



HOW TO SIMULATE TAPES USING SPRAYLINES

Since tapes cannot be telescoped (changing sizes down the lateral) in IRRICAD you will need to simulate tapes as spraylines to achieve this feature.

This is a brief description of how to simulate tapes with suitable spraylines so that analysis and design can be carried out for blocks with tape that have multiple sizes.

SUMMARY

- Enter the required data into the database as a sprayline and nozzle
- Duplicate your design, replace existing tapes with spraylines and nozzles
- If using LP Design to size the submain, guess a nominal pressure, analyze and adjust as required so it simulates the tape as close as possible
- If the submain has been manually selected, guess at a nominal outlet pressure and use detailed analysis to analyze

SETTING UP DATABASES

Entries to simulate the tape need to be made in the pipe and outlet databases.

In the pipe database add a pipe with the internal diameter as the tape entry (do not forget to give it a unique warehouse code). The roughness for the pipe can be determined from trials to achieve the same headloss through the pipe that the tape gives. To do this, in a clean design, run out a tape a set length (similar to the run length in the design), e.g. 300ft (100m). Then run out your new pipe the same length. Connect with a large submain pipe and a control valve. Analyze the zone and check the Zone Full report. Change the roughness factor for the new pipe until it achieves the same headloss through the pipe that the tape is giving.

In the outlet database, make an entry for the tape outlet. The constant and index for this can be derived in a number of ways:

- Directly from tape manufacturers data
- From manufacturers data using Outlet Flow curve fitting utility
- Assuming the index is 0.5 and calculating the constant by substitution in the equation (this method is normally accurate enough) $\text{Flow (lph)} = \text{Const} * \text{Pressure (m)}^{0.5}$ (for PC emitter the index is 0 and the constant is equal to the flow rate)
- Contact AEI Software

The radius is not important just use a constant of say 1.0 and an Index of 0.0.

CREATING THE SIMULATED DESIGN

It is generally better to duplicate your tape design and make the changes required to simulate the tapes on a separate copy.

Make a copy of your design by using *File/Save As* and save the design under new name.

In the copy of your design, replace the existing tapes with connected spraylines using the tape pipe and tape outlet you created for this purpose. To do this select the block and then select *Tools/Tapes to Spraylines* and select you new pipe and new outlet.

Sprinklers are always assumed to be at ground level. If in your design they are not at ground level, you must select an outlet connector with the appropriate height previously entered in the Height field (in the database) to ensure that IRRICAD uses that height in the pressure calculations at the sprinkler. Note the height entered into the database is the height above ground, not the length of the outlet connector from a buried submain to the height of the outlet. For subsurface outlets (e.g. subsurface dripline) the height above ground will be negative (-ve).

If you are going to design the submain with this method, then it is important to determine what nominal pressure you need to assign to the outlets so that the resulting flow for your simulated tape matches the tape specifications. You need to do this because the inlet pressure is specified for tapes and you need to get the average pressure that will normally be less than the inlet. The simplest way to do this is to layout a single simulated tape (with the same length and slope of the tapes in your block) connected to a very short (no headloss) submain and valve. The valve pressure then is fixed (in *Design|Zone Design Configuration*) to the tape inlet pressure you wish to use. Guess a pressure for the outlets (e.g. half way between the minimum pressure allowed and the inlet pressure) and then analyze the simulated tape (normal analysis, not detailed). You can then adjust your guess and re-analyze until the flow for your simulated tape matches that for a real tape of the same length, slope and inlet pressure.

If you have an existing submain you wish to analyze, then it is unnecessary to go through the above process. Simply make a guess at the nominal pressure of your outlets and then use detailed analysis to analyze the system. This does not apply to normal analysis where you need to use the method outlined above.

SIZING / ANALYSIS

The Simulated block can now be sized or analyzed. It is advisable, after sizing, to run detailed analysis (do not forget to set the valve pressure in Zone Design Configuration) as a check.

DETAILED ANALYSIS OF TAPES UNDER FLUSHING

Because IRRICAD cannot have two submains on a block of tapes, the following method must be used to analyse tapes under flushing conditions.

The flushing valves used need to be entered as outlets in the database. The radius equation is unimportant so use a K of 1.0 and an n of 0.0. Values for the pressure / flow equation (Constant and Index) should be derived using the tabulated headloss vs. flow values for the valve in the Outlet Flow curve fitting utility.

Tape needs to be mirrored as a sprayline as tapes cannot have a submain on both ends.

SUMMARY

- Simulate the tape as a pipe and outlet
- Use Change Type to change all tapes to spraylines using the pipe and outlet
- Add the flushing main
- Analyze

SETTING UP DATABASES

Entries to mirror the tape need to be made in the pipe and outlet databases.

