Defining Materials and Material States

Introduction

Defining a material in Sitelink3D is very simple. At its most basic, a material is a descriptive name that can be associated with regions and used in reporting. More complex material representations are also supported. Sitelink3D allows materials to be defined in a level of detail that accommodates the following.

- The different states that materials take at a Site.
- Bulking (swell) factors that apply to materials when, for example, in transit, wet or compacted.
- Different units and unit conversions that are used to quantify materials in various states at a Site.
- Haul Truck App operator measurement and state entry options for Haul Feature integration.
- Weighing properties including density and price for RDS Feature integration.

Sitelink3D amalgamates material definitions and material state definitions. Consolidating this information is beneficial for the aggregation of report data.

Purpose of this workflow

Correctly defining materials in Sitelink3D is important for seamless integration with the features and systems active on a Site and for the accuracy of reports. Material definitions are useful for many purposes within Sitelink3D including the following.

- Add context to work conducted on Site by using descriptive material names.
- Enable filtering of Haul, Weight and Delay report data by material.
- Define the units and materials that Haul Truck App operators can select for haul cycles.
- Associate material with regions for seamless load behavior when using the Haul Feature.
- Integrate with RDS weighing systems when using the RDS Feature.
- Configure live reporting widgets.

Definitions

Site

A Site within Sitelink3D represents a collection of resources managed by a Sitelink3D owner. Data within Sitelink3D is indexed by Site. Although Sites are represented visually as occupying space on a map, it is perfectly valid for two or more Sitelink3D Sites to exist at the same location. Sites are identified by name within Sitelink3D.

Active Site

An Active Site is simply the currently selected Site. Operations within Sitelink3D are applied to the Active Site. The addition of an operator or the definition of a material are examples of operations that apply to the Active Site. Only one Site can be active at once. The name of the current Active Site is displayed on the Site Menu Selector.

Haul Truck App

The Haul Truck App is an iOS application that forms part of the Haul Feature. The Haul Truck App provides operators with the following features.

- Automatic Site identification based on vehicle location.
- Connection to Sites via Site Discovery using only a PIN.
- Easy management of vehicles, materials, operators and delays.
- Automatic detection of load and dump events based on vehicle location and movement.

• Online and offline operation.

Site Discovery

Site Discovery is a new feature that allows users to browse and connect to Sites in their vicinity using GPS enabled equipment such as a mobile phone.

Feature

Features are complete pieces of functionality that implement workflows built using Sitelink3D technology. The Haul Feature is an example that provides haul truck specific functionality including the ability to add haulier data in the Metadata dialog, log haul cycle data and view haul specific report content. Features are configured by clicking on the *"Site Features"* or *"Organisation Features"* buttons as appropriate in the Configuration Menu.

Toolbar

The white bar at the top of the Sitelink3D screen is referred to as the Toolbar. It provides access to the Configuration Menu on the right via the cog icon.



Configuration Menu

The Configuration Menu allows access to Site and Organization level data and operations. Access the Configuration Menu by clicking on the cog icon to the right of the Toolbar.



Metadata Dialog

The Metadata dialog allows for the creation and management of data that describes or provides context to the Active Site. The types of Metadata available will depend on the Features currently selected. Access the Metadata dialog by clicking on the *"Metadata"* button in the Configuration Menu.

⊞ METADATA			×
🛧 Activities	✓ Showing Active	1 Import Regions	+ New
🚑 Assets	filter		
🔑 Auth Codes			
🕚 Delays	No results		
🛆 Materials			
🔐 Operators			
E Regions			
🛗 Shift Plans			
📋 Working Sets			
RDS			
🔀 Destinations			
🛔 Hauliers			
📁 Locations			
🚓 Mixes			
🗮 Notes			
🚛 Trucks			

New Material Dialog

Materials are created using the *New Material* dialog. Access the New Material dialog by clicking on the *"New"* button on the Metadata Dialog.

- Name: A descriptive title that will identify the material in the Metadata dialog and other places including when filtering reports and using the Haul Truck App.
- Code: An identifier to qualify the material name.
- Accepted Measurement Types: The collection of quantities that will describe all states of the material. The preferred unit system for each measurement type can be selected.
- Default State Name: An identifier for the material when no bulking, swell or unit conversions are applied. All conversions are applied to the material in the default state.
- Default State Measurement Conversion: A numerical conversion, if appropriate, that Sitelink3D can use to convert between measurement systems for data entry, visualization and reporting.

Na	ame *				
G	iravel				
Сс	ode				
Ac	cepted Mea	surement Type	es :	*	
;	× Volume ×	Weight			× •
Vo	lume *	Cubic Metres			•
We	eight *	Kilograms			•
St	ates				
De	efault State				
Ν	ame *				
1	Vative				
Ν	leasurement	Type Convers	sio	าร	
1	Volume			Weight	
	1	Cubic Metres	=	1.8	Kilograms

• Additional State: Groups of controls that allow this material to be represented in a different condition. Examples of different conditions may include wet versus dry material and native material at the borrow versus compacted material. Conversion fields that map the selected measurements from the default state to each additional state are provided.

