FRANK VICIDOMINA, LLC

This is a self-taught 8-hour course on efficient application of Value Engineering Function Analysis (FA). My instructor notes will precede some of the slides and appear in a box like this one.

PLEASE NOTE: THIS COURSE IS NOT APPROVED BY SAVE INTERNATIONAL AND CAN NOT BE USED TOWARDS CERTIFICATION CREDITS. I FREQUENTLY 'VIOLATE' BASIC SAVE STANDARDS REGARDING F.A.S.T. DIAGRAMS WITH SUCH BLASPHEMOUS THINGS LIKE INCLUDING PROJECT/PROJECT ACTIVITIES, PERFORMANCE ATTRIBUTES AND IDENTIFYING SECONDARY FUNCTIONS ASSOCIATED WITH BASIC FUNCTIONS. SO DO NOT USE THIS AS A GUIDE FOR YOUR CVS TEST!

FRANK VICIDOMINA, LLC

EFFICIENT FUNCTION ANALYSIS WITHOUT SHORTCUTS

Virtual Course
May, 2025

INSTRUCTOR – Frank Vicidomina, PE, CVS-Life

COURSE CONTENT

Why do we perform FA?

Does FA need to be complex?

Common FA ‘shortcuts’

Are shortcuts OK?; possible ‘shortcomings’ of FA shortcuts

COURSE CONTENT (CONT.)

How can we perform FA efficiently without omissions?

Is it ok to include project/process activities or ‘performance attributes’ in a F.A.S.T. diagram?

Use of the F.A.S.T. diagram template to help identify functions

Presentation of the ‘Sandwich’ method of creating a F.A.S.T. diagram

COURSE CONTENT (CONT.)

Identifying major functions

Identifying secondary functions and their importance

Identifying redundancies and omissions

Summary

Class course exam (F.A.S.T. exercise)

WHY DO WE PERFORM FA?

Get an understanding of the project/process (and parts of) purpose

Broaden the scope of the VE workshop

Identify how project elements integrate

Develop team dynamics (imperative for success of subsequent VE phases)

Other reasons?.....

DOES FA NEED TO BE COMPLEX?

It depends…..

Intricate process (Bitcoin transaction); yes

Most large civil works projects; no (functions not complicated….. Just BIG!)

Other thoughts?……..

EFFICIENT FUNCTION ANALYSIS WITHOUT SHORTCUTS

In recent years as a semi-retired VE person I've served on a number of workshop teams. All have been with highly rated VE firms. I am alarmed at The number of shortcuts that are being used by many practitioners that are Significantly diminishing the quality of these VE studies. If I were still serving as a VE program manager, I certainly would reject such practices.

The reason for these shortcuts is obviously to reduce the work associated with a VE workshop. Function Analysis can be a cumbersome task and is one Of the targets of shortcutting……

I believe this is not necessary and offer better ways to efficiently perform proper, and comprehensive Function Analysis.

COMMON FA 'SHORTCUTS' – PROS AND CONS

No F.A.S.T. diagram (or done after the workshop)

Limited identification of functions (applying Pareto's Principle)

No effort in identifying secondary functions

COMMON FA 'SHORTCUTS'

- PROS AND CONS (CONT.)

Facilitator prepares (draft?) F.A.S.T. prior to team involvement

Facilitator prepares F.A.S.T. without team involvement

Others?

COMMON FA 'SHORTCUTS'

- PROS AND CONS (CONT.)

What is/are differences between limiting FA 'complexities' and 'shortcuts'?

SO HOW MAY WE CONDUCT FA IN AN EFFICIENT MANNER WITHOUT SHORTCUTS?

Is it OK to use project/process activities in a F.A.S.T. diagram?

Can we use project/process ‘performance attributes’ in FA?

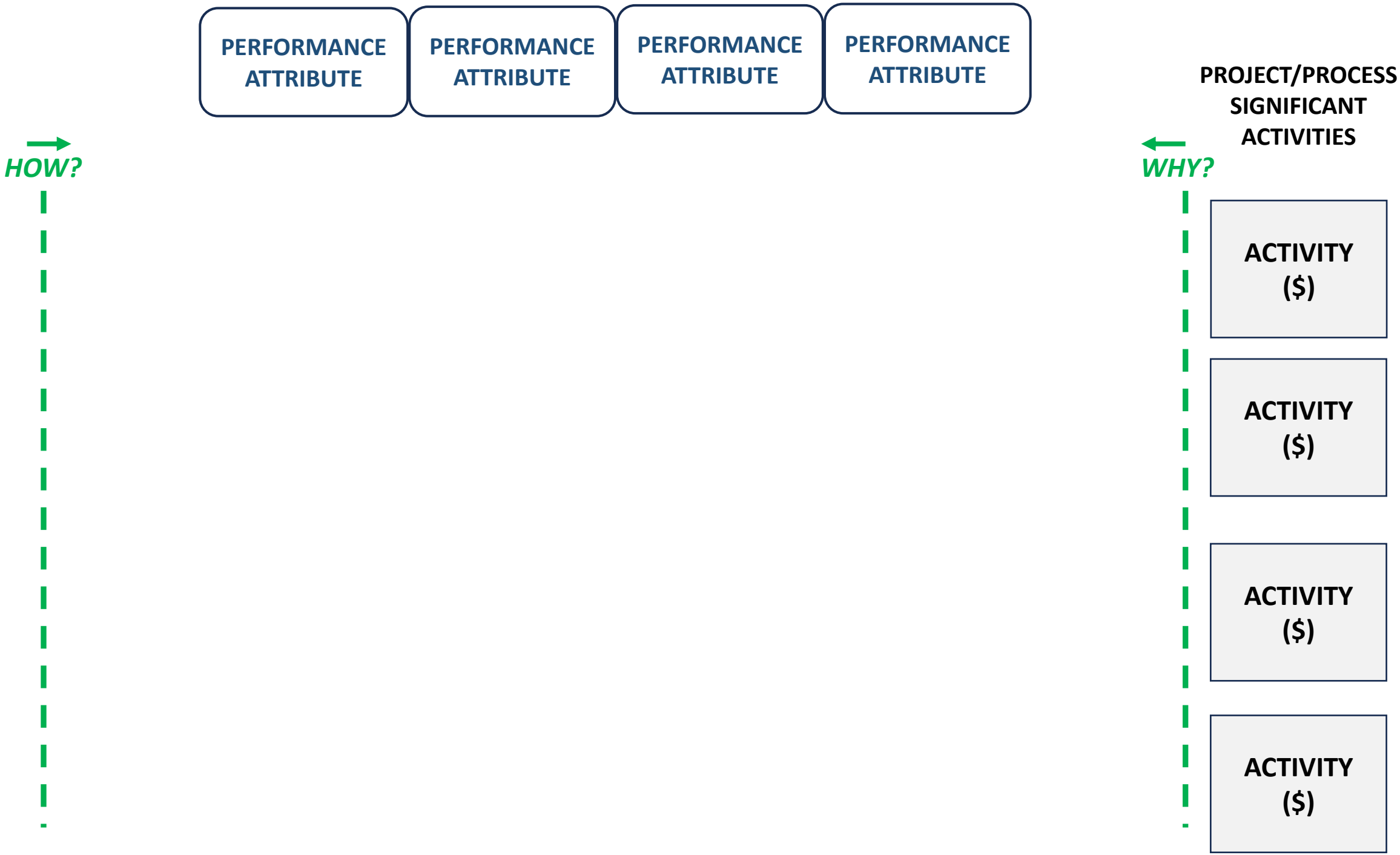
USING THE F.A.S.T. DIAGRAM TEMPLATE AND THE 'SANDWICH' METHOD TO IDENTIFY AND ORGANIZE FUNCTIONS

EFFICIENT FUNCTION ANALYSIS WITHOUT SHORTCUTS

Below I present a method that efficiently and comprehensively Performs Function Analysis (FA) and produces a useful F.A.S.T. diagram. My students named this the 'sandwich method' as it calls for creating F.A.S.T. diagram simultaneously from both sides of the chart. This method also provides a means of initiating FA which is often an issue for many facilitators.

