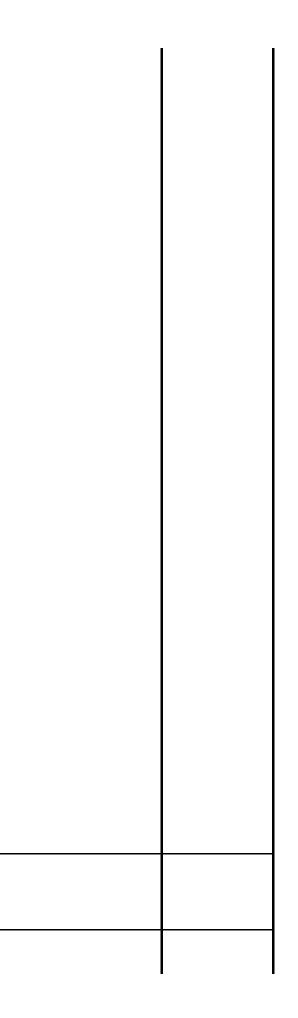
MINnD s2 GT1.4 IFC-Tunnel Commentaires AFTES GT45 MINnDs2\_GT1.4\_ifc-tunnel\_annexe\_wp10\_coordination\_bSI\_ifc-tunneling\_047\_2021\_eng

## MINnD GT1-4 - Review of buildingSmart Int'l RAR v1

			MINnD GT1-4 - Review of buildingSmart Int'l RAR v1			
Chap	te Subject Page	Date	Chrono Comments A	Associated doc/img/Ink Author	Date Review GT1-4 Decision GT1-4	Transmission bSI
1	Overview and methodology		Underground works are, among all civil engineering, the most hazardous and dangerous works due to the high level of interactions between anthropic and natural structures. Identification and management of risks, most of them related to geosciences, represents the highest value to be created during the design and construction process. This high level characteristic of underground works should be highlighted upfront the document and not wait until the chapter 8 on geotechnical requirements. A resumé of the risk scope should be brought from chapter 8 to this chapter. Minimizing and controlling the risk is a main factor when designing use cases and prioritizing them. This will also explain why incorporation of geosciences field in IFC are so crucial, although it should have beeen developed much earlier in IFC roadmap: I don't know of 1 any building or infrastructure that are not supported on ground!	GT1-4		
2	Scope 8	<u>17/12/2020</u> 17/12/2020	The graphic mentions "mined conventional" and "mined mechanical". For consistency - the mine tunnels are excluded - it would be better to have only "conventional" and "mechanical". Similarly and in view of several geo-* models it should be considered to express "geoscience models" rather	<u>GT1-4</u> GT1-4		
2.1 2.2	Tunnel types 8 Tunnel subsystems 9		From tunnel engineering point of view, and in consideration of the higher risks presented by these structures, access shafts (function priorization) and vertical excavation (construction 4 method priorization) should be considered as high priority.	GT1-4		
3	Use cases 10	17/12/2020	Although the size of the physical space that needs to be modelled during a tunnel project is not linked to the conceptual data model, it has a great importance as to the level of details and to the total size of the digitalized data (and this is a consideration later called in for advocating a technical solution rather than another one as in geometry discussions). This should be the time to intorduce geotechnical impacted zones" which are dimensioned in consideration of each specific risk. If one excepts the very early planning phase where as for other linfrastructure a large deca to hecto kilometrix corridor shall be considered, most of the time, an area of a few hundred meters should be considered with data related to all structures be they 5 anthropic or natural.	GT1-4		

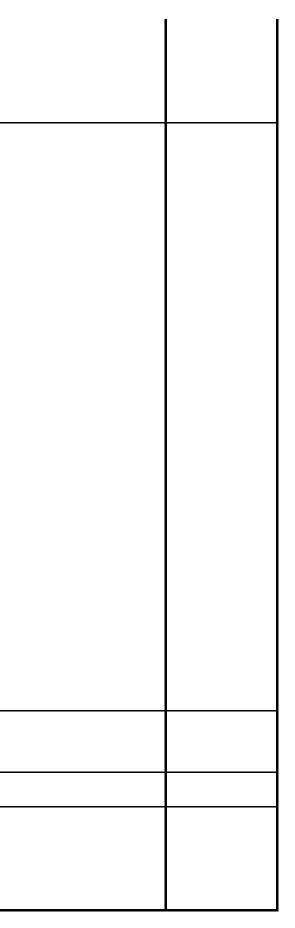
	17/12/2020	The exchanges considered in the use cases identifications chapter are most of the time bilateral exchanges between at most two or three disciplinary domains. This is of course true but does not underline the unavoidable role in complex structures and projets of the systems architect that must integrate all disciplines and technologies in one coherent solution and obtain the convergence of all actors. There is then a high level supervisory role that must perform all types of exchanges to guarantée the final performance of the tunnel. This should be present at all moments of the IFC Tunnel 6 project. Although geologists and hydrogeologists share a large number of concepts, they are different specialists having specific models developing specific risks. Their impact ranges are also quite different. Use case 1 b should be described as geologic	<u>GT1-4</u>
