6) | 6 | Inclination of the sensor from the vertical |
| SENSITIVITY | 9 | Decimal(9,6) | 6 | Sensitivity |
| SENSITIVITY_UNIT | 10 | Varchar(10) | | Sensitivity units |
| GAIN | 9 | Decimal(9,6) | 6 | Multiplicative factor |
| FREQUENCY | 5 | Decimal(5,2) | 2 | Sensor natural frequency (Hz) |
| DAMPING | 5 | Decimal(5,2) | 2 | Damping |
| FULLSCALE | 5 | Decimal(5,2) | 2 | Full scale |

Table name: POLE

| FIELD | LENG | TYPE | N.DEC | NOTE |
|-------------------------|------|--------------|-------|---|
| POLE_TYPE_CODE | 8 | Varchar(8) | | Pole/Zero |
| NET_CODE | 2 | Varchar(2) | | Network code |
| ORIENTATION_CODE | 2 | Long | | Link to table <i>D-ORIENTATION</i> |
| STATION_CODE | 5 | Varchar(5) | | Link to table <i>STATION</i> |
| INSTALLATION_START_TIME | 19 | Varchar(19) | | Date of channel opening (YYYY-MM-DD hh:mm:ss) |
| REAL_PART | 5 | Decimal(5,2) | 2 | Real part |
| IMAGINARY_PART | 5 | Decimal(5,2) | 2 | Imaginary part |

Dictionary tables

Table name: D_INSTRUMENT_TYPE

| FIELD | LENG | TYPE | N.DEC | NOTE |
|----------------------|-------------|--------------|--------------|------------------------------------|
| INSTRUMENT_TYPE_CODE | 8 | Varchar(8) | | Instrument type code |
| DESCRIPTION | 255 | Varchar(255) | | Description of the instrument type |

Table name: D_ORIENTATION

| FIELD | LENG | TYPE | N.DEC | NOTE |
|------------------|-------------|--------------|--------------|-------------------------|
| ORIENTATION_CODE | 2 | Varchar(2) | | Orientation code |
| DESCRIPTION | 255 | Varchar(255) | | Orientation description |

Table name: D_POLE_TYPE

| FIELD | LENG | TYPE | N.DEC | NOTE |
|----------------|-------------|--------------|--------------|-------------|
| POLE_TYPE_CODE | 2 | Varchar(2) | | Code |
| DESCRIPTION | 255 | Varchar(255) | | Pole / Zero |

3.4 INFORMATION ON THE INSTITUTIONS MANAGING NETWORKS, STATIONS OR DATA BASES

Table name: OWNERS

| FIELD | LENG | TYPE | N.DEC | NOTE |
|-------------|------|--------------|-------|---|
| OWNER_CODE | 6 | Long | | Univocal code |
| SHORT_CODE | 5 | Varchar(5) | | Code of max 5 characters, abbreviation of the complete name |
| DESCRIPTION | 255 | Varchar(255) | | Long description |
| INFO | 255 | Varchar(255) | | Information on the Agency |
| PHONE | 50 | Varchar(50) | | Telephone number |
| CONTACT | 255 | Varchar(255) | | Referring information |

3.5 RECORDING CHARACTERISTICS

Characteristics of the unprocessed and processed recordings

Table Name: WAVEFORM

| FIELD | LENG | TYPE | N.DEC | NOTE |
|-------------------------|------|-------------|-------|--|
| INSTALLATION_START_TIME | 19 | Varchar(19) | | Date of the channel opening (YYYY-MM-DD hh:mm:ss) |
| EVENT_TIME | 19 | Varchar(19) | | Event time (YYYY-MM-DD hh:mm:ss) |
| NET_CODE | 2 | Varchar(2) | | Network code |
| STATION_CODE | 6 | Varchar(5) | | Link to table <i>STATION</i> |
| FLAG_DIGIT | 3 | Varchar(3) | | Digitalization Flag A = automatic M = manual A/M = automatic/manual |
| UNPT_NS | 10 | Long | | Number of samples of uncorrected record (NS component) |
| UNPT_WE | 10 | Long | | Number of samples of uncorrected record (WE component) |
| UNPT_UP | 10 | Long | | Number of samples of |