Name		
Excavated Dry		
Conversions From Default	t Sta	ate
Volume (Cubic Metres)	×	1
Weight (Kilograms)	×	0.75
		▲ ▼ ×
Name		
Excavated Wet		
Conversions From Default	t Sta	ate
Volume (Cubic Metres)	×	1
Weight (Kilograms)	×	0.83
		▲ ▼ ×

- Haul Operator Entry Measurement: The units that are presented to the Haul Truck App operator when entering or accepting load measurements.
- Haul Operator Entry State: The state that the material is in when the Haul Truck App operator hauls it.

Operator Entry Measurement Type	
Volume (Cubic Metres)	*
Operator Entry State	

Process

The following workflow describes how materials are added to Sites.

- 1. Click on the cog icon at the right of the Toolbar to show the Configuration Menu.
- 2. Click on the "Metadata" button to show the Metadata dialog.
- 3. Select "Materials" in the left-hand pane.
- 4. Click the "New" button at the top right of the Metadata dialog.

- 5. Populate the New Material Dialog noting that the data entered here can be modified later. Select a descriptive name for the material such as "Gravel" being careful not to include state in the material name such as "Wet Gravel".
- 6. Click the blue arrow under "Accepted Measurement Types" and select all the measurement quantities that will be used to represent this material in all its states. For example, a material that is quantified by area when dumped, by weight when in transit and by volume when excavated would require selection of "Volume", "Area" and "Weight" checkboxes.
- **7.** For each Accepted Measurement selected, specify the units that will be used to represent that quantity in the provided combo boxes. For example, volume may be expressed in cubic metres on metric Sites.
- 8. Add a name for the default state. Dirt at the borrow for example may have a default state name of "Native".
- **9.** Add any appropriate conversion coefficients for the measurement pair fields provided. For example, one cubic metre of gravel in its default state may weigh 1.8 tonnes. Note that not all measurement pairs will necessarily be convertible.
- 10.If the material is to be represented in multiple states, click the blue plus button under "Additional State" for each state and define a Name and any relevant conversions from the default state. For example, material in an excavated wet state will require a weight multiplier that accommodates the material's bulking factor and water weight.
- **11**.Select the "Operator Entry Measurement" and "Operator Entry State" options that respectively define the units and state that this material is in when a Haul Truck App operator records a haul cycle.
- 12.Click "Save".

Sitelink3D will return to the Metadata dialog where the new material will be visible in the list.

Worked Example

A material definition for sand is to be added at a Sitelink3D Site.

- Both dry and wet states are to be tracked.
- Sand is measured by volume when excavated and by weight when hauled.
- The site uses Cubic Metres for measuring volume and Kilograms for measuring weight.
- Sand is mostly hauled when dry.
- The density of dry sand at the borrow is determined to be approximately 1,600kg / m³ with a bulking factor of 25%.
- The density of wet sand at the borrow is determined to be 1,950kg / m³ with a bulking factor of 20%.

Such a material could be represented in Sitelink3D as follows.

1. The material will be named "Sand"

×

2. The "Accepted Measurement Types" will be "Volume" and "Weight"

Accepted Me	asurements	
Volume 🗙	Weight 🗙	~
□ Area ☑ Weight	🗕 Custom 🗖 Length 🗹 Volume	
Volume is to be mea	sured in units of Cubic Metres and Weight in ur	nits of Kilograms
Volume	Cubic Metres	•
Weight	Kilograms	•

4. The default state for sand is at the Borrow where 1 Cubic Metre weighs 1,600 Kilograms

States			
Default State			
Name			
Borrow			
Measuremen	t Conversions		
Volume		Weight	
1	Cubic Metres	= 1600	Kilograms

5. When hauled dry, this sand occupies 125% of the volume due to swelling. Multiplying the default weight by 1 would then require multiplying the default volume by 1.25

Additional State	
Name	
Haul Dry	
Conversions From Default S	tate
Weight (Kilograms) ×	1
Volume (Cubic Metres) ×	1.25
	* *

6. When hauled wet, this sand occupies 20% more volume and weighs 1,950kb / m³ rather than 1,600kg / m³ in its default state. This requires multiplying the default weight by 1.21875 and the default volume by 1.20

3.

Name	
Haul Wet	
Conversions From Default St	ate
Weight (Kilograms) $~\times$	1.21875
Volume (Cubic Metres) \times	1.2
	▲ ▼ ×

7. When hauled, sand is quantified by weight and truck operators usually haul dry sand. The units that haul truck operators will enter weights in then is kilograms and the state of the material when loaded into the haul truck is *"Haul Dry"*.

Haul	
Operator Entry Measurement	
Weight (Kilograms)	•
Operator Entry State	
Haul Dry	•

Learning Outcomes

Q: If a material in an additional state weighs 20% less than it does in the default state, what is the value that is entered in the additional state's "Weight (Kilograms) x" field?

A: 0.8

Q: What field on the "New Material" dialog determines the units for measurements entered by operators in the Haul Truck App?

A: Operator Entry Measurement.

Q: Are state definitions compulsory when creating a new material?

A: No.

Q: Would "Wet Limestone" be considered to be a suitable material name? Why?

A: No. Ideally material names should not reference state. A better material name would be *"Limestone"* with a state defining how the Limestone parameters change when wet.