Steps to implement this method and discussed and illustrated below:

STEP 1) Prior to your FA session, start a F.A.S.T. diagram with Project / process activities on the far-right column outside of your Scope Line. Also show project / process Performance Attributes (PAs) at the top of your diagram. Yor PAs should have been identified during the Information Phase of your workshop. Putting them in your F.A.S.T. diagram replaces SAVE Required "functions that happen all the time" which sill be like your PAs. However, Pas are more germane to your project / process and are a Better choice in my not so humble opinion. Note that SAVE forbids both PAs And project / process activities on your F.A.S.T. diagram. I have found over the years and 200 or so workshops that showing activities helps a great deal in getting people on the team not familiar with VE to understand F.A.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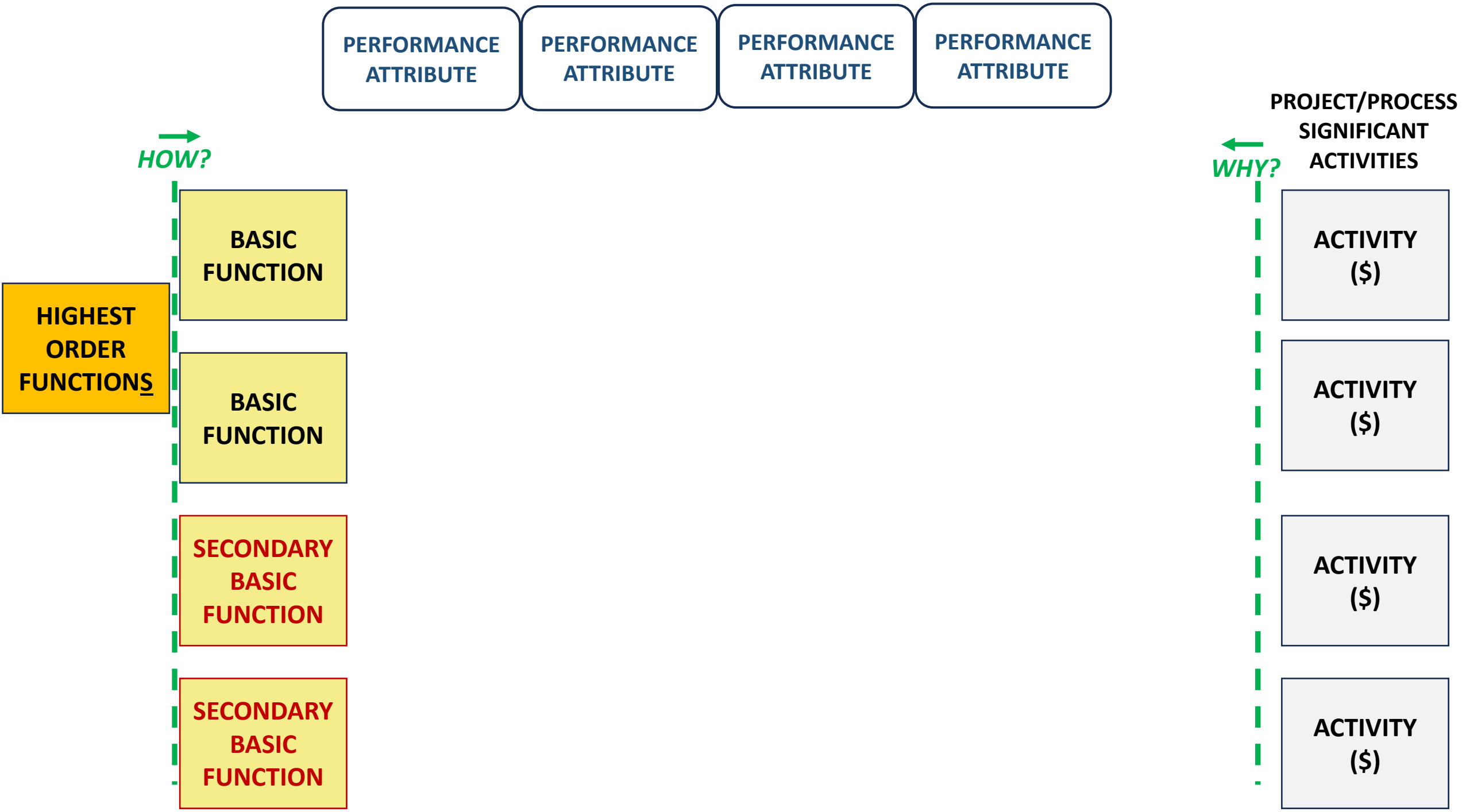
PROJECT/PROCESS SIGNIFICANT ACTIVITIES
HOW?
WHY?
ACTIVITY ($)
ACTIVITY ($)
ACTIVITY ($)
ACTIVITY ($)

STEP 2) *Now start your left side of your diagram via having the team identify the project / process highest order function(s), basic functions and any associated secondary functions. Again, SAVE outlaws any secondary functions tied to high order or basic functions. For the life of me, I don't understand this as the vast majority of my projects have very important secondary functions associated with basic functions. For example, highest order function – Reduce Flood Damage; basic function – Increase Conveyance; Major secondary function to that is – Maintain Commerce (widening a canal Requires relocation of bridges and utilities, often a major feature of such a project).*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HIGHEST ORDER FUNCTIONS
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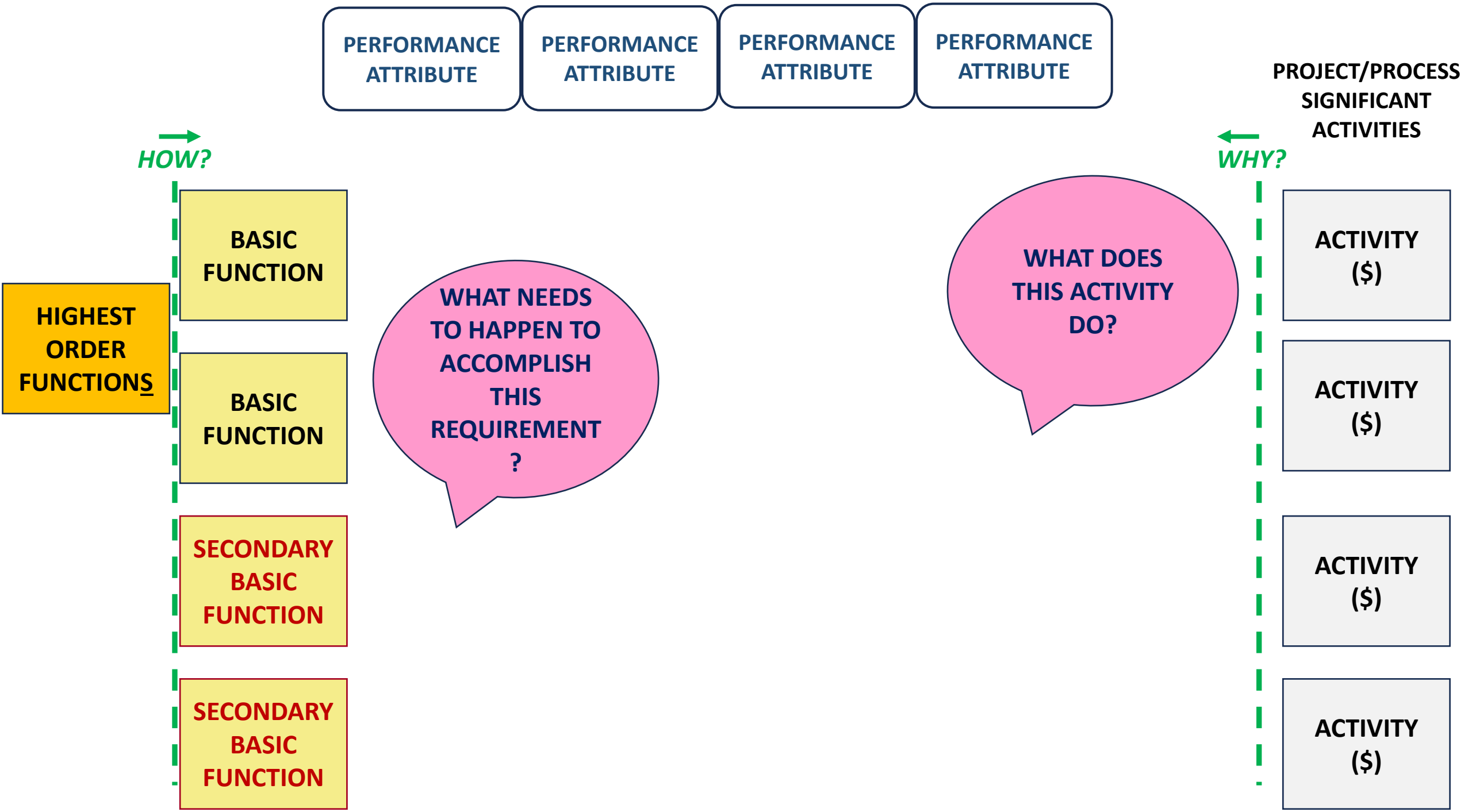
EFFICIENT FUNCTION ANALYSIS WITHOUT SHORTCUTS

STEP 3) *Continue with diagram construction from both sides; on the 'left' ask the question "What needs to happen to accomplish this function?", and from the right ask, "What does this activity do?". Team answers define the 'next step' functions on both ends.*

STEP 4) *'Bridging' functions are then identified via the traditional "How?" from left to right, and "Why?" from right to left.*

STEP 5) *FA / F.A.S.T. diagram is completed with the addition of secondary functions and logic layout.*