	17/12/2020	7 and hydrogeologic factual data. The use case 6b (D2D w full logic) is at the core of all engineers works when developing functional models (i.e. theories of how the tunnel system works all along its life cycle). It is understood that tha amount of works is fairly large and that it should be posponed but this is a decision which will make the furutrre works harder. There is no doubt that this will have eventually to be developed if IFC technology wants to last, the sooner the better. The same comment applies to the split to	<u>GT1-4</u>
	17/12/2020	<ul> <li>8 operate between functional objects and real objects.</li> <li>Use case 7 is a core analysis to consider mechanical and hydrostaboility at the excavation front and at longer range near the existing strures present in the vicinity. Excavation stability</li> </ul>	<u>GT1-4</u>
	17/12/2020	8 analysis should be a better name for such a use case. Use cases 8a and 8b are formulated for air and water flows in terms that refer only to permanent exploitation of the tunnel (and even only the water transfer tunnel for water). The title of later cases do not seem to cover the construction phase. But designing the construction phase is a must of the design phase and ventilation air and exhaust water systems durung construction should also be considered at desgin stage 8a and	<u>GT1-4</u>
	17/12/2020	10 8b. Use case 11 should take on board "excavation front stabilization" in the designation itself. The excavation front is the most dangerous place in tunnel works and this demands a	<u>GT1-4</u>
	<u>17/12/2020</u> <u>17/12/2020</u>	<ul> <li>11 special attention.</li> <li>12 Use case 12a and 12b should be a single one. Use case 17 requires an extensive semantics to record all types of damages and time alterations. These semantivcs were well developed during the FP7 European Innovation Project</li> </ul>	<u>GT1-4</u> <u>GT1-4</u>
	17/12/2020	13 NETTUN. Use case 18 on settlement monitoring implies all ground and	<u>GT1-4</u>
	17/12/2020	14 anthropic structures inside the geotechnical impacted zones.	GT1-4
4 Use cases prioritization	19 17/12/2020	Apart the comments made above on the use case 6b having been taken out of scope, risk considerations should raise the level of priority from lower to highest for cases 7, 8a and b 15 during construction, 15c and 18.	GT1-4
5 Process map and exchange scenarios	21 17/12/2020	Figure 5,1 is in a low definition mode preventing anyone to read and use it. It is suggester to have it at hich definition in pdf 16 and to have it as an A3 folded page.	GT1-4



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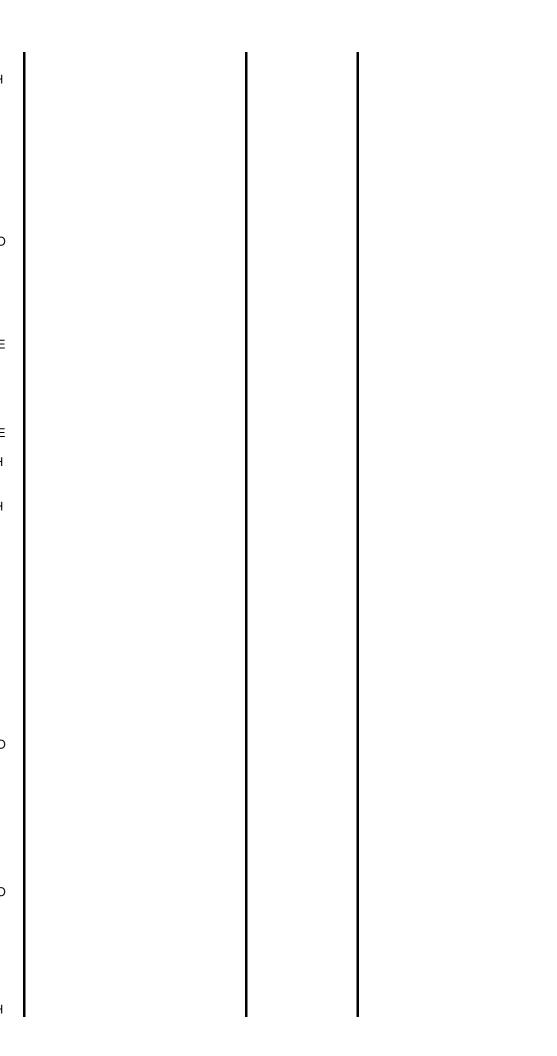
	70		
8.5.a OGC-standards 8.5.b Inspire	70 72		
8.5.c IFC-geotech by Ifc4.3 (Common-schema) project	72		
o.s.e in e geoteen by net.s (common schema) project	72		
9 Excavation requirements	76		
9.1 Overview	76		
9.1.1 Abbreviations	76		
9.1.2 Conventional tunnelling	76		
9.1.3 Mechanised tunnelling	78		
9.1.4 Cut-and-cover tunnelling	80		
9.2 Semantics	81		
9.2.1 Conventional tunnelling	81		
9.2.2 Mechanised tunnelling	82		
9.2.3 Cut-and-cover tunnelling	82		
9.3 Geometry	82		
		The longitudinal section is not discussed. One shall not forget	
		the importance of the free span excavation lentgth in the	
	00	longitudinal section as it relates to the unsupported length of	
9.3.1 Conventional tunnelling	82	excavated tunnel . This is indeed one of the key factor to	
