

## SECTOR REFERENCE LIST

### Rigid Catenary

March 2021

Project Name	Location	Date	Length (km)	Voltage	Design Speed (km/h)
Metro Buenos Aires Line B Alem-Rosas	Argentina	2014	25	600 V	90
Metro Buenos Aires Line E Bolívar-Retiro	Argentina	2018	4	1,5 kV	90
Perth- Forestfield Airport link	Australia	2019	15	25 kV	140
Melbourne Metro Rail Project	Australia	Design	1	1,5 kV	90
ÖBB Marchtrenk-Traun	Austria	1993	0.5	15	-
SNCV Charleroi	Belgium	1992	0.7	750 V	80
STIB Schaerbeek Depot Brussels	Belgium	1998	0.77	750 V	20
STIB Rogier Tunnel Brussels	Belgium	2008	0.5	750 V	80
STIB Haren Depot	Belgium	2008	3	750 V	20
STIB Thomas Tunnel Brussels	Belgium	2009	0.1	750 V	20
STIB Marconi depot	Belgium	2016	5	750 V	20
STIB Simonis	Belgium	2017	3.1	750 V	20
INFRABEL Tunnel Saint Martin Liege	Belgium	2019	1.35	3 kV	80
INFRABEL Tunnel Pierreuse	Belgium	2020	3.2	3 kV	80
Metro Sao Paulo Line 4	Brazil	2010	28	1.5 kV	110
Metro Sao Paulo Line 5 phase 1	Brazil	2013	2.3	1.5 kV	100
Metro Sao Paulo Line 5 phase 2	Brazil	2018	21	1.5 kV	100
Metro Sao Paulo Line 4 Extension	Brazil	2021	4.5	1.5 kV	110
Metro Sofia Line 3	Bulgaria	2018-2019	23.04	1.5 kV	90
Toronto Saint Clair station	Canada	2016	0.37	750 V	30
Ottawa Confederation Line	Canada	2018	7.88	1.5 kV	90
Metro Santiago de Chile L3 & 6	Chile	2016	79.75	1.5 kV	80
Guangzhou	China	1999	0.2	1.5 kV	-
MTR Hong Kong SIL-KTE	China	2015	12	1.5 kV	90
MTR Hong Kong SCL	China	2017	25	25 kV	130

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Helsinki-Vantaa Airport	Finland	2012	16	25 kV	120
RATP Défense/Nation RER A	France	1983	0.4	1.5 kV	110
Eurotunnel under the Channel	France	1992-1995	0.6	25 kV	110
SNCF Paris RER C	France	1991-1997	21.6	1.5 kV	110
Tramway Marseille	France	2007	1	750 V	60
Havre Harbour Rouge bridge	France	2008	0.4	750 V	20
Saint Michel – Nice Bridge	France	2009	0.2	25 kV	-
Tramway Strasbourg	France	2011	0.1	750 V	-
Tramway Brest	France	2012	0.1	750 V	-
SNCF Levallois Depot	France	2013	0.47	25 kV	15
SNCF Crêt d'Eau tunnel (Bellegarde)	France	2014	9.5	25 kV	140
Tramway Montpellier	France	2016	0.25	750 V	30
Tramway Nantes	France	2017	0.25	750 V	30
Grand Paris Line 16 & 17	France	Design	30.34	1.5 kV	115
Grand Paris Line 16	France	Design	12.72	1.5 kV	60
Grand Paris Line 15 SO	France	Design	34.45	1.5 kV	60
Frankfort Depot	Germany	2005	-	15 kV	15
Berlin Depot	Germany	2005	-	15 kV	15
Plochingen Depot	Germany	2006	-	15 kV	15
Gemmenicher tunnel	Germany	2008	1.75	15 kV	80
Leipzig tunnel DB	Germany	2009	3.5	25 kV	120
Leipzig new phase DB	Germany	2014	7	25 kV	120
DMRC Metro New Delhi Line 2	India	2005	30	25 kV	110
DMRC Delhi Airport Metro Express Link	India	2010	32	25 kV	135
Jaipur Chandpole station	India	2013	0.8	25 kV	90
Jaipur phase 1-B	India	2018	3.12	25 kV	90
Metro Mumbai line 3	India	Construction	68	25 kV	95
FART Domodossola	Italy	1992	0.1	1.5 kV	20
ATM Milan	Italy	1992	0.3	1.5 kV	-
FS Milano Fiorenza	Italy	1995	1.7	25 kV	-
FS Intercantieri Vittadello Depot	Italy	1998	1	3 kV	20
FS Martesana Milano	Italy	1999	1.5	3 kV	-
Metro Roma line C	Italy	2012	40.8	1.5 kV	80
Metro Roma line C extension	Italy	2020	1.75	1.5 kV	80
Metro México Line 12	México	2012	29	1.5 kV	80
Guadalajara	México	2018	10	1.5 kV	100
México-Toluca	México	2019	8.27	25 kV	140