Below is a previous class produced example of FA / F.A.S.T. for a proposed playground. 'Green' boxes/functions indicate higher cost items which I will discuss in the next section.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WHY?
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WHAT NEEDS TO HAPPEN TO ACCOMPLISH THIS REQUIREMENT ?
WHAT DOES THIS ACTIVITY DO?
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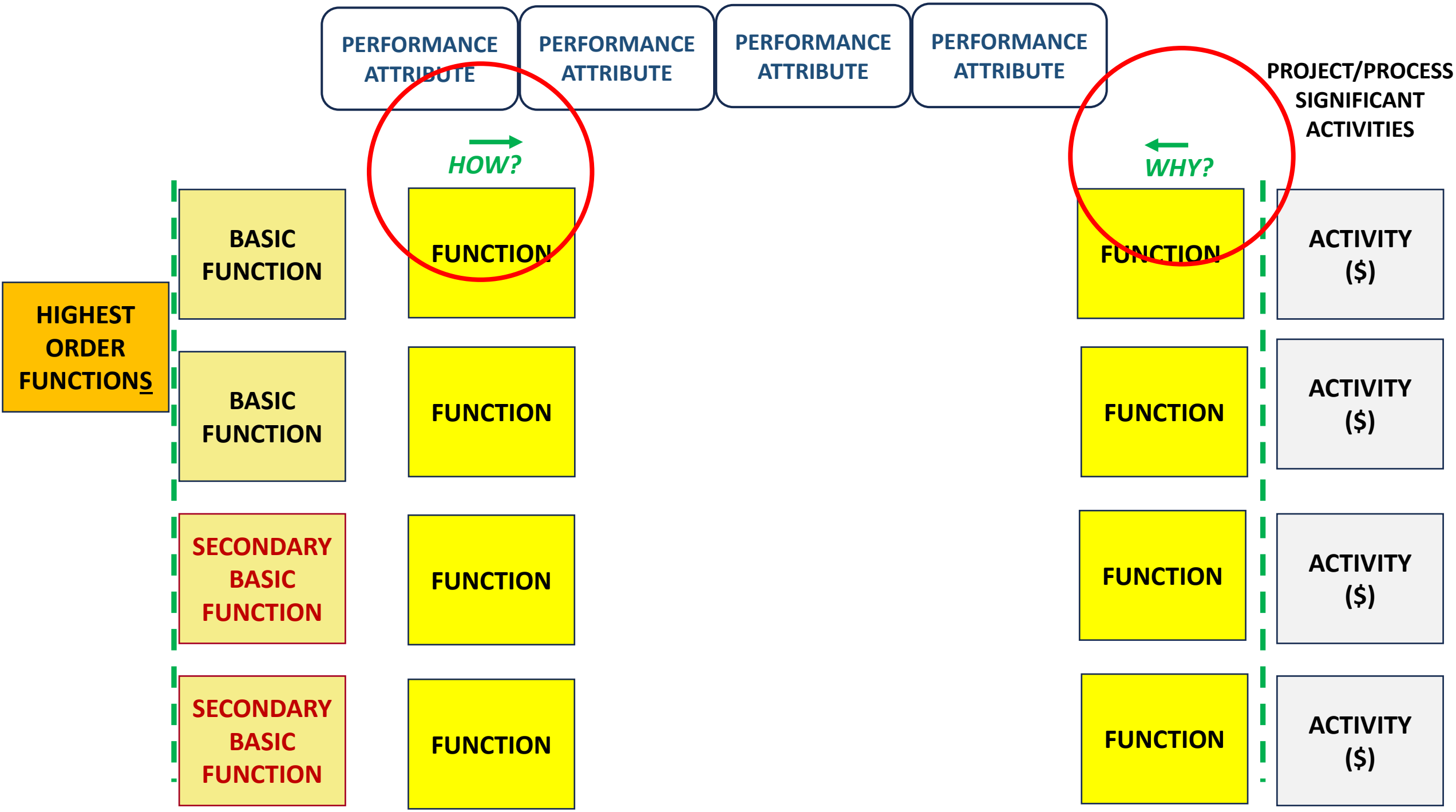
ACTIVITY ($)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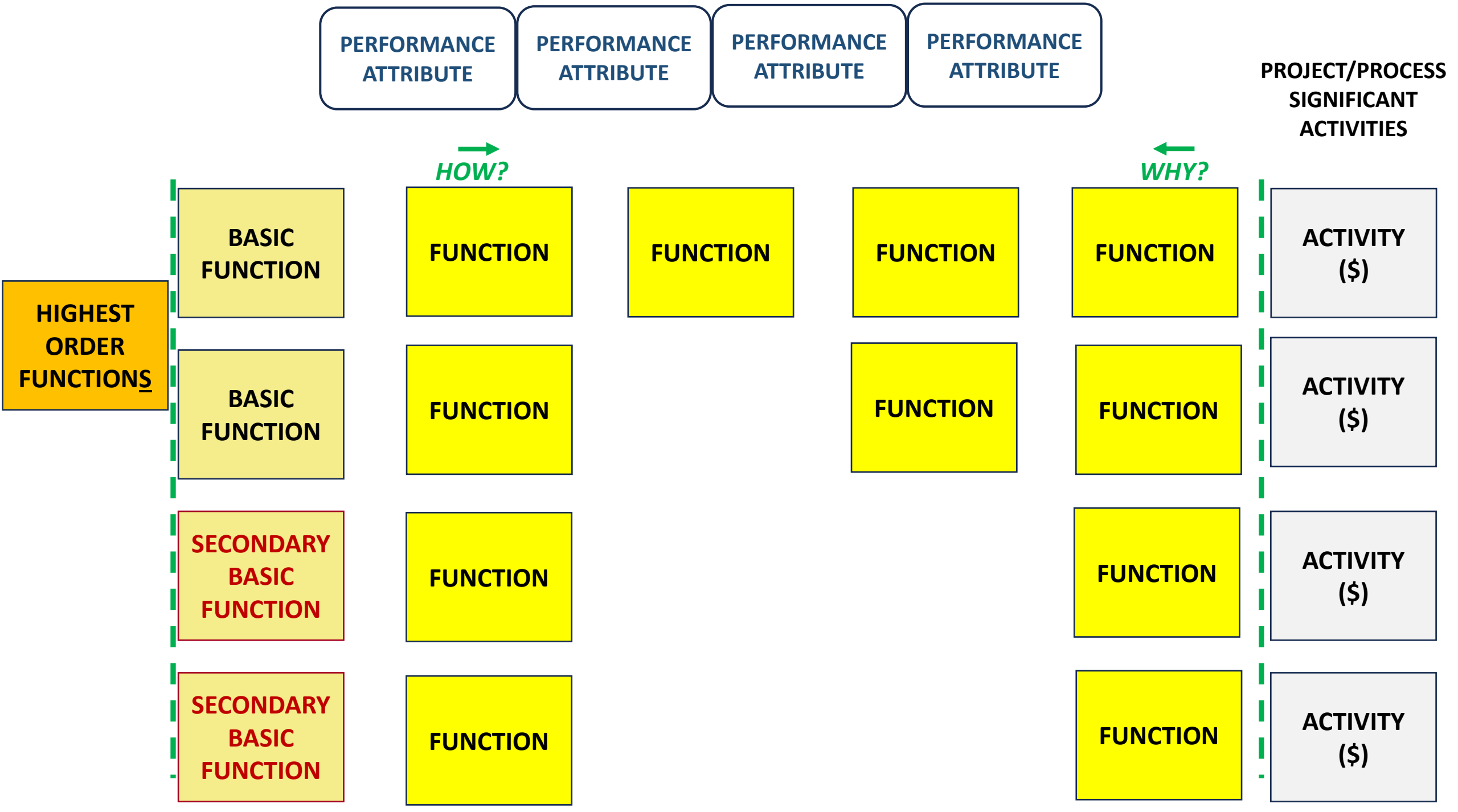
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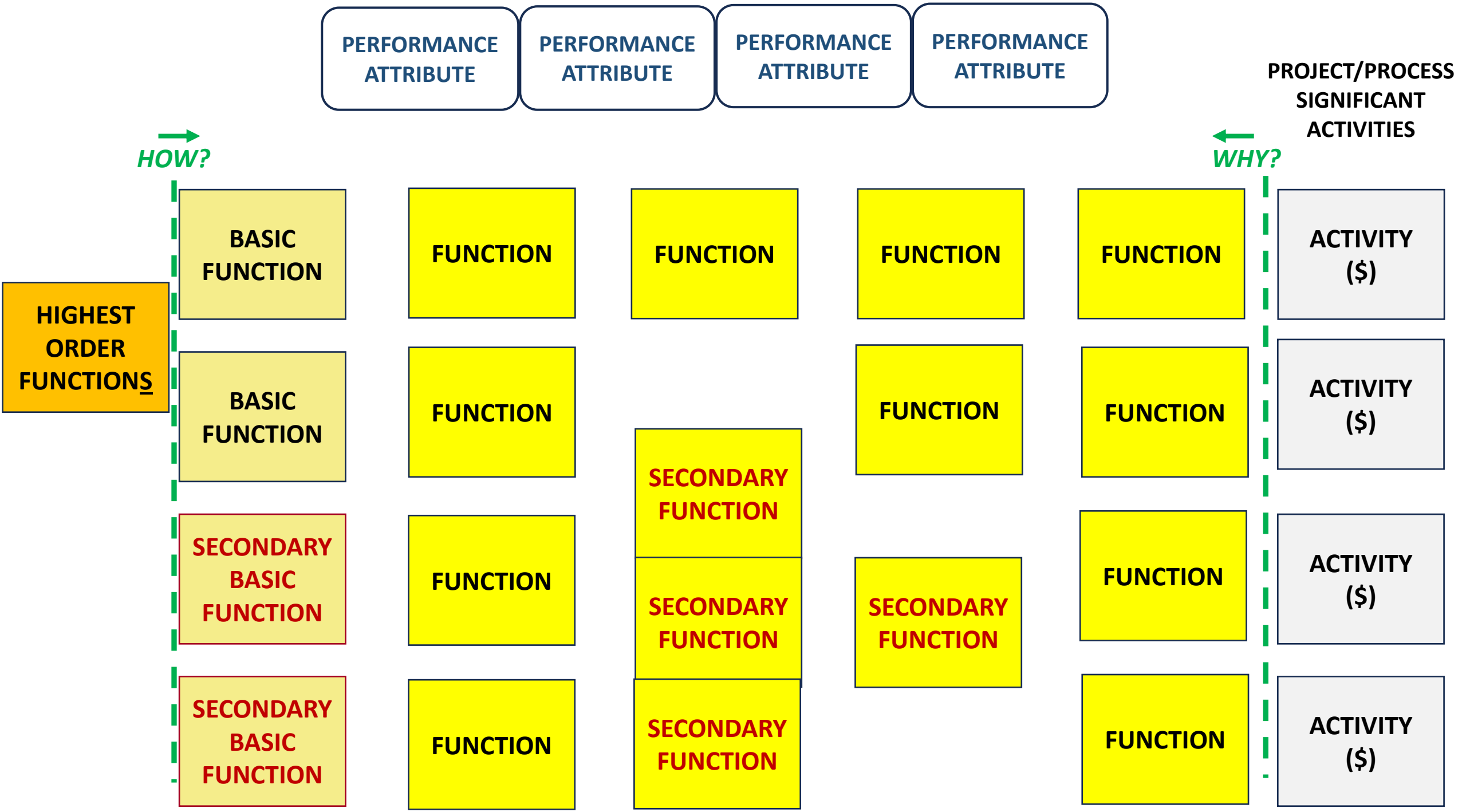
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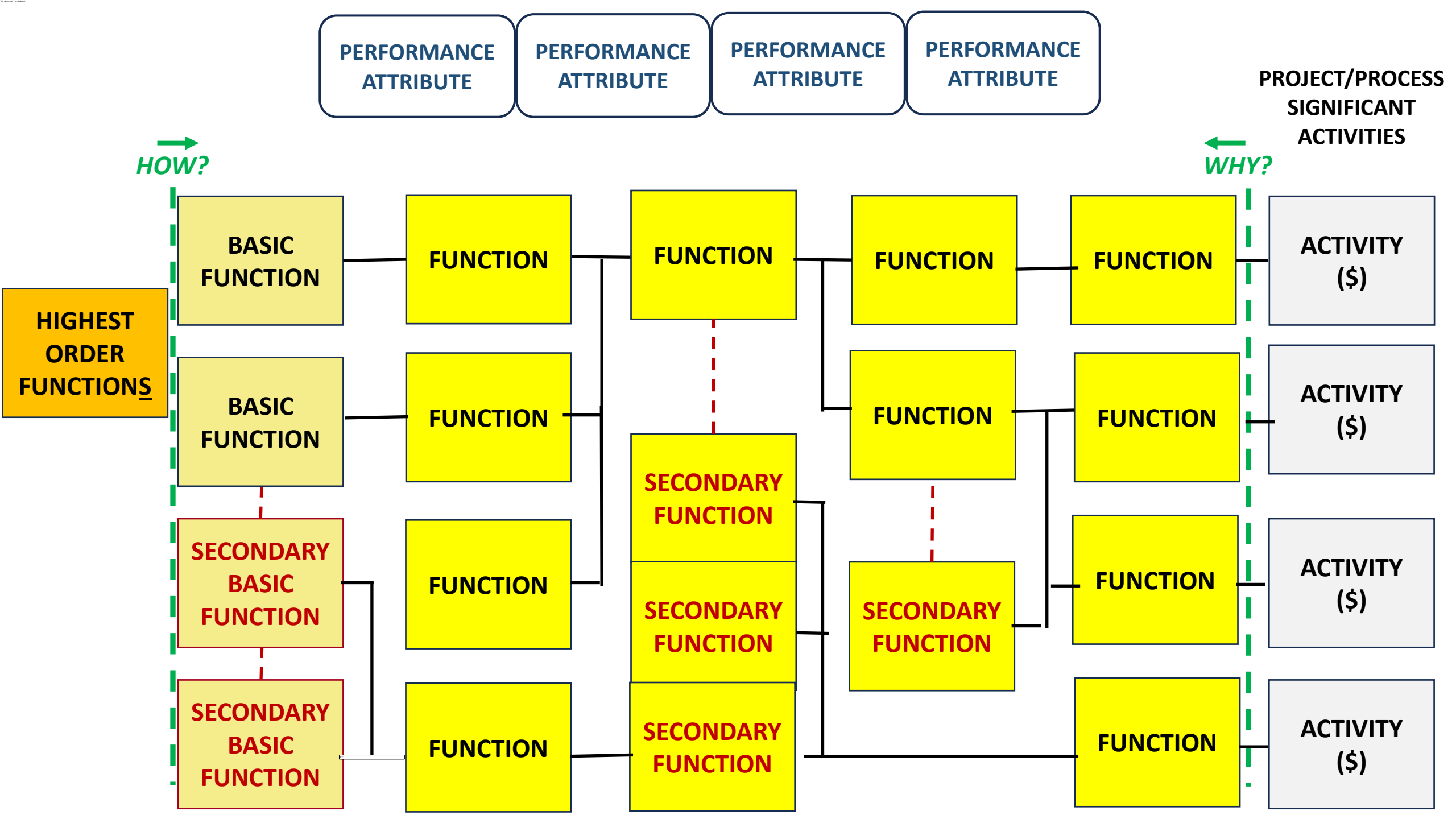
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FA FOR A PROPOSED PLAYGROUND