| | | | | |
|--------------|----|--------------|---|---|
| | | | | uncorrected record (UP component) |
| UDT | 9 | Decimal(9,4) | 4 | Sampling rate (s) of uncorrected record |
| FLAG_FC | 1 | Long | | Fixed trace Flag (0 = absent, 1 = present) |
| UPGA_NS | 9 | Decimal(9,4) | 4 | Uncorrected peak ground acceleration NS |
| UPGA_WE | 9 | Decimal(9,4) | 4 | Uncorrected peak ground acceleration WE |
| UPGA_UP | 9 | Decimal(9,4) | 4 | Uncorrected peak ground acceleration UP |
| UPGA_NS_TIME | 9 | Decimal(9,4) | 4 | Time of UPGA_NS from the beginning of the recording, in seconds |
| UPGA_WE_TIME | 9 | Decimal(9,4) | 4 | Time of UPGA_WE from the beginning of the recording, in seconds |
| UPGA_UP_TIME | 9 | Decimal(9,4) | 4 | Time of UPGA_UP from the beginning of the recording, in seconds |
| NPT_NS | 10 | Long | | Number of samples of the processed signal (NS component) |
| NPT_WE | 10 | Long | | Number of samples of the processed signal (WE component) |
| NPT_UP | 10 | Long | | Number of samples of the processed signal (UP component) |
| UNITS | 10 | Varchar(10) | | Acceleration units of the processed signal |
| DT | 9 | Decimal(9,4) | 4 | Sampling rate (s) of the processed signal |
| FILTYPE | 15 | Varchar(15) | | Filter type |
| HP1_NS | 9 | Decimal(9,4) | 4 | Low-cut frequency NS |
| HP1_WE | 9 | Decimal(9,4) | 4 | Low-cut frequency WE |
| HP1_UP | 9 | Decimal(9,4) | 4 | Low-cut frequency UP |
| HP2_NS | 9 | Decimal(9,4) | 4 | Roll-on frequency NS |
| HP2_WE | 9 | Decimal(9,4) | 4 | Roll-on frequency WE |
| HP2_UP | 9 | Decimal(9,4) | 4 | Roll-on frequency UP |

| | | | | |
|-------------|---|--------------|---|--|
| LP1_NS | 9 | Decimal(9,4) | 4 | Roll-off frequency NS |
| LP1_WE | 9 | Decimal(9,4) | 4 | Roll-off frequency WE |
| LP1_UP | 9 | Decimal(9,4) | 4 | Roll-off frequency UP |
| LP2_NS | 9 | Decimal(9,4) | 4 | High-cut frequency NS |
| LP2_WE | 9 | Decimal(9,4) | 4 | High-cut frequency WE |
| LP2_UP | 9 | Decimal(9,4) | 4 | High-cut frequency UP |
| PGA_NS | 9 | Decimal(9,4) | 4 | Peak ground acceleration NS of the processed signal |
| PGA_WE | 9 | Decimal(9,4) | 4 | Peak ground acceleration WE of the processed signal |
| PGA_UP | 9 | Decimal(9,4) | 4 | Peak ground acceleration UP of the processed signal |
| PGA_NS_TIME | 9 | Decimal(9,4) | 4 | Time of the PGA_NS from the beginning of the recording, in seconds |
| PGA_WE_TIME | 9 | Decimal(9,4) | 4 | Time of the PGA_WE from the beginning of the recording, in seconds |
| PGA_UP_TIME | 9 | Decimal(9,4) | 4 | Time of the PGA_UP from the beginning of the recording, in seconds |
| PGV_NS | 9 | Decimal(9,4) | 4 | Peak ground velocity NS of the processed signal |
| PGV_WE | 9 | Decimal(9,4) | 4 | Peak ground velocity WE of the processed signal |
| PGV_UP | 9 | Decimal(9,4) | 4 | Peak ground velocity UP of the processed signal |
| PGD_NS | 9 | Decimal(9,4) | 4 | Peak ground displacement NS of the processed signal |
| PGD_WE | 9 | Decimal(9,4) | 4 | Peak ground displacement WE of the processed signal |
| PGD_UP | 9 | Decimal(9,4) | 4 | Peak ground displacement UP of the processed signal |