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Bergen Depot	Norway	2009	0.1	1,5 kV	20
Tramway Bergen Nesttun tunnel	Norway	2012	0.8	750 V	50
Metro Panama city Line 1	Panama	2013	28	1,5 kV	80
Metro Panama city Line 2	Panama	2018	46.71	1,5 kV	80
Tramway Poznan	Poland	2012	5	750 V	60
Metro Lusail	Qatar	2016	14	750 V	70
KNR Seoul, Kwachon Line	South Korea	1991	30	25 kV	110
KNR Seoul, Bundang Line	South Korea	1992	28	25 kV	110
IJAR phase 1 & 2	South Korea	2005-2009	66	25 kV	110
Shinbundang subway	South Korea	2009	43.1	25 kV	110
Yeosu Depot	South Korea	2010	1.1	25 kV	20
Incheon airport phase 1	South Korea	2013	4	25 kV	140
MRR Suseon Station	South Korea	2014	7.2	25 kV	110
Shinbundang subway extension	South Korea	2014	26.12	25 kV	110
Incheon airport phase 2	South Korea	2016	11.5	25 kV	140
Shinbundang line Yongsan-Gangnam	South Korea	2020	5.24	25 kV	110
TMB Barcelona Line 2 Paralelo-Sagrada	Spain	1992	9	1.5 kV	110
TMB Metro Barcelona Line 2	Spain	1996	41	1.5 kV	110
TMB Triangulo Ferroviario Line 4	Spain	1996	4.5	1.5 kV	110
RENFE Tarragone	Spain	1996	0.14	3 kV	110
TMB Metro Barcelona Line 5	Spain	1997	35	1.5 kV	110
Bilbao ria 2000	Spain	1997	2.4	3 kV	110
Metro Madrid Line 11	Spain	1998	5	750 V	110
Metro Madrid Line 1	Spain	1998-1999	7.7	600 V	60
Metro Madrid Line 4	Spain	1999	3.4	750 V	110
TMB Barcelona Line 4	Spain	1999-2002	35.7	1.5 kV	110
TMB Metro Barcelona Line 3	Spain	1999-2006	38.5	1.5 kV	110
Metro Madrid Line 7	Spain	1999	17	750 V	110
Laguna Depot Line 3	Spain	-	0.22	1.5 kV	20
RENFE Madrid San Sebastián - Alcobendas	Spain	2000	4	3 kV	110
Metro Madrid Line 2	Spain	2000-2004	12	750 V	110
TMB Metro Barcelona Line 1	Spain	2001	42	1.5 kV	110
Metro Bilbao Line 2	Spain	2001	10	1.5 kV	110
RENFE Cadiz underground	Spain	2001	3.5	3 kV	160
Vizcaya Baracaldo - Ansio - Urbinaga Line 2	Spain	2001-2002	4	1.5 kV	80
Metro Madrid Line 10	Spain	2001-2002	46	1.5 kV	110

