Full Pipeline Examples
Without Forwarding (Assume No Early Branching)

Non-LW (+2)									
add	F	D	E	M	W				
sub		F	🟨	🟨	D	E	M	W	

LW (+2)									
lw	F	D	E	M	W				
sub		F	🟨	🟨	D	E	M	W	

Non-LW before Branch (+2)									
add	F	D	E	M	W				
beq		F	🟨	🟨	D	E	M	W	

LW before Branch (+2)									
add	F	D	E	M	W				
beq		F	🟨	🟨	D	E	M	W	

After Branch (+3)									
beq	F	D	E	M	W				
add		🟨	🟨	🟨	F	D	E	M	W

With Forwarding but No Early Branching

Non-LW (+0)									
add	F	D	E	M	W				
sub		F	D	E	M	W			

LW (+1)									
lw	F	D	E	M	W				
sub		F	D	🟨	E	M	W		

Non-LW before Branch (+0)									
add	F	D	E	M	W				
beq		F	D	E	M	W			

LW before Branch (+1)									
add	F	D	E	M	W				
beq		F	D	🟨	E	M	W		

After Branch (+3)									
beq	F	D	E	M	W				
add		🟨	🟨	🟨	F	D	E	M	W

With Forwarding and Early Branching

Non-LW (+0)									
add	F	D	E	M	W				
sub		F	D	E	M	W			

LW (+1)									
lw	F	D	E	M	W				
sub		F	D	🟨	E	M	W		

Non-LW before Branch (+1)									
add	F	D	E	M	W				
beq		F	🟨	D	E	M	W		

LW before Branch (+2)									
add	F	D	E	M	W				
beq		F	🟨	🟨	D	E	M	W	

After Branch (+1)									
beq	F	D	E	M	W				
add		🟨	F	D	E	M	W		

Branch

Branch without Early Branch with Branch Prediction (Taken) (+3)									
beq	F	D	E	M	W				
inst1		F	D	E	M	W			
inst2			F	D	E	M	W		
inst3				F	D	E	M	W	
label		🟨	🟨	🟨	F	D	E	M	W

Branch with Early Branch with Branch Prediction (Taken) (+1)									
beq	F	D	E	M	W				
inst1		F	D	E	M	W			
label		🟨	F	D	E	M	W		

Branch with(out) Early Branch with Branch Prediction (Not Taken) (+0)									
beq	F	D	E	M	W				
inst1		F	D	E	M	W			
inst2			F	D	E	M	W		