

States, Firms, & Households Manual v2

In this manual, you will learn about the workings of SF&H and what strategies can be used to maximize success.

Controls

Name	Meaning
Right-click	1. Clicking on units or buildings will open up windows to give information
ESC key	1. Clicking on the ESC key in game or editor will open up the escape options on the left
F1 key	1. Clicking F1 at any time will save a screenshot to the /screenshots/ folder
F12 key	1. Clicking on F12 at any time will save a screenshot using Steam
TAB key	1. Pressing on the TAB key will open up the player stats in game mode
WASD keys	1. The WASD keys can be used to scroll the map
Arrow keys	1. The arrow keys are also used to scroll

Basic layout

There are several windows in game mode that are used to gain information and adjust variables.

Name	Access	Meaning	Options	Controls	Information
Truck manager	1. Clicking on a truck 2. Clicking on the "Truck Manager" button	Controls for variables related to trucks owned or information about other firms' trucks	Price: This is the price of transporting goods to the requesting player Wage: This is the wage to pay workers Selling price: The price of any truck owned if set to sell	Set: Accept the changes and finalize them Close: Exit the Sell: This checkbox sets the trucks for sale at the given price once the Set button is clicked, allowing other players to buy	Price and wage of trucks of a player

				them	
Building view	1. Clicking on a building	Controls for adjusting production parameters	Wage: This is the wage of the building Price(s): Various resources produced here have prices Build price: Trucks can have a price for manufacture that covers the requisite costs Production level: A number from 0 to 1000 that indicates the level of utilization Sale price: If being sold, this will be the price shown	Set: Sends the information to the host Close: Closes window Sell: This checkbox sets the property for sale, if Set is pressed Build order: Trucks are manufactured at factories Demolish: A building can be freed up by demolition	Stockpiled goods at this building, wage, price, production level, and property price. Goods that are capacities are shown as #remaining/#production, #usage/#production in the case of Housing, and #usage/#usage in the case of demanders.
Construction view	1. Clicking on a building under construction 2. Clicking on a conduit under construction	Controls for construction wage and information about requisite materials	Wage: construction wage	Buy: sometimes a player that ran out of funds will have to sell property and an option to buy construction property will show up Set: send the information to the host Close: closes window	Stockpiled materials for construction are displayed, along with wage
Player statistics	1. Pressing TAB key	The player statistics shows			Net worth: Current

	2. Pressing on the “Player Stats” button	how the players compare, and can be used to look up current players and AI in play			balance of the firm Utility: whenever a job, or consumer good, is chosen as the most desirable based on a utility score, that score is recorded, and if that job or consumer good is obtained, the score is awarded to that firm Throughput: the funds channeled in and out of the firm is shown here
Building preview	1. Hovering over any of the build options	Information about build options			The inputs, outputs, and construction costs are shown

There are several buttons in game mode:

Button	Meaning
Debug info	This will show debug information, like frame rate, update rate, packets, connections, synchronization, and the simulation frame number
Show transactions	This will show transactions as floating bubbles whenever they occur
Save	This opens up a window to save the current progress to a save game file
Quick save	This either saves to the previously selected save

	file, or opens up a save dialog if the progress has not been saved yet
Load	This opens up a window to select a game file to open, unless the game is multiplayer
Pause	This tells the host that you are pausing to consider options
Play	Once you are done deciding or want the game to slow down from fast forward mode, use Play
Fast forward	Fast forward unlocks the update rate and continue as fast as possible
Truck manager	If you have any trucks, you can get options here
Exit	Use exit to end sessions
Player stats	Show player earnings, scores, speed and colour
Build menu	The 9 buttons show possible buildings and the bottom right arrow cycles through the entire list

Each window has two buttons:

Name	Meaning
Close	Closes the window
Maximize	Maximize the window size

A bar at the top displays the resources that are available for spending on construction and initial stock. A date shown in play mode is an indicator of how fast the simulation is progressing.

Trucks

Trucks charge the set price every `DRIVE_WORK_DELAY` frames and pay the current driver the set wage. Because the `DRIVE_WORK_DELAY` may be too long for any single drive delivery, only the player and worker that are involved when the simulation arrives at the `DRIVE_WORK_DELAY`'th frame are charged and paid (rather than keeping track of how much time is spent and allocating a partial amount).