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Metro Madrid Line 8	Spain	2002	17	1.5 kV	130
TMB Barcelona Connection Line 2 & 4	Spain	2002	4	1.5 kV	110
AVE Zaragoza Euroasce	Spain	2002	3.5	25 kV	-
Madrid Metrosur line 12	Spain	2002	80	750 V	110
Asturias Sandichel tunnel	Spain	2002	0.3	1.5 kV	100
Metro Valencia Line 5	Spain	2002-2006	19.6	1.5 kV	80
TMB Metro Barcelona Line 11 Can Cuyas	Spain	2003	1.5	1.5 kV	110
Zaragoza ADIF Delicias station	Spain	2003	2	3 kV	120
Euskotren San Sebastian	Spain	2004	4.5	1.5 kV	100
Metro Valencia extension Line 4	Spain	2004	3.5	1.5 kV	80
Bilbao Sestao – Portugalete Line A2	Spain	2005	1.8	1.5 kV	80
Nuevo Atocha – Chamartin tunnel ADIF	Spain	2006	15	3 kV	120
Metro Mallorca	Spain	2006	12.5	1.5 kV	80
TMB Barcelona Line 3 extension Trinitat nova	Spain	2006	4.5	1.5 kV	80
Metro Sevilla Line 1	Spain	2007	24	1.5 kV	80
Metro Bilbao Portugalete - Santurce	Spain	2007	4	1.5 kV	80
Metro Barcelona Bellvitge L1 station	Spain	2007	0.5	1.5 kV	80
ADIF Sants station	Spain	2007-2011	9	25 kV	120
Eusko Trenvideak Durango - Traña	Spain	2008	3	1.5 kV	100
Metro Barcelona Line 1 Mercat Nou station	Spain	2008	1.5	1.5 kV	80
Metro Barcelona metro Line 9 tramo 4	Spain	2009	10	1.5 kV	80
Bilbao Basurto tunnel	Spain	2009	4	1.5 kV	100
Metro Barcelona Line 5 Horta-Vall Hebron	Spain	2009	5.1	1.5 kV	80
ADIF Castellbisbal-Mollet	Spain	2009	12.5	25 kV	130
ADIF Cercanias Barcelona	Spain	2009-2010	74.5	3 kV	120
ADIF Malaga - Airport	Spain	2010	1	3 kV	120
ADIF Malaga – Fuengirola (Cercanias)	Spain	2010	6	3 kV	140
Metro Palma de Mallorca Line 2	Spain	2010	7	1.5 kV	80
F.G.C Terrassa Rambla (Barcelona)	Spain	2010	1.5	1.5 kV	100
ADIF Atocha – T4 Barajas	Spain	2010	12	25 kV	120
ADIF Sagrera	Spain	2010	3	3 kV	120
AVE Barcelona Sants station	Spain	2011	3.6	25 kV	80
Metro Bilbao Etxebarri-Basauri	Spain	2011	3	1.5 kV	80
TMB Line 9 Zona Franca (Viaduct)	Spain	2012	2.5	1.5 kV	80
Prat-el Gornal Line 9	Spain	2012	14.7	1.5 kV	80
Prat-Airport Line 9	Spain	2012	20	1.5 kV	80
ADIF Sabadell tunnel	Spain	2012	10.5	3 kV	120
Metro Malaga	Spain	2012	17.1	1.5 kV	80
FEVE Escrita tunnel	Spain	2012	1.5	1.5 kV	80
EUSKOTREN Loiola-Herrera	Spain	2012	4.7	1.5 kV	-
EUSKOTREN Durango	Spain	2012	2	1.5 kV	-