		control excavation front stability. It varies a lot depending upon	
		grounds conditions. Determined lengthes of the tunnel are also	
		7/12/2020 22 dedicated to drilling, mucking, supporting, lining	GT1-4
9.3.2 Mechanised tunnelling	83		
9.3.3 Cut-and-cover tunnelling	83 84		
	04		
10 Excavation support, ground improvement, waterproof	fiı 86		
10.1 Excavation support	86		
		It is worth emphasizing the fact that most support measures	
10.1.1 Conventional tunnelling	86	(p86 to 98) refer to drilling holes in a certain geometric facshior	
	00	or arrangement). The same applies to drilling holes for	
		7/12/2020 23 blasting. Drilled holes is a very generic object.	GT1-4
		Considerations on longitudnal section should also be given to see the length of tunnel with the annular space between virgin	
10.1.2 Mechanised tunnelling	106	ground and segments in place, this void being later injected.	
		And also to see the extent of the front excavation ahead of the	
		7/12/2020 24 cutting head, partially filled with excavated slurry.	GT1-4
10.1.3 Cut-and-cover tunnelling	112		
		The method of compensation grouting is not mentioned	
10.2 Ground improvement and water control	116	although it is used for general stability control. Grout injection rates ares controlled by in situ measurement of settlements or	
		7/12/2020 25 of overcut estimates.	GT1-4
			G
10.2.1 Conventional tunnelling	116		
10.2.2 Mechanised tunnelling	119		
10.2.3 Cut and Cover tunnelling	120		
10.3 Waterproofing	120		
10.3.1 Conventional tunnelling	120		
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10.4 Tunnel Linings	124		

10.4.1 Conventional Tunnelling	124			I
10.4.2 Mechanised Tunnels	131			
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	152			
11 Tunnel systems requirements	135			
11.1 Systems, sub-systems, components & characteristics	135			
11.2 Systems required during construction	136			
11.3 Existing Ifc4.3 objects vs specific IfcTunnel objects	137			
11.3.1 Existing Ifc Railway objects	138			
11.3.2 Existing IfcRoad objects	143			
11.3.3 IFC4 (buildings) objects	145			
11.4 Ventilation	145			
11.4.1 Ventilation systems under tunnel operation	145			
11.4.2 Ventilation systems during tunnel construction	147			
11.4.3 Main components and characteristics	149			
11.5 Power supply – High voltage	151			
11.5.1 Power supply under tunnel operation	151			
11.5.2 Power supply during tunnel construction	151			
11.5.3 Main components and characteristics	152			
11.6 Energized equipments	153			
11.6.1 Energized equipments under tunnel operation	154			
11.6.2 Energized equipments during tunnel construction	154			
11.6.3 Main components and characteristics	155			
11.7 Drainage	158			
11.7.1 Drainage system during tunnel operation	158			
11.7.2 Drainage system during tunnel construction	159			
11.7.3 Main components and characteristics	160			
11.8 Safety & evacuation	161			
11.8.1 Safety & evacuation during tunnel operation	161			
11.8.2 Safety & evacuation during tunnel construction	162			
11.8.3 Main components and characteristics	163			
11.9 Fire protection	165			
11.9.1 Firefighting during tunnel operation	165			
11.9.2 Firefighting during tunnel construction	165			
11.9.3 Main components and characteristics	167			
11.5.5 Main components and characteristics	107			
		To cover the needs o	f the tunnel system's architect there	
12 Model View Definitions	169	should be also a "univ	versal MVD". It could also be used by	
		7/12/2020 26 controlling organisation	ons.	GT1-4
13 Next Steps	171			
			mment as to the necessity to introduce	
			ng hazards as the main control.	