Trucks will need to be refueled when the fuel tank reaches $\text{STARTING_FUEL} * 3/4$. This check will only happen if the truck does not have any assigned task. Otherwise, if `TBID_DELAY` frames have passed, new jobs will be checked for delivery.

Trucks consume `TRUCK_CONSUMPRATE` fuel every `TRUCK_DIST` centimeters. The trucks do not keep track of distance, but a method based on the simulation frame is used. The simulation frame number is multiplied by `TRUCK_SPEED` (which it would move in a frame), and the remainder of the division by `TRUCK_DIST` is checked to be lower than "m", the distance moved in that frame.

When bidding for transportation, the demanders first make bids on trucks that would be the cheapest at the set price and location. Then the trucks that are bidden on decide on the most profitable (longest) route.

Labourers

Labourers consume retail food in batches of SHOP_RATE. MAX_SHOP labourers can be at one shop maximum. Obtaining MUL_RETFOOD will allow the labourer to grow and multiply into another worker. Labourers can only do STARTING_LABOUR units of work before needing rest. If housing is available, they will rest there but can also regenerate labour without housing. When they are idle, and WORK_DELAY frames have passed, they will first check if they need food if the consumption propensity at that time is greater than 0. The consumption propensity takes the satiety (owned food minus STARTING_RETFOOD) and returns the additive inverse. They are able to go FOOD_CONSUM_DELAY_FRAMES without needing to consume LABOURER_FOODCONSUM food. Else, they will check if they need rest. Otherwise, if LOOKJOB_DELAY_MAX frames have passed and they are able to work, they will compare jobs.

Simulation constants

Name	Value	Meaning
CYCLE_FRAMES	SIM_FRAME_RATE*60*1	The time that passes between building production
MAXPATHCM	TILE_SIZE*640*TILE_SIZE	Maximum distance in centimeters of a path
MAXPATHN	MAXPATHCM/PATHNODE_SIZE	Maximum distance in path nodes of a path
STARTING_LABOUR	1000*7	Number of milli-labour-minutes workers can do without rest
CS_WORKERS	5	Maximum construction workers at one place
FOOD_CONSUM_DELAY_FRAME S	SIM_FRAME_RATE*60*60	Delay between consumptions of food (expenditure)
LABOURER_FOODCONSUM	2100/24	Calories consumed every delay
MINWAGE	1100	The minimum wage AI firms will set
DRIVE_WORK_DELAY	SIM_FRAME_RATE*60	The delay between when labour is consumed and payments made
WORK_DELAY	SIM_FRAME_RATE*60	The delay between when labour is consumed and payments made

WORK_RATE	1000	The number of milli-labour-minutes consumed in WORK_DELAY
LOOKJOB_DELAY_MAX	$SIM_FRAME_RATE * 50$	The pause between looking for jobs
STARTING_RETFOOD	$3500 * 100 / 60$	The calories that a worker starts with
MUL_RETFOOD	$STARTING_RETFOOD * 2$	Amount of calories needed to multiply
SHOP_RATE	$800 / 60$	Rate at which food is bought every WORK_DELAY
MAX_SHOP	10	Maximum number of shoppers at 1 tile
TRUCK_DIST	$160934 * 13 / 3786$	Centimeters per milliliter of fuel
TRUCK_CONSUMPRATE	1	Milliliters of fuel consumed every TRUCK_DIST
TBID_DELAY	200	Frames between bids on transporation
STARTING_FUEL	$20 * 3785$	Starting fuel tank capacity
TRUCK_SPEED	30	Centimeters per frame moved by trucks
DEFL_DRWAGE	900	Default wage paid to drivers
DEFL_TRFEE	1000	Default truck fee
DEFL_CSWAGE	DEFL_DRWAGE	Default pay for construction
INST_FUNDS	$40 * 1000 * 1000$	Starting firm funds
SIM_FRAME_RATE	30	The frames in a second at base speed
RATIO_DENOM	1000	The maximum denominator used in ratios
STOCKING_RATE	$RATIO_DENOM * 1 / 20$	Default stocking amount
TILE_SIZE	1000	Tile size in centimeters
PATHNODE_SIZE	$TILE_SIZE / 20$	Size of smallest collidable unit
AI_FRAMES	$CYCLE_FRAMES / 30 + 1$	The time between AI player actions
NETTURN	$200 / SIM_FRAME_RATE$	The time between lockstep command turns (~6 frames)
BUILD_FRAMES	$NETTURN + 13$	A variable used in AI