| | | | | |
|------------|---|--------------|---|---|
| DUR_NS | 9 | Decimal(9,4) | 4 | 90% energy duration NS of the processed signal |
| DUR_WE | 9 | Decimal(9,4) | 4 | 90% energy duration WE of the processed signal |
| DUR_UP | 9 | Decimal(9,4) | 4 | 90% energy duration UP of the processed signal |
| EPA_NS | 9 | Decimal(9,4) | 4 | Effective Peak Acceleration NS of the processed signal |
| EPA_WE | 9 | Decimal(9,4) | 4 | Effective Peak Acceleration WE of the processed signal |
| EPA_UP | 9 | Decimal(9,4) | 4 | Effective Peak Acceleration UP of the processed signal |
| IA_NS | 9 | Decimal(9,4) | 4 | Arias intensity NS of the processed signal |
| IA_WE | 9 | Decimal(9,4) | 4 | Arias intensity WE of the processed signal |
| IA_UP | 9 | Decimal(9,4) | 4 | Arias intensity UP of the processed signal |
| EPI_DIST | 9 | Decimal(9,4) | 4 | Epicentre-station distance in km |
| EPI_AZ | 9 | Decimal(9,4) | 4 | Epicentre-station azimuth, clockwise from the N |
| FAULT_DIST | 9 | Decimal(9,4) | 4 | Joyner-Boore distance (distance from the station to the fault projection) in km |

Data dictionary

Table Name: D_FLAG_DIGIT

| FIELD | LENG | TYPE | N.DEC | NOTE |
|-----------------|------|--------------|-------|---------------------|
| FLAG_DIGIT_CODE | 3 | Varchar(3) | | Digitalization code |
| DESCRIPTION | 100 | Varchar(100) | | Description |

3.6 ADDITIONAL DATA DICTIONARIES

*References***Table Name: REFERENCE**

| FIELD | LENG | TYPE | N.DEC | NOTE |
|----------------|------|--------------|-------|--------------------------------|
| REFERENCE_CODE | 6 | Long | | Univocal self-incremental code |
| TITOLO | | MEMO | | Description of the reference |
| REF_ABBR | 255 | Varchar(255) | | Brief reference description |

*Administrative data***Table Name: NATION**

| FIELD | LENG | TYPE | N.DEC | NOTE |
|-------------|------|--------------|-------|-----------------|
| NATION_CODE | 3 | Varchar(3) | | UN country code |
| NATION_NAME | 100 | Varchar(100) | | Country name |

Table Name: MUNICIPALITY

| FIELD | LENG | TYPE | N.DEC | NOTE |
|---------------|------|--------------|-------|--|
| NATION_CODE | 3 | Varchar(3) | | UN country code |
| REGION_CODE | 2 | Varchar(2) | | ISTAT region code |
| PROVINCE_CODE | 3 | Varchar(3) | | ISTAT district code |
| COMUNE_CODE | 6 | Varchar(6) | | ISTAT municipality code |
| COMUNE_NAME | 100 | Varchar(100) | | Municipality name |
| LATITUDE | 9 | Decimal(9,5) | 5 | Latitude of the municipality centroid |
| LONGITUDE | 9 | Decimal(9,5) | 5 | Longitude of the municipality centroid |
| PEOPLE | 8 | Long | | Number of inhabitants |

Table Name: PROVINCE

| FIELD | LENG | TYPE | N.DEC | NOTE |
|---------------|------|------------|-------|---------------------|
| NATION_CODE | 3 | Varchar(3) | | UN country code |
| REGION_CODE | 2 | Varchar(2) | | ISTAT region code |
| PROVINCE_CODE | 3 | Varchar(3) | | ISTAT district code |
| PROVINCE_ABBR | 2 | Varchar(2) | | District code |

| | | | | |
|---------------|----|-------------|--|---------------|
| PROVINCE_NAME | 50 | Varchar(50) | | District name |
|---------------|----|-------------|--|---------------|

Table Name: REGION

| FIELD | LENG | TYPE | N.DEC | NOTE |
|-------------|------|-------------|-------|-------------------|
| NATION_CODE | 3 | Varchar(3) | | UN country code |
| REGION_CODE | 2 | Varchar(2) | | ISTAT region code |
| REGION_NAME | 50 | Varchar(50) | | Region name |

Cartographic projections

Table Name: D_PROJECTION

| FIELD | LENG | TYPE | N.DEC | NOTE |
|-----------------|------|--------------|-------|------------------------|
| PROJECTION_CODE | 10 | Varchar(10) | | Projection code |
| DESCRIPTION | 100 | Varchar(100) | | Projection description |