FAST DIAGRAM FOR PLAYGROUND

PERFORMANCE ATTRIBUTES:

MINIMIZE MAINTENANCE	MAINTAIN SAFETY	STIMULATE THOUGHT	INCREASE USEAGE	SATISFY PARENTS

HOW? → ← WHY?

PROPOSED ACTIVITIES:

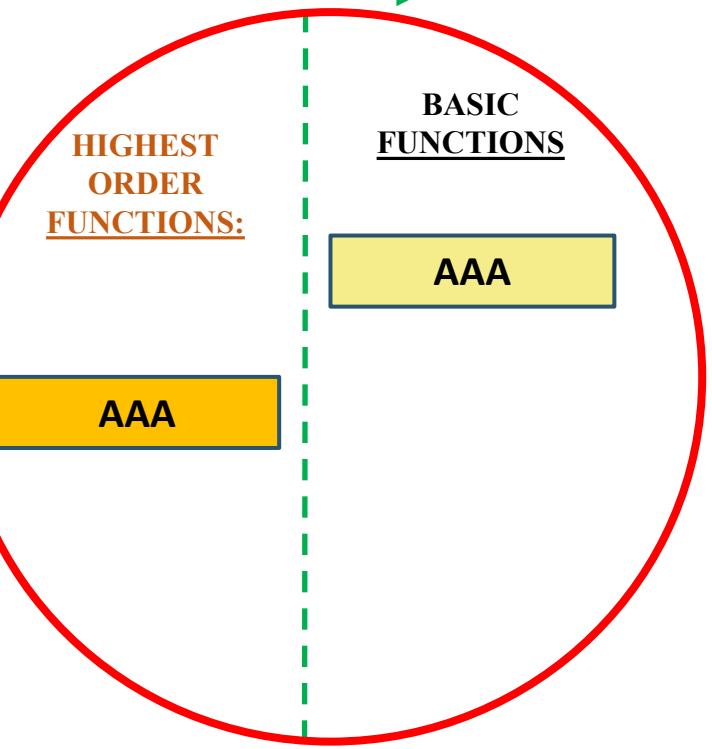
- CONSTRUCT SHELTERS
- INSTALL EQUIPMENT & FOUNDATION
- INSTALL LANDSCAPING & BENCHES
- INSTALL FENCING & GATE
- PERFORM SITE PREP AND INSTL PAVEMNT
- INSTALL ELEC & PLUMBING

FAST DIAGRAM FOR PLAYGROUND

PERFORMANCE ATTRIBUTES:

- MINIMIZE MAINTENANCE
- MAINTAIN SAFETY
- STIMULATE THOUGHT
- INCREASE USEAGE
- SATISFY PARENTS

HOW? → ← WHY?