Resource constants

Name	Capacity	Physical	Conduit	Measuring unit	Decay half-life	Starting quantity
Funds	No	Yes	None	Cents	None	INST_FUNDS
Labour	No	Yes	None	Milli-labour-minute	None	0
Housing	Yes	Yes	Road	Occupants	None	0
Farm products	No	Yes	Road	Kilocalories	$SIM_FRAME_RATE * 60 * 60 * 24 * 30 / 30 / 30 / 24$	$90 * CYCLE_FRAMES / WORK_DELAY$
Production	No	Yes	Road	Production	None	400000
Retail food	No	Yes	Road	Kilocalories	$SIM_FRAME_RATE * 60 * 60 * 24 * 30 / 30 / 30 / 24$	$90 * CYCLE_FRAMES / WORK_DELAY$
Crude oil	No	Yes	Crude oil pipeline	Milliliters	None	0
Wholesale fuel	No	Yes	Road	Milliliters	None	0
Retail fuel	No	Yes	Road	Milliliters	None	0
Energy	Yes	No	Powerline	Kilowatts	None	0
Chemicals	No	Yes	Road	Liters	None	0
Iron ore	No	Yes	Road	Kilograms	None	0
Metal	No	Yes	Road	Kilograms	None	150
Stone	No	Yes	Road	Kilograms	None	4000
Cement	No	Yes	Road	Kilograms	None	150
Uranium	No	Yes	Road	Grams	None	4000
Coal	No	Yes	Road	Kilograms	None	0

Building constants

Name	In	Out	Default price	Construction	Manufactures	Size	Hugs terrain	AI build proportion	To worker proportion	AI stocking rate
House	Energy: 2*10*1	Housing: 5*1*1	Housing: 600	Cement: 4 Labour: 4*1000*1	Nothing	1x1	No	110	RATIO_DENOM*2*1	STOCKING_RATE

				Stone: 2						
Apartment building	Energy: 1000*10*1	Housing: 150*1*1	Housing: 600	Cement: 40 Labour: 40*1000*1 Stone: 20	Nothing	2x2	No	0	RATIO_DEN OM*6*1	STOCKING_RATE
Factory	Labour: 10*1000*10*1 Energy: 100*10*1 Chemicals: 3*10*1 Metal: 182*10*1	Production: 1800/3*10*1	Production: 30	Labour: 4*1000*1 Metal: 2 Cement: 3	Truck	1x1	No	3	RATIO_DEN OM*20*1	STOCKING_RATE
Oil refinery	Labour: 10*1000*10*1 Energy: 5*10*1 Crude oil: 45*10*1*3 785	Wholesale fuel: 42*10*1*3 785	Wholesale fuel: 1	Cement: 5 Labour: 10*1000*1	Nothing	1x1	No	7	RATIO_DEN OM*2*1	STOCKING_RATE
Name	In	Out	Default price	Construction	Manufactures	Size	Hugs terrain	AI build proportion	To worker proportion	AI stocking rate
Coal powerplant	Coal: 5*10*1 Labour: 5*1000*10*1	Energy: 500*10*1	Energy: 4	Cement: 5 Labour: 5*10*1	Nothing	1x1	No	10	RATIO_DEN OM*2*1	STOCKING_RATE*10
Chemical plant	Iron ore: 5*10*1 Energy: 5*10*1 Labour: 5*1000*10*1	Chemicals: 100*10*1	Chemicals: 10	Cement: 5 Labour: 10*1000*1	Nothing	1x1	No	10	RATIO_DEN OM*2*1	STOCKING_RATE*3
Gas station	Wholesale fuel: 20*10*1*3 785 Energy: 5*10*1 Labour: 2*1000*10*1	Retail fuel: 20*10*1*3 785	Retail fuel: 100	Cement: 5 Labour: 10*1000*1	Nothing	1x1	No	9	RATIO_DEN OM*2*1	STOCKING_RATE
Cement plant	Stone: 5*10*1 Energy: 5*10*1 Labour: 5*1000*10*1	Cement: 10*10*1	Cement: 100	Cement: 5 Labour: 10*1000*1	Nothing	1x1	No	9	RATIO_DEN OM*2*1	STOCKING_RATE
Iron smelter	Labour: 10*1000*10*1 Iron ore: 125*10*1 Chemicals: 10*10*1	Metal: 125*10*1	Metal: 1	Labour: 4*1000*1 Cement: 3 Stone: 1	Nothing	1x1	No	11	RATIO_DEN OM*2*1	STOCKING_RATE*2
Nuclear powerplant	Uranium: 5*10*1 Labour: 5*1000*10	Energy: 4000*10*1	Energy: 4	Cement: 5 Labour: 10*1000*1	Nothing	1x1	No	1	RATIO_DEN OM*20*1	STOCKING_RATE*10