Networks

Table Name: D_NET_TYPE

| FIELD | LENG | TYPE | N.DEC | NOTE |
|---------------|------|--------------|-------|---------------|
| NET_TYPE_CODE | 1 | Varchar(1) | | Net type code |
| DESCRIPTION | 100 | Varchar(100) | | Description |

Coordinates

Table Name: D_COORDINATE_SOURCE

| FIELD | LENG | TYPE | N.DEC | NOTE |
|------------------------|------|--------------|-------|------------------------|
| COORDINATE_SOURCE_CODE | 1 | Varchar(1) | | Coordinate source code |
| DESCRIPTION | 100 | Varchar(100) | | Description |

Event location

Table Name: D_LOCATED

| FIELD | LENG | TYPE | N.DEC | NOTE |
|--------------|------|--------------|-------|---------------|
| LOCATED_CODE | 1 | Varchar(1) | | Location code |
| DESCRIPTION | 100 | Varchar(100) | | Description |

*Sensitivity units***Table Name: D_UNITS_SENSITIVITY**

| FIELD | LENG | TYPE | N.DEC | NOTE |
|--------------|-------------|--------------|--------------|-------------|
| UNITS_CODE | 1 | Varchar(1) | | Unit ID |
| DESCRIPTION | 100 | Varchar(100) | | Description |