In the pipe database add a pipe with the internal diameter as the tape entry (do not forget to give it a unique warehouse code). The roughness for the pipe can be determined from trials to achieve the same headloss through the pipe that the tape gives. To do this, in a clean design, run out a tape a set length (similar to the run length in the design), e.g. 300ft (100m). Then run out your new pipe the same length. Connect with a large submain pipe and a control valve. Analyze the zone and check the Zone Full report. Change the roughness factor for the new pipe until it achieves the same headloss through the pipe that the tape is giving.

In the outlet database make an entry for the tape outlet. The constant and index (for the Iteration calculation method) for this can be derived in a number of ways:

- Directly from tape manufacturers data
- From manufacturers data using Outlet Flow curve fitting utility
- Assuming the index is 0.5 and calculating the constant by substitution in the equation (this method is normally accurate enough) $\text{Flow (lph)} = \text{Const} * \text{Pressure (m)}^{0.5}$ (for PC emitter the index is 0 and the constant is equal to the flow rate)
- Contact AEI Software

CREATING FLUSHING DESIGN

Draw a block of tapes.

It is generally better to duplicate your tape design and make the changes required to carry out the flushing analysis on a separate copy. To do this, use the *File/Save As...* command and save it with a different file name.

In the copy of your design select the tape block and change the tapes to connected spraylines (use *Tools/Select/Window* then select *Tools/Tapes to Spraylines*). Select the tape pipe you entered above then the tape outlet in the dialog.

Sprinklers are always assumed to be at ground level. If in your design they are not at ground level, you must select an outlet connector with the appropriate height previously entered in the Height field (in the database) to ensure that IRRICAD uses that height in the pressure calculations at the sprinkler. Note the height entered into the database is the height above ground, not the length of the outlet connector from a buried submain to the height of the outlet. For subsurface outlets (e.g. subsurface dripline) the height above ground will be negative (-ve).

Add the flushing main to the tape block using *Zone/Cut Pipe*.

ANALYSIS

Set the valve pressure required for the zone in *Design/Zone Design Configuration* (you can get this from the Zone Summary report from the design of the real tape block).

Run *Design/Zone Design/Detailed Analysis*, this will analyze the tape block under normal conditions.

Now insert flushing valves where required (from the Outlet database) onto the flushing main.

You can vary the valve pressure as you wish and examine the results in reports.

Note: A word of warning - Do not use a flush valve that is too big, i.e. make sure you use one that has 1.4 - 2.1psi (2m - 3m) of headloss at the flushing flows you expect. If you use a flushing valve that has too low a headloss, you will have problems getting a solution.

If you do have problems with convergence, there is a detailed analysis factor in *Design/Design Parameters/Analysis Parameters* that you can increase (e.g. use 0.85 rather than 0.75). Remember to return the parameter to its original value after you have finished this design.

The required flushing velocity rule of thumb is 1ft/s (0.305m/s) down the tapes. Set the valve pressure to achieve the correct velocity.

MODELING MULTIPLE DRIPLINES AS A SINGLE LINE

Make a copy of your design and remove the laterals that are going to be combined leaving one for each group. Generally it is best to have the notional lateral approximately in the center of the group of laterals being modeled. This means that you will need a half lateral at the beginning and end of the submain, the diameter and emitter parameters for this lateral will need to be calculated

and entered into the database separately. For example if you have 100 laterals that you are splitting up into groups of 10 then you should start and end with a group of 5 and then have 9 groups of 10 laterals in between. Change tapes to spr Due to the size constraints in IRRICAD it is sometimes useful to be able to reduce the size of an analysis by combining a number of laterals / driplines into a single notional one. This is especially true in highly looped systems such as the analysis of tape / lateral blocks with flushing submains.

The following notes show how to accomplish this.

Add a new emitter / emitter nozzle to the database that has the same index as one used on the single lateral / dripline. The constant will be n times the single one, where n is the number of laterals being combined. If you are using a tape / dripline then see the notes on flushing analysis for sources of the emitter equation. Make sure that the warehouse code is different to the normal emitter / nozzle.

A new pipe needs to be added to mirror the hydraulic performance of the required number of laterals / driplines. Make sure that the description identifies what the pipe is for and use a unique warehouse code. The actual diameter is set by the following equation:

$$D_{new} = (d^{4.871} \times n^{1.852})^{0.2053}$$

where d is the single lateral diameter, n is the number of laterals being combined, and D_{new} is the diameter of the combined lateral. For example a 16mm ID combined into 10 laterals gives a new diameter of 38.4mm. This equation will work with any units. Use the same C factor as for the single lateral.

aylines if required and then replace the emitters and pipes with the Multiple items determined above.

SUMMARY

- Create an outlet and nozzle to simulate the multiple laterals.
- Create a new pipe.
- Remove a group of laterals and replace with a single lateral