14 Conclusion	172		are a must in tunnel as for all the	
			ruction industry. There are no construction n ground and in close interaction with its	
		7/12/2020 27 environment.		GT1-4
				~··· T

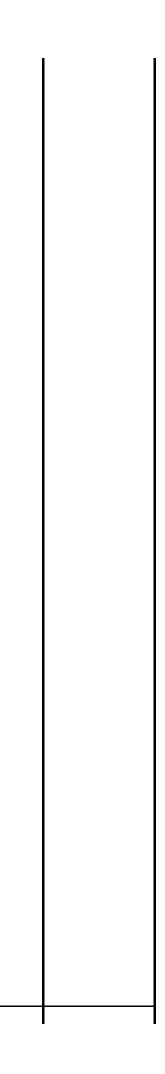


				MINnD GT1-5 - Review of buildingSmart Int'l RA	R v1			
Chap ter		age	Date Chron	o Comments	Associated doc/img/lpk	Author	Date Review GT1-4 Decision GT1-4	Transmission bSI
1	Overview and methodology	6						
2	Scope	Q						
2.1	Tunnel types	8						
2.2	Tunnel subsystems	9						
3	Use cases	10						
4	Use cases prioritization	19						
5	Process map and exchange scenarios	21						
	Georeferencing, geometries and positioning	22						
6	requirements	23						
6.1	Overview	23						
6.2	Georeferencing	23						
6.3	Alignment and tunnel axis Geometry	27 30						
6.4 6.4.1	Explicit Geometry	30 30						
	Procedural Geometry	31						
6.5	Voxel grids and octrees for representing geological data	40	25/01/2021	5 Section xy		MBE		
				ISO19123 provide definition of coverages that encompasses grids. In case an IFC extension				
				is proposed, interoperability with that standard				
			25/01/2021	6 shall be adressed.		MBE		
7	Spatial structure and spaces	41						
				Very different scales between site and facility part that may lead to the use of different CRS.				