4. OUTLINE OF THE EXISTING RELATIONS INSIDE THE DATA BASE

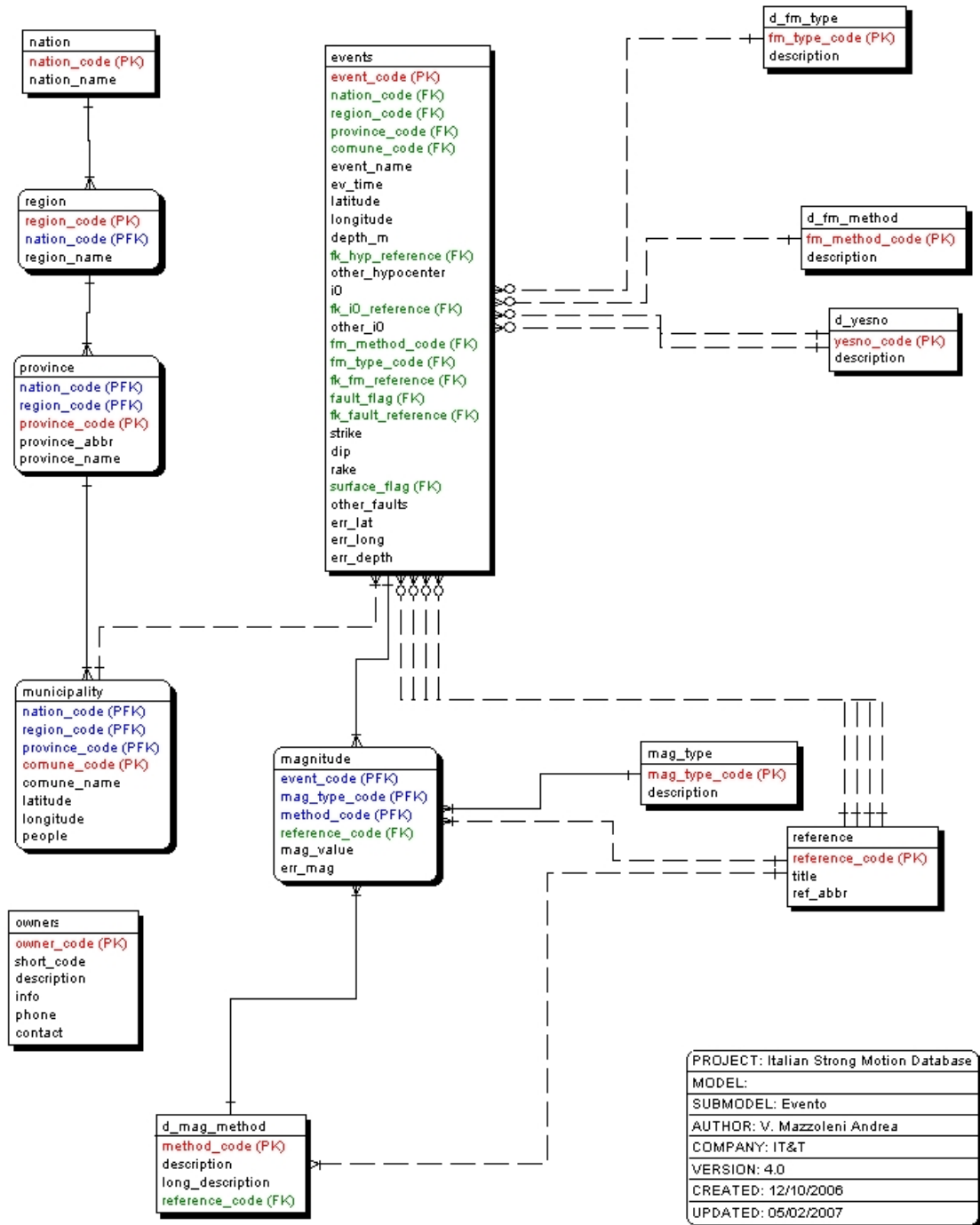


Figure 1: structure of the EVENT block