	*1									
Farm	Labour: 1*1000*1*1/100	Farm products: 684*1*1	Farm products: 1	Labour: 4*1000*1	Nothing	1x1	Yes	83	RATIO_DENOM*2*1	STOCKING_RATE/STOCKING_RATE*10
Store	Labour: 10*1000*10*1 Energy: 10*10*1	Retail food: 210000*10*1	Retail food: 5	Cement: 5 Labour: 10*1000*10*1	Nothing	1x1	No	4	RATIO_DENOM*9*1	STOCKING_RATE*10
Name	In	Out	Default price	Construction	Manufactures	Size	Hugs terrain	AI build proportion	To worker proportion	AI stocking rate
Oil well	Energy: 5*10*1 Labour: 5*1000*10*1	Crude oil: 10*10*1*3785	Crude oil: 1	Cement: 5 Labour: 1*1000*1	Nothing	1x1	No	16	RATIO_DENOM*2*1	STOCKING_RATE
Shaft mine	Labour: 5*1000*10*1	Iron ore: 70*10*1 Stone: 100*10*1 Uranium: 50*10*1 Coal: 50*10*1	Iron ore: 100 Stone: 100 Uranium: 100 Coal: 100	Labour: 4*1000*1 Cement: 3	Nothing	1x1	No	10	RATIO_DENOM*2*1	STOCKING_RATE
Bank	Nothing	Nothing	N/A	Labour: 4*1000*10*1 Cement: 3	Nothing	1x1	No	1	RATIO_DENOM*2*1	STOCKING_RATE

Unit constants

Name	Speed (cm/frame)	Roaded	AI manufacture proportion to buildings	Size	Manufacture
Labourer	3	No	0	PATHNODE_SIZE	N/A
Truck	TRUCK_SPEED	Yes	RATIO_DENOM*14/70	PATHNODE_SIZE*3	Production: 18000/3

AI behaviour

The AI will only be invoked for an AI firm every AI_FRAMES. If invoked, the phase variable is set to the simulation frame divided by BUILD_FRAMES. Based on certain rules designed to stagger the actions of the AI and give them a certain proportion, different actions are invoked.

Name	Condition	Meaning
AI build	(Phase + AI player index +	New buildings are placed based

	simulation frame) % MAX_PLAYERS == 1	on density, proportion rate, and worker proportion rate
AI manufacture	(Phase + AI player index + simulation frame) % (MAX_PLAYERS * 100 / 60) == 2	New units are manufactured based on proportion to building rate
Buy properties	(Phase + simulation frame) % MAX_PLAYERS == 3	Properties on sale are purchased based on history of sales and expenses
Adjust truck prices and wages	(Phase + simulation frame / 30) % MAX_PLAYERS == 3	Wages and prices for trucks are adjusted based on number of jobs given, fulfilled and earnings and spending for the last 2 CYCLE_FRAMES

There is also the action of adjusting building prices and wages, which happens at the end of every building cycle. All other actions like adjusting building supplier and transportation are done the same way as for players (based on utility). The prices and wages are partly trial and error and reinforcement and approach the profitable maximum over the last 2 CYCLE_FRAMES. That means periodic decay of food and subsequent expenses are not taken into account.

Pathfinding

An a-star algorithm is used in all paths using a diagonal distance heuristic and no corrections for shorter found hops. The path nodes are stored in a binary heap and the newer path nodes of equal value tend to be picked first.

Strategies

Players should be aware of expenses and earnings in the building views. A general strategy is to pay enough to meet production targets, or to scale back production, when earnings are insufficient. Building in a central location will maximize customers and improve sales. Food will decay and it is recommended to sell fast. However, sales for consumer goods and housing are easier. Demanders have no choice in who they buy from, only the price at which they buy. If all the prices are too expensive, the only thing that can be done is to cut off production.

Changes

v2 TRUCK_DIST and TRUCK_CONSUMPRATE changed
v1 Initial release