7.1	Spatial Structure / Project Hierarchy	41	05/04/0222	Spatial structure / Project hierarchy shall take				
7.2	Spaces	46	25/01/2021	7 this into account.		MBE		
/.2	Spaces	-10						
8	Geology and geotechnics modelling requirements	50						
				It is indicated that Geological / Geotechnical model should be covered by IFC. It could be				
8.1	Introduction	50		interesting to expand this idea to other				
				consistent model description as those studied				
			01/03/2021	18 in Minnd (Geosci ML, Water ML, RESQML) Modelisation of waterground should be added		BLH		
				at the same level as Geological or				
			01/03/2021	19 Geotechnical model		BLH		
8.1.a	Requirements in a tunnel lifecycle	50		20			I	I I

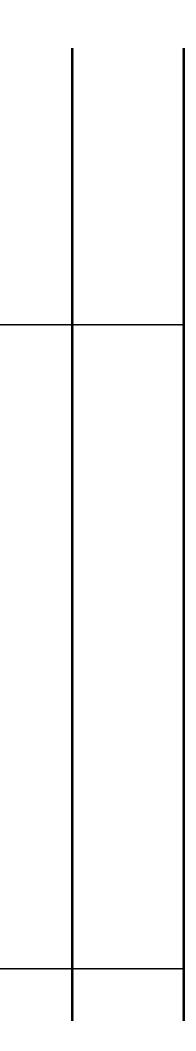
8.1.c       Terminology       51         8.1.d       Abbreviations       51         8.1.d       Abbreviations       51         8.1.d       Abbreviations       52         8.1.e       Focal points: exchanged geological/geotechnical information and models       52         8.1.e       Focal points: exchanged geological/geotechnical information and models       52         8.1.e       Focal points: exchanged geological/geotechnical information and models       52         8.1.e       Focal points: exchanged geological/geotechnical information and models       52         8.1.e       Focal points: exchanged geological/geotechnical information and models       52         8.1.e       Focal points: exchanged geological/geotechnical information and models       52         8.1.e       Focal points: excha
8.1.c       Terminology       51       geotenthical models are presented. The submitties geological ins is norm evaly almost autonomous of geology with their own sub-specialists. Linking geological models one may compute hydrological models. The impacted compute hydrological models. The impacted compute hydrological models. The impacted compute hydrological models is a submitting geological depending upon the compute hydrological furnel Documentation is also factual data. It should be paid attention in phase 2 hot defining twice some Observations & Measurements because they can appear either during the pre-construction phase.       V         25/01/2021       8 construction and maintenance.       M         25/01/2021       8 construction and maintenance.       M         25/01/2021       9 geotechnical: models are waves built from geological model. Actually, for turnel projects in geotechnical model are always built from geological model. Actually, for turnel projects in the could be interesting to add the molino of ZIG, Geotechnical influence Area defining by Oti/03/2021       23 volume of soil alyer impacted by the project       M         8.1.d       Abbreviations       52       Books A, B and C are designed at design and construction to enable a fully informed call for tomole and maintenance which shall be field and supplemented by inputs coming from on going surveys, audit and diagnostic to understand we athering processes and progressive damages to funders. NETHUN which has developed a compilete       B         8.1.d       Focal points: exchanged geological/geotechnical information and maintenance which shall be field and supplemented by inputs coming from on going surveys, audit and diagnostic to understand
8.1.c       Terminology       51       scientific disciplin is in some way almost autonomous of geology with their own sub-specialists. Unlike geological models one may compute hydrological models. The impacted is zone can be very large depending upon the compute hydrological models. The impacted is zone can be very large depending upon the geological models in the aquiters.       V         19/01/2021       1 size of the aquiters.       V         Geological Turnel Documentation is also factual data. It should be paid attention in phase 2 hot defining two esome Observations & Measurements because they can appear either during the pre-construction phase,       M         25/01/2021       8 construction and maintenance.       M         geological model construction phase,       25/01/2021       9 geotechnical model models. Case where geological models. Case where geological models can be very and maintenance.       M         8.1.d       Abbreviations       52       1/03/2021       22 to hydrogeological model is not with a model are skipped at for small projects in models. Case where geological model is construction of 21G, and the notion of 21G, and th
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should ne taken with the 6th PCRD project NETTUN which has developed a complete
NETTUN which has developed a complete
semantics and ontology dedicated to this
19/01/2021 2 domain. V
In line with comment 1, it would be worth
introducing hydrological between geological
