ภาคผนวก

การออกแบบระบบค้ำยันเข็มพืดเหล็ก

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Input

■ "ข้อกำหนด";

"ชนิดของดินทราย = 1";
"ชนิดของดินเหนียวอ่อน = 2";
"ชนิดของดินเหนียวแข็ง = 3";
"ข้อมูลได้ไม่ทราบกรุณาใส่ 0";

■ "กรอกข้อมูลของดินชั้นที่ 1 ";

t1 =

"ความลึกหรือความหนาของชั้นดินชั้นที่ 1(H)"	12.5	" m"
"ค่าหน่วยน้ำหนักของดินชั้นที่ 1(γ)"	1.6	"t/m³"
"ค่า Undrained Shear Strength ชั้นที่ 1(c)"	1.7	"t/m²"
"Angle of Friction(ϕ)"	0	"ไม่มีหน่วย"
"ชนิดของชั้นดิน"	2	"ไม่มีหน่วย"
"แรงเสียดทานของเสาเข็ม(f_s)"	1.63	"t/m³"

;

■ "กรอกข้อมูลของดินชั้นที่ 2";

t2 =

"ความลึกหรือความหนาของชั้นดินชั้นที่ 2(H)"	2.5	"m"
"ค่าหน่วยน้ำหนักของดินชั้นที่ 2(γ)"	1.65	"t/m³"
"ค่า Undrained Shear Strength ชั้นที่ 2(c)"	4	"t/m²"
"Angle of Friction(ϕ)"	0	"ไม่มีหน่วย"
"ชนิดของชั้นดิน"	2	"ไม่มีหน่วย"
"แรงเสียดทานของเสาเข็ม(f_s)"	3.52	"t/m³"

;

■ "กรอกข้อมูลของดินชั้นที่ 3";

t3 =

"ความสูงหรือความหนาของชั้นดินชั้นที่3(H)"	100	" m"
"ค่าหน่วยน้ำหนักของดินชั้นที 3(γ)"	0	"t/m^3"
"ค่า Undrained Shear Strength ชั้นที 3(c)"	15	"t/m^2"
"Angle of Friction(ϕ)"	0	"ไม่มีหน่วย"
"ชนิดของชั้นดิน"	3	"ไม่มีหน่วย"
"แรงเสียดทานของเสาเข็ม(f_s)"	6.6	"t/m^3"

;

■ "กรอกข้อมูลของดินชั้นที่ 4";

t4 =

"ความสูงหรือความหนาของชั้นดินชั้นที 4(H)"	0	" m"
"ค่าหน่วยน้ำหนักของดินชั้นที 4(γ)"	0	"t/m^3"
"ค่า Undrained Shear Strength ชั้นที 4(c)"	0	"t/m^2"
"Angle of Friction(ϕ)"	0	"ไม่มีหน่วย"
"ชนิดของชั้นดิน"	0	"ไม่มีหน่วย"