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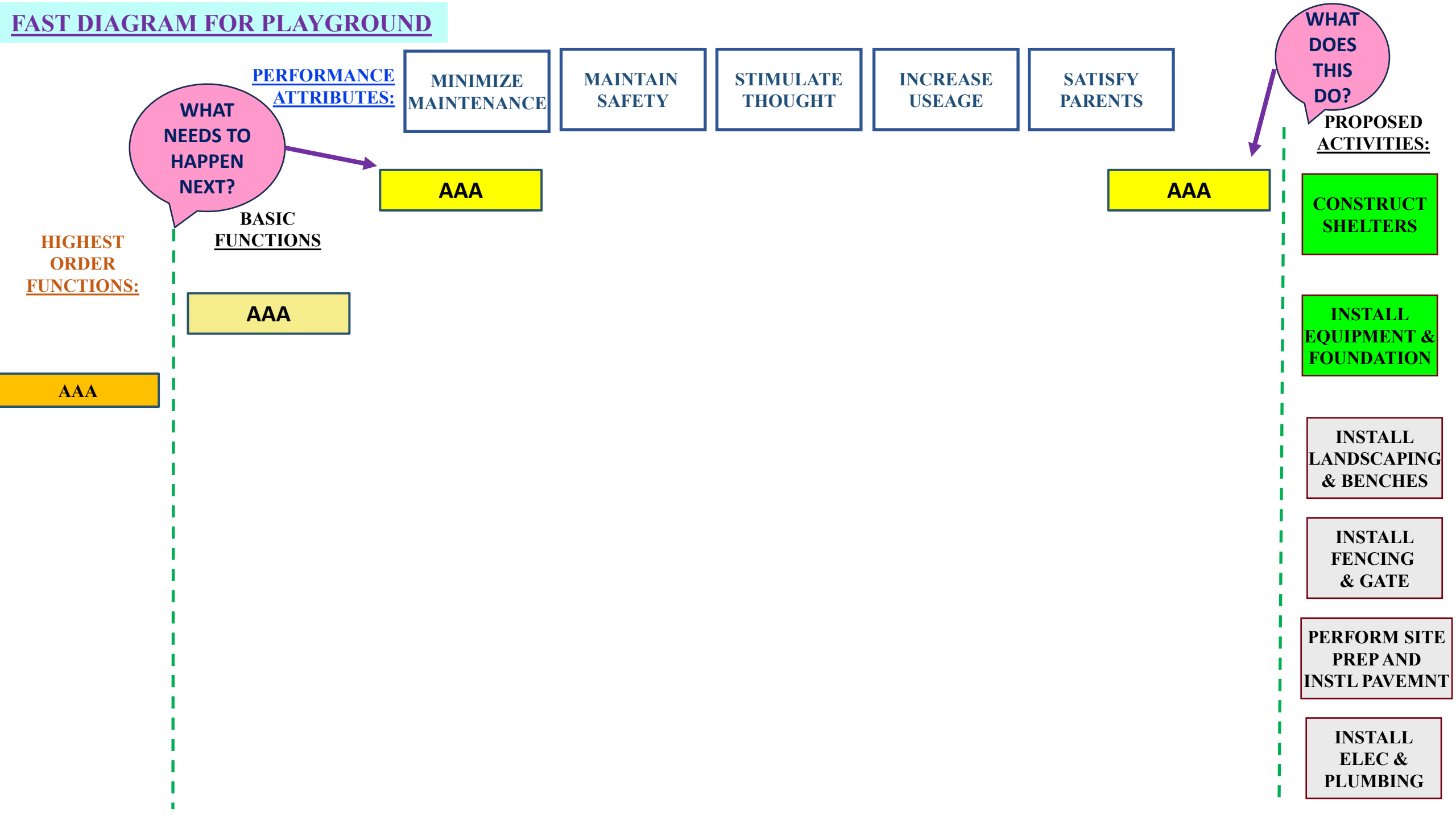
FAST DIAGRAM FOR PLAYGROUND



FAST DIAGRAM FOR PLAYGROUND

PERFORMANCE ATTRIBUTES:

MINIMIZE MAINTENANCE | MAINTAIN SAFETY | STIMULATE THOUGHT | INCREASE USEAGE | SATISFY PARENTS

HOW? → AAA

WHY? ← AAA

HIGHEST ORDER FUNCTIONS:

AAA

BASIC FUNCTIONS

AAA

PROPOSED ACTIVITIES:

- CONSTRUCT SHELTERS
- INSTALL EQUIPMENT & FOUNDATION
- INSTALL LANDSCAPING & BENCHES
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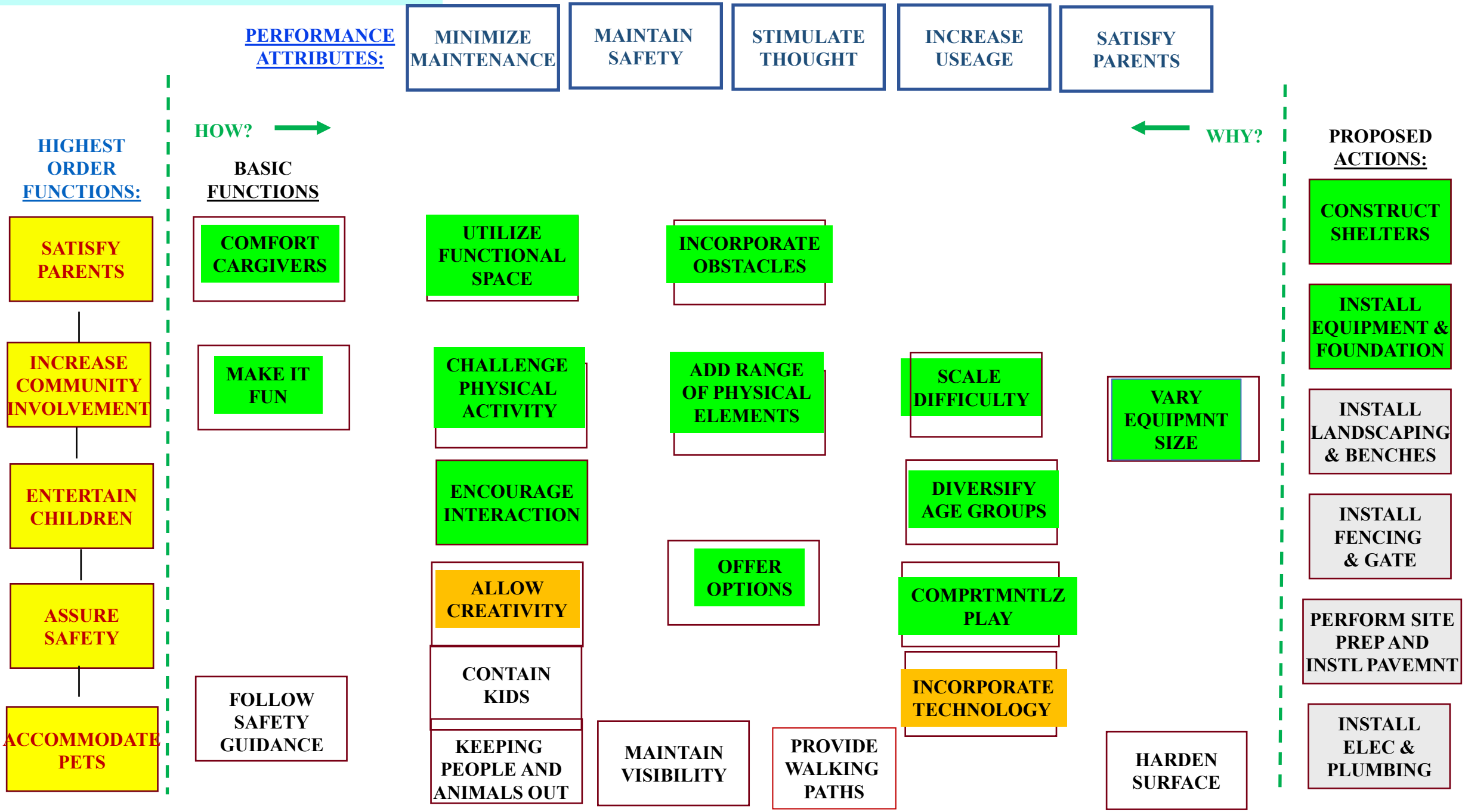
From a previous class…….

FAST DIAGRAM FOR PLAYGROUND



USING THE F.A.S.T. DIAGRAM TEMPLATE AND THE 'SANDWICH' METHOD TO IDENTIFY AND ORGANIZE FUNCTIONS (CONT.)

Your thoughts:

Advantages: …. ?

Disadvantages: … ?

MAJOR AND SECONDARY FUNCTIONS

The identifications of critical project / process functions is one of the most important parts of Value Engineering. F.A.S.T. diagrams illustrate project / process functions and their logical relationship. Based on the relative importance and associated cost of accomplishing any given function the VE team can focus efforts accordingly (Pareto Principle – 80% of costs are often found in just 20% of features). Thid does raise the question, "Is it OK to limit focus on non-major and secondary functions?" My answer is NO! Secondary functions, while defined as not a primary component of project / Process accomplishment and are usually not high-cost, can often be critical and warrant VE attention if not for cost but for other important factors such as reliability, etc. Below I demonstrate such for a pump station.

The latest short-cutting craze (…. and I mean craze as in completely crazy) I've experienced as a team member in recent VE workshops is the facilitator asking the team to identify "the one or two most important project / process functions. Once identified, all other functions are IGNORED!!

IDENTIFYING MAJOR FUNCTIONS

Why do this?

Determine by related cost, or performance, or both?

Is this a FA ‘shortcut’ ?

Other thoughts?

IDENTIFYING SECONDARY FUNCTIONS AND THEIR IMPORTANCE

Why do this?