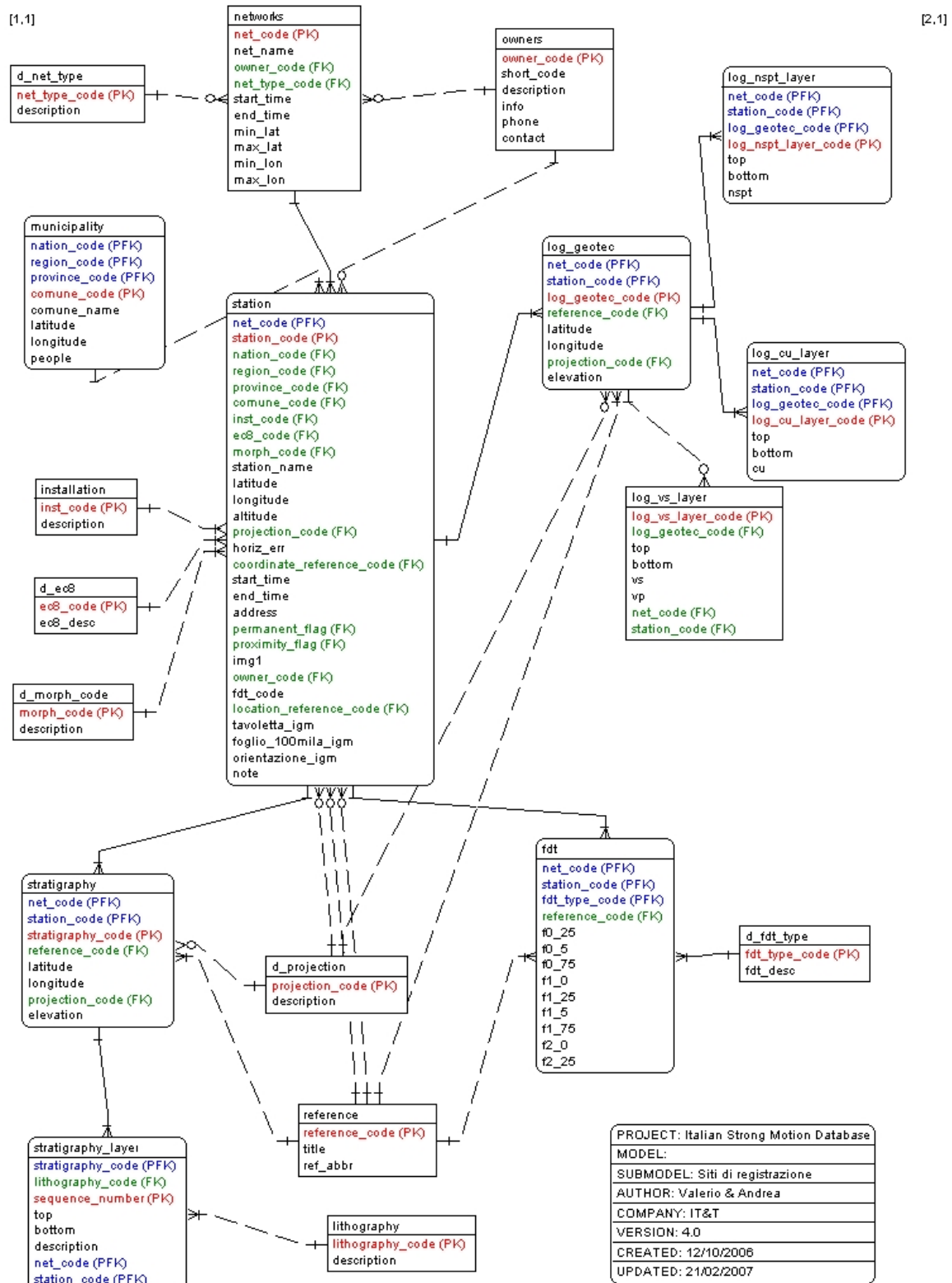


Figure 2: structure of the RECORDING SITE block

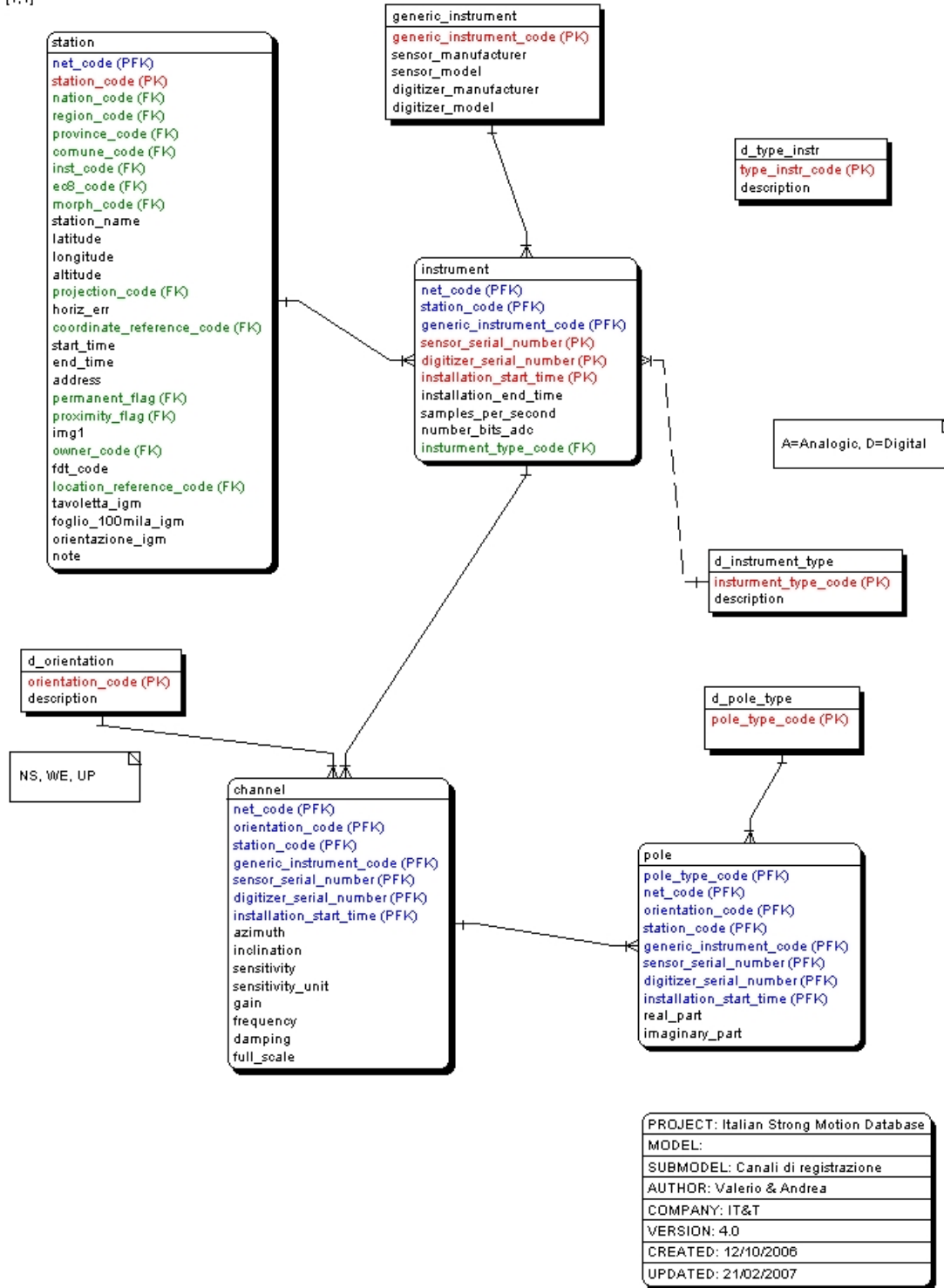