and aspects box. In the text, one should mention that mosts risks find their origin in
8.1.1 Important aspects ground, water or air. Case A7 could be titled
"Faults and disturbed zones with or without
water" or "Water bearing fault zones" case be singled out, A15, A16, A17 could be grouped
19/01/2021       3 into a single one "Dangerous materials"       V
singled out. A15, A16, A17 could be grouped 19/01/2021 3 into a single one "Dangerous materials" V
singled out. A15, A16, A17 could be grouped 19/01/2021 3 into a single one "Dangerous materials" V It could be added the principle of limiting the risk by performing investigation during the
singled out. A15, A16, A17 could be grouped 19/01/2021 3 into a single one "Dangerous materials" V It could be added the principle of limiting the risk by performing investigation during the project phase until construction phase (PRELI,
singled out. A15, A16, A17 could be grouped 19/01/2021 3 into a single one "Dangerous materials" V It could be added the principle of limiting the risk by performing investigation during the
singled out. A15, A16, A17 could be grouped         19/01/2021       3 into a single one "Dangerous materials"       V         It could be added the principle of limiting the risk by performing investigation during the project phase until construction phase (PRELI, AVP, PRO, EXE). At least, it could be important       V



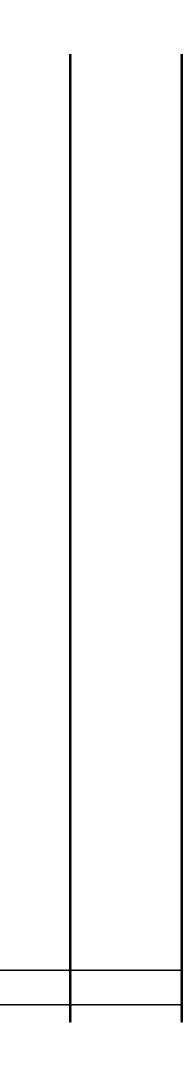
1		I			
				It could added the lifetime / lyfecycle of model	
l				(evolution of soil mechanical parameter during	
			01/03/2021	25 construction, addition of investigation, etc)	BLH
				What does "semantics sufficient" mean? No	
		<b>F7</b>		geometry is required? Location of the possible	
1	Table 1	57		appearance of noxious gas, aggressive water or cavities is really helpful as they can be very	
			25/01/2021	10 local.	MBE
			20/01/2021		MBE
1				"Instability of natural slope" The geometrical	
				representation expected is a part of the	
				geological / geotechnical model? Or could we	
l	Table 1	57		have another model issued from the	
				geological/geotechnical model exploitation (object) : a surface or volume representing the	
				hazard area? Wich must be combine to the	
			28/01/2021	1 tunnel location to obtain a risk ranking zone?	CGA
	Table 2	61	25/01/2021	Missing H to geotechnical	MBE
1				"The relevant information is transported in the	
l				semantics" : does it mean there will be no	
			25/01/2021	proposal risk / hazard description?	MBE
				In the § "interpreted models" one could mention that hydrogeo models include sources and	
8.2	Semantics	64		wells. And it is worth mentioning here that the	
				range of impacted zones and studies should be	
			19/01/2021	4 larger than for mechanical hazards.	VCO
		64	05/04/0004	Shall remind that the Appendix C is a draft	
			25/01/2021	11 proposal, as indicated in the previous chapter	MBE
		64	25/01/2021	Hydromodel appearing yet not mentionned in 12 previous sections. Link to comment 1	MBE
			25/01/2021	13 TunnelDocu inside GeoDocu	MBE
			25/01/2021	14 HydroGeoModel. See comment 12.	MBE
			25/01/2021	"Both options should be supported". Not very	
		65	25/01/2021	15 clear.	MBE
				Point representation. Cartesian vs along an	
8.3	Geometry	66		alignment is just about coordinate expression.	
			25/01/2021	16 Why mentioning Annotation?	MBE
		66	05/04/0004	IFC Curve > Replace by Curve at this RAR	
			25/01/2021	17 step.	MBE
8.4	Uncertainty	69		It could be indicated example of uncertainty modelisation (varation of soil layer by different	
0.4	Uncertainty		01/03/2021	24 volume, data uncertainty, etc)	BLH
8.5	Existing standards	70	0.1,00,2021		
	OGC-standards	70			
	Inspire	72			
	IFC-geotech by Ifc4.3 (Common-schema) project	72			
0.5.0	in a geoteen by news (common schema) project	, 2			
				Geological, geotechnical model reprensent the	
				initial state of the soil before tunneling. It could	
				be interesting to add mechanical parameter of	
				the soil layer after tunnel construction: reused	
	other			soil after excavation (storage, embankment,	
				etc), reinforced soil (nailed or injected soil volume), fractured soil behavior, etc To reach	
				this goal, it is important to integrate the	
				maximum information from investigation from	
			01/03/2021	25 the start of the project	BLH
			• • • . = • = ·		
	other			Neighboring modelisation could be presented	
	other		01/03/2021	Neighboring modelisation could be presented 26 (impact with tunnel)	BLH



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	94	28/01/2021	In addition to wire mesh, steel straps, and bolts, is there any use of wire ropes to fix wire meshes to the rock surface? If this is the case, 2 this object can be added in the list on page 94.	CGA	
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