Can secondary functions be important?

Identifying secondary functions can often reveal project/process omissions

Other thought?

FA EXAMPLE FOR A PUMP STATION

Below is an example of function analysis for the mechanical features of a proposed large pump station. A cost breakdown of features clearly indicates That most of the money is in the actual pumps and drive train. A F.A.S.T. diagram for the project was developed with primary (major) functions and secondary functions illustrated. While it is tempting to focus VE efforts On the pumps and drive-trains, the secondary function line of 'Protect Pumps', 'Screen Debris' and 'Remove Debris' while relatively low in cost, is extremely critical to overall project performance. Relative Potential cost-savings may be low, but improvement in these features can result in improved project reliability which can be critical for this project. Attention to these 'secondary – low-cost functions is quite warranted. The fueling system, is a primary function but not a relative high-cost item. It also warrants attention given its critical contribution.

FA FOR THE MECHANICAL FEATURES FOR A LARGE PUMP STATION

Tasked to do VE on the *mechanical portion* of a large drainage pump station (5,000 cfs)

Estimated cost of:

- Pumps, engines and gears $35,000,000 (84%)
- Self-cleaning screens $5,000,000 (12%)
- Fuel storage and delivery $1,500,000 (4%)

So, applying 'Pareto's Principle' can (should) we eliminate screens and fuel from our analysis?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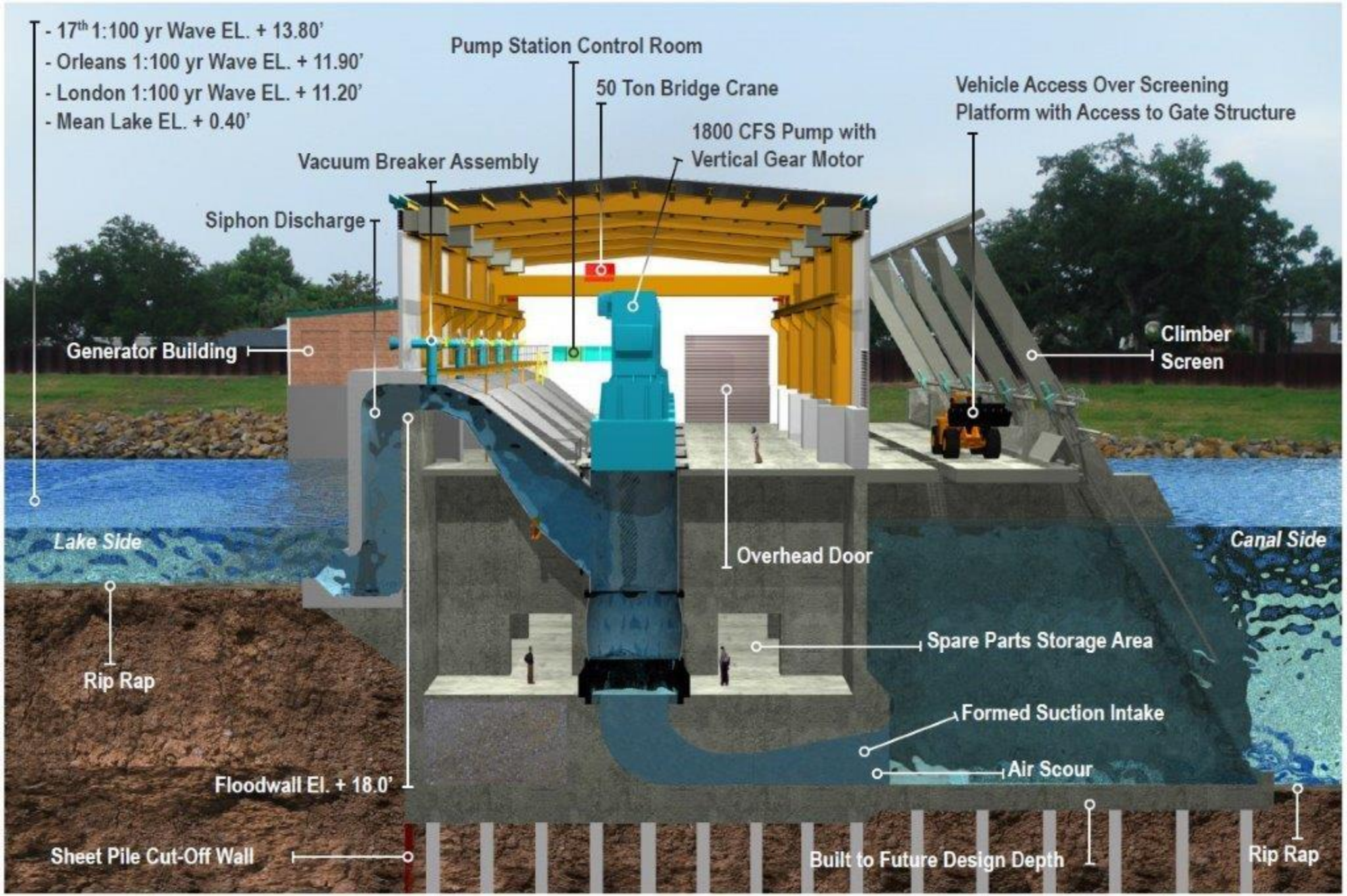
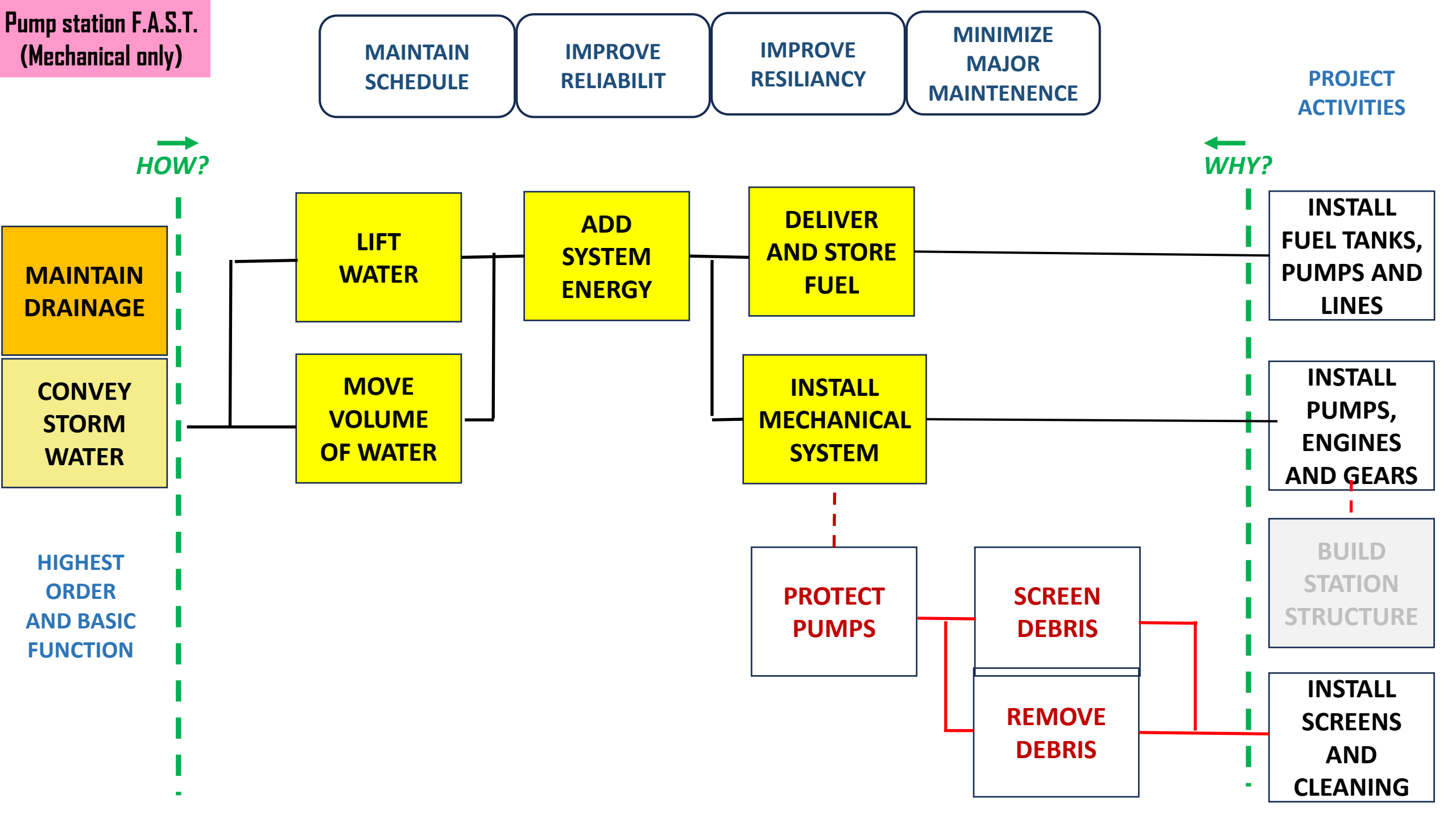

- 17th 1:100 yr Wave EL. + 13.80'
- Orleans 1:100 yr Wave EL. + 11.90'
- London 1:100 yr Wave EL. + 11.20'
- Mean Lake EL. + 0.40'
Pump Station Control Room
50 Ton Bridge Crane
Vehicle Access Over Screening Platform with Access to Gate Structure
1800 CFS Pump with Vertical Gear Motor
Vacuum Breaker Assembly
Siphon Discharge
Generator Building
Climber Screen
Lake Side
Canal Side
Overhead Door
Spare Parts Storage Area
Rip Rap
Formed Suction Intake
Air Scour
Floodwall El. + 18.0'
Sheet Pile Cut-Off Wall
Built to Future Design Depth
Rip Rap

Pump station F.A.S.T. (Mechanical only)



Pump station F.A.S.T. (Mechanical only)

MAINTAIN SCHEDULE | IMPROVE RELIABILIT | IMPROVE RESILIANCY | MINIMIZE MAJOR MAINTENENCE

PROJECT ACTIVITIES

HOW? ← → WHY?