Figure 3: structure of the INSTRUMENT block

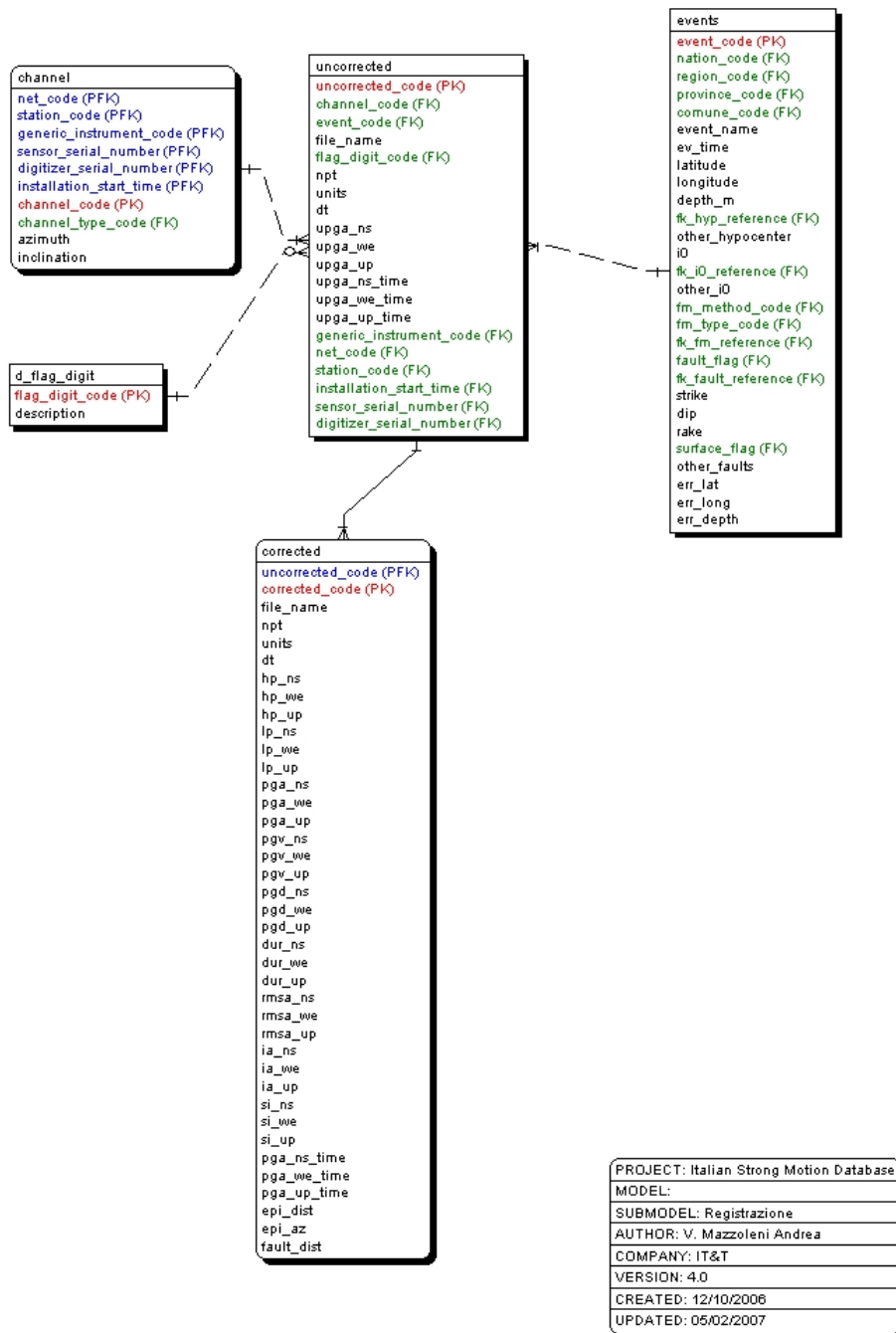


Figure 4: structure of the RECORD block