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AVE Barcelona – French border	Spain	2012	9.5	25 kV	120
TMB Barcelona Access to viaduct L9	Spain	2013	1.7	1.5 kV	20
FGC Barcelona Terrassa Rambla-Can Roca	Spain	2013	9	1.5 kV	90
Metro Bilbao Santurtzi-Kabiezes	Spain	2013	3	1.5 kV	80
FGV Ribarroja-Manisses	Spain	2014	1.3	1.5 kV	80
TMB Barcelona Line 9 tramo 1	Spain	2014	14.56	1.5 kV	80
Metro Granada	Spain	2015	4.87	750 V	80
Tunnel FGC Sabadell tramo 1	Spain	2015	3.2	1.5 kV	90
Metro Madrid Line 1	Spain	2016	30	1.5 kV	90
Barcelona Metro Line 5	Spain	2016	5.55	1.5 kV	90
Metro ETS Herrera-Altza S. Sebastian	Spain	2016	2.4	1.5 kV	90
Tunnel FGC Sabadell tramo 2	Spain	2016	4.62	1.5 kV	90
Metro Bilbao Line 3	Spain	2017	18.73	1.5 kV	90
Tunnel FGC Sabadell tramo 3	Spain	2017	3.1	1.5 kV	90
Atocha-Chamartin AVE	Spain	2017	13	25 kV	140
Metro Madrid replacement SI	Spain	2017	0.8	1.5 kV	90
Tunnel FGC Pl. Catalunya-Sarrià	Spain	2017	7.98	1.5 kV	90
Tunnel FGC Sarrià-R. Elisenda	Spain	2017	2.4	1.5 kV	90
Metro Madrid Line 5	Spain	2018	23	1.5 kV	90
Barcelona Sants station ADIF	Spain	2018	0.36	3 kV	30
Finca Adhoc light train FGV Alicante	Spain	2018	2.88	750 V	90
FGC Pl. Espanya - Europa Fira/Gornal	Spain	2018	8.12	1.5 kV	90
FGC Sabadell tunnel Can Feu	Spain	2018	0.67	1.5 kV	90
FGC Europa Fira/Gornal - Av Carrilet	Spain	2019	5.6	1.5 kV	90
Tunel Atocha-Chamartin	Spain	2019	18.60	1.5 kV	120
Metro Madrid Line 4	Spain	2020	20.20	3 kV	90
Electrification Sagrera Station	Spain	2020	4.42	3 kV	120
Electrification Sagrera Access	Spain	2020	2.75	3 kV	120
ADIF Martorell tunnel	Spain	2020	1.5	1.5 kV	120
FGC Av Carrilet-Cornellà	Spain	2020	7.85	1.5 kV	90
AVE Murcia station Access	Spain	Construction	2.75	25 kV	100
SJ	Sweden	1990	0.2	15 kV	-
CFF Opfikon	Switzerland	1984	0.32	15 kV	105
CFF Simplon tunnel	Switzerland	1988	1.2	15 kV	140
CFF Musemenstrasse station (Zurich)	Switzerland	1988	3.8	15 kV	-
CFF Witzigen tunnel	Switzerland	1988	0.28	15 kV	-
CFF Enge tunnel	Switzerland	1989	2	15 kV	-
CFF Umberg tunnel	Switzerland	1990	2.2	15 kV	-
SZU Zurich	Switzerland	1990	4.2	15 kV	-
FART Locarno	Switzerland	1990	3.55	1.5 kV	-



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TSOL Lausanne	Switzerland	1990	0.58	750 V	70
Zurich tunnel	Switzerland	2013	12	15 kV	-
Istanbul Marmaray tunnel	Turkey	2012	23.5	25 kV	-
Istanbul Metro Kartal-Kaynarka	Turkey	2015	8.64	1.5 kV	90
Metro Saint Louis EADS Bridge	USA	2014	1.92	1.5 kV	90
SEPTA Philadelphia	USA	2017	0.2	25 kV	30
L.A. Regional Connector	USA	2018	6.2	750 V	90
L.A. Blue Line	USA	2018	2.42	750 V	90
Metro Saint Louis Union Station	USA	2018	0.64	1.5 kV	90
Boston MBTA Floodgate	USA	2019	0.01	750 V	30
Seattle Northgate and East Link extensions	USA	2019	5.25	1.5 kV	90
Valencia Metro	Venezuela	2013	4	1.5 kV	90
<b>Total</b>			<b>2037.42</b>	<b>km</b>	