MAINTAIN DRAINAGE

CONVEY STORM WATER

LIFT WATER

MOVE VOLUME OF WATER

ADD SYSTEM ENERGY

DELIVER AND STORE FUEL

INSTALL MECHANICAL SYSTEM

PROTECT PUMPS

SCREEN DEBRIS

REMOVE DEBRIS

INSTALL FUEL TANKS, PUMPS AND LINES

INSTALL PUMPS, ENGINES AND GEARS

BUILD STATION STRUCTURE

INSTALL SCREENS AND CLEANING

HIGHEST ORDER AND BASIC FUNCTION

High-cost item and functions

IDENTIFYING REDUNDANCY AND OMISSION ACTIVITIES VIA THE F.A.S.T. DIAGRAM

EFFICIENT FUNCTION ANALYSIS WITHOUT SHORTCUTS

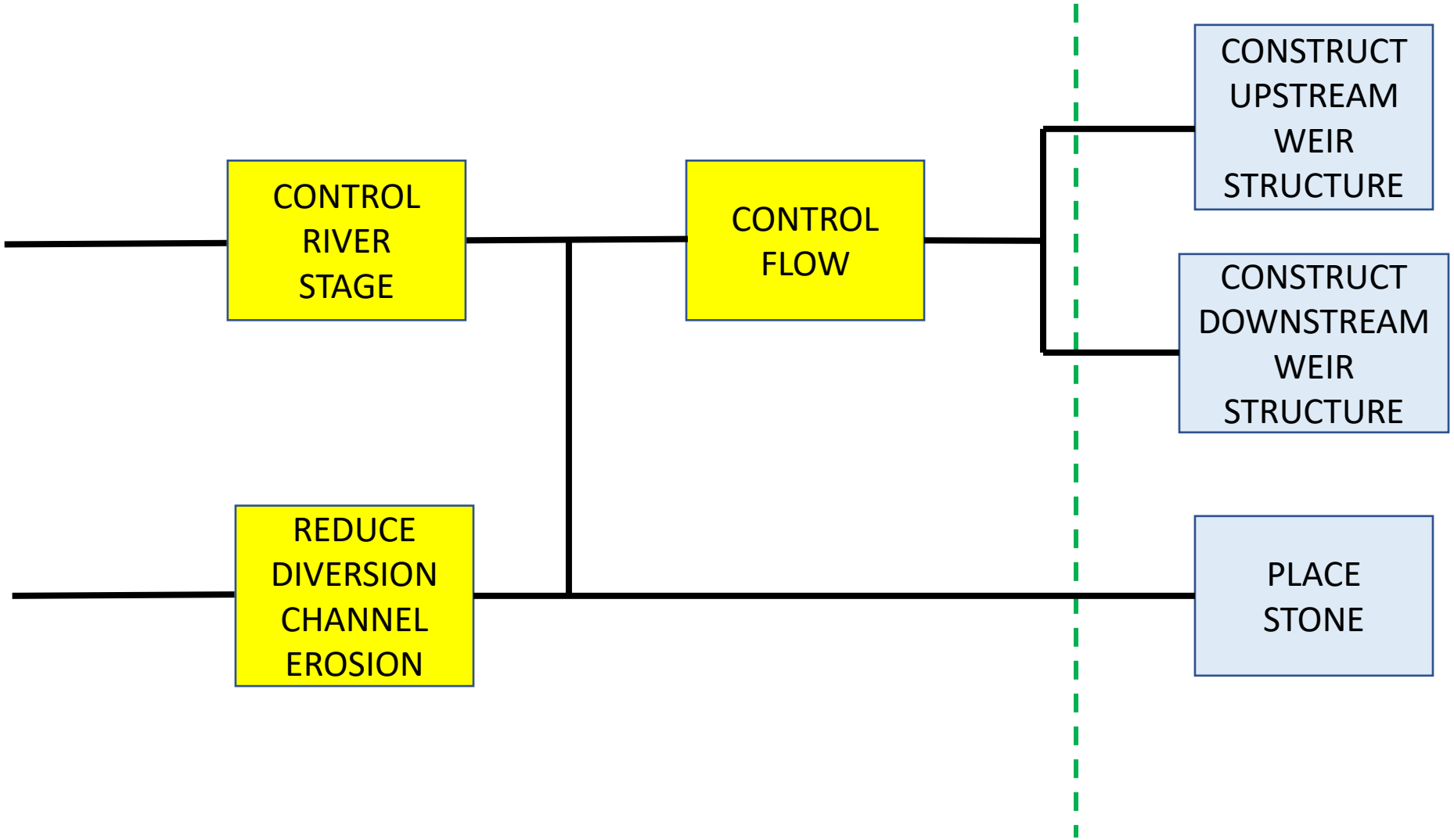
While FA shortcuts can expedite your workshop there are significant potential benefits in producing a comprehensive F.A.S.T. diagram. Such include, but are not limited to, the identification of activity redundancy and omission of a required activity needed to satisfy a project/process function.

Identifying activity redundancy through FA is a regular occurrence for VE workshops addressing processes. While relatively rare, it can also happen in A project-based VE study. When this does happen, it can be a very big deal. An example of this is shown in the partial F.A.S.T. diagram below for a very large civil works project. FA raised the question as to what the proposed downstream flow control structure needed to do. The answer revealed was that The structure was determined to be necessary to slow flow velocity down to reduced bank erosion. FA also questioned the 'overlapping need' for the national debt of rock protection for the new channel banks. Turns out the decision to add stone protection came years after the decision to include The downstream flow control structure since velocities needed to be lower than that achieved by the structure. The VE team then questioned the need for both the structure and protective rock. The need for the structure was negated.

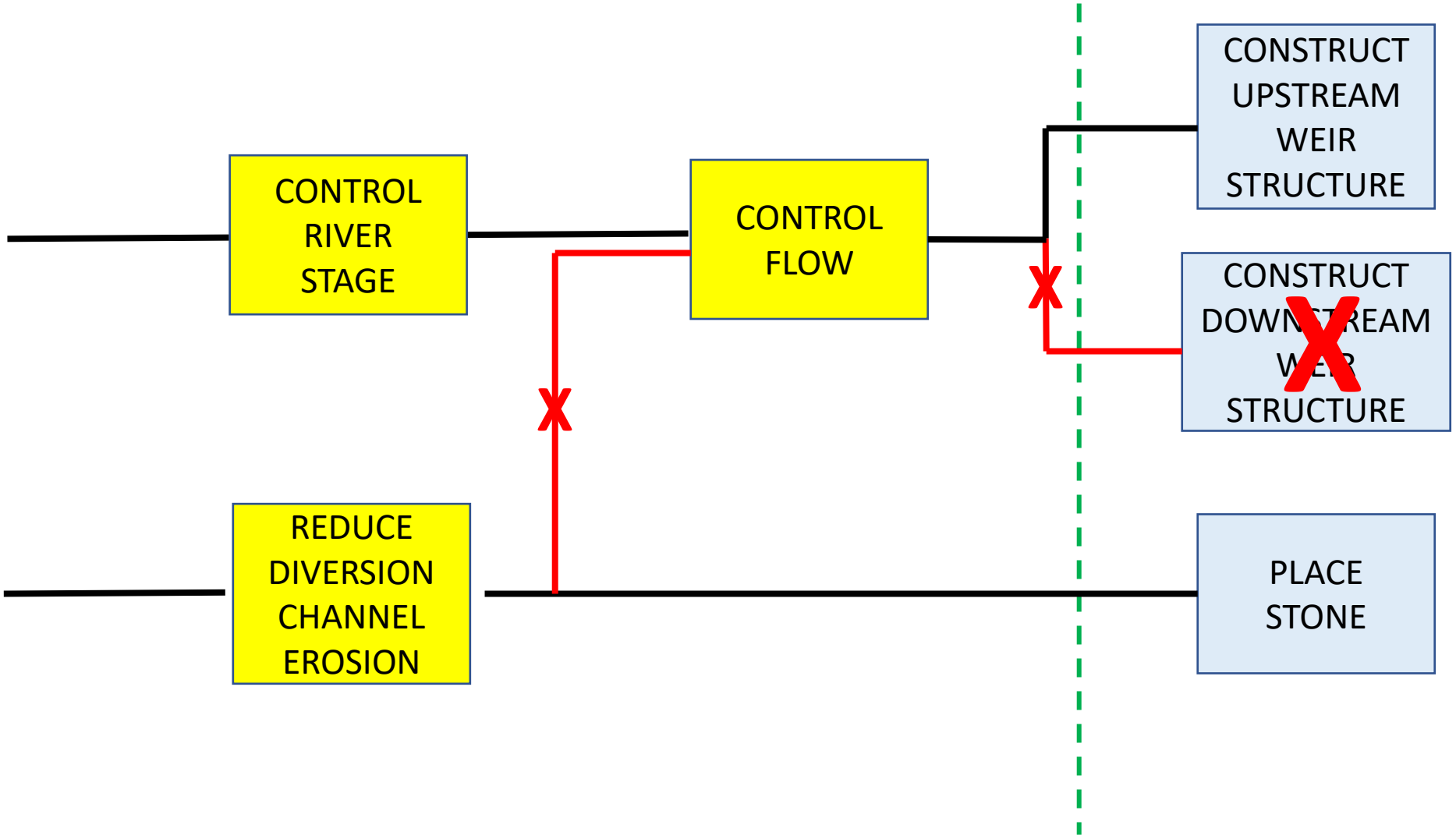
EFFICIENT FUNCTION ANALYSIS WITHOUT SHORTCUTS

Identifying project or process activity omission(s) through FA does not happen often, but when it does it is also usually a big deal. The second example illustrates the entire F.A.S.T. diagram for a major flood control project. Alternatives focused on either raising an existing levee to contain the ultimate flood event, or hardening the levee in reaches where raising was not feasible to prevent levee erosion and breach failure. Water flowing over the Levee in these reaches was considered to be residual flooding. FA identified That mitigating residual flooding was a secondary, but important project Function that wans not being addressed. The VE team identified additional cost-effective activities to convey levee overtopping in such a manner to minimize flooding (for s several other reasons this turned out to be a really big deal!).

COMITE RIVER DIVERSION



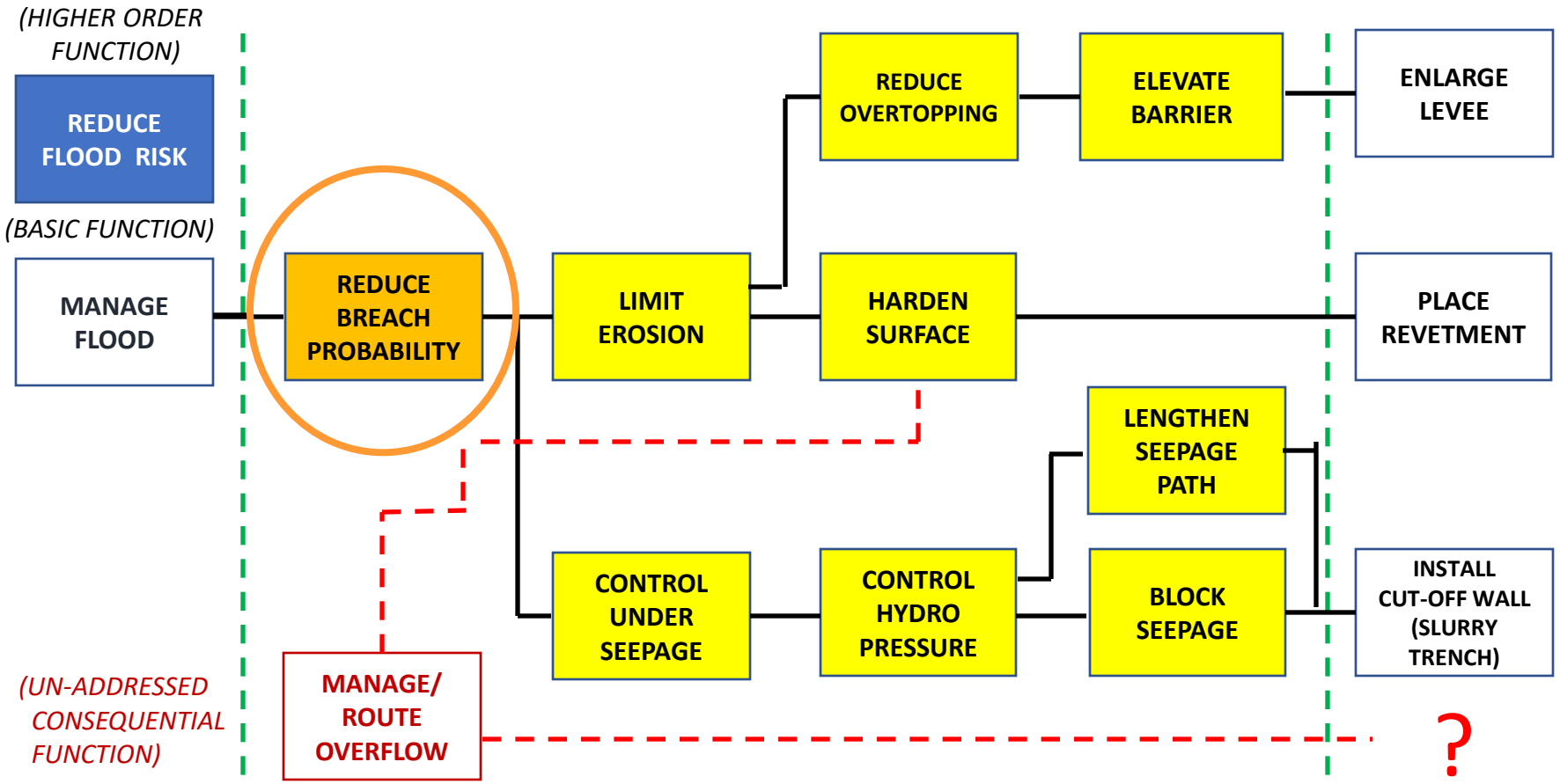
COMITE RIVER DIVERSION



DALLAS FLOODWAY
RISK REDUCTION – PLANNING PHASE

(PERFORMANCE ATTRIBUTES)

- LOWER RISK
- IMPROVE AESTHETICS
- IMPROVE O&M
- ASSURE SPONSOR BUY-IN
- INCREASE RESILIENCY
- REDUCE UNCERTAINTY
- IMPROVE INSPECTIONS
- IMPROVE CONSTRCTBLTY



Course Summary:

The following questions cover the topics covered by this course.
I hope you've both enjoyed and got wisdom from it.

Thank you! and let me know what you think about this course.

FrankVicidominaLLC@Yahoo.com

SUMMARY OF COURSE CONTENT

Why do we perform FA?

Does FA need to be complex?

Common FA ‘shortcuts’

Are shortcuts OK?; possible ‘shortcomings’ of FA shortcuts

SUMMARY OF COURSE CONTENT (CONT.)

How can we perform FA efficiently without omissions?

Is it ok to include project/process activities or 'performance attributes' in a F.A.S.T. diagram?

Use of the F.A.S.T. diagram template to help identify functions

Presentation of the 'Sandwich' method of creating a F.A.S.T. diagram

SUMMARY OF COURSE CONTENT (CONT.)

Identifying major functions

Identifying secondary functions and their importance

Identifying redundancies and omissions

BONUS: (F.A.S.T. exercise)

CLASS DEVELOPMENT OF A F.A.S.T. DIAGRAM FOR 'FUNCTION ANALYSIS' (USE 'SANDWICH' METHOD)

BONUS: Try to make a F.A.S.T. for FA

F.A.S.T. for FA

PERFORMANCE ATTRIBUTE | PERFORMANCE ATTRIBUTE | PERFORMANCE ATTRIBUTE | PERFORMANCE ATTRIBUTE

PROJECT/PROCESS SIGNIFICANT ACTIVITIES

HOW? ← *WHY?*

HIGHEST ORDER FUNCTIONS

BASIC FUNCTIONS

ACTIVITY

ACTIVITY

ACTIVITY

ACTIVITY

F.A.S.T. for FA

PERFORMANCE ATTRIBUTES:

- MEET VE STANDARD
- ENHANCE VE STUDY
- ENCOURAGE PARTICIPATION

HOW?

WHY?

HIGHEST ORDER FUNCTION

CONNECT VE PHASES

BASIC FUNCTIONS

- UNDERSTAND PROJECT/ PROCESS
- EXPAND VE SCOPE
- DEVELOP TEAM DYNAMICS

- IDENTIFY PRIMARY FUNCTIONS → ASK/ANSWER HOW/WHY QUESTIONS
- DETERMINE FUNCTION ORDER LOGIC → PERFORM HOW/WHY ORDER ITERATIONS
- IDENTIFY SECONDARY FUNCTIONS → ASK/ANSWER WHEN QUESTIONS

UTILIZE TEAM PARTICIPATION

PROJECT/PROCESS SIGNIFICANT ACTIVITIES

COMPLETE F.A.S.T. DIAGRAM

FRANK VICIDOMINA, LLC

Thank You !!!

(Your thoughts on this course?)

FrankVicidominaLLC@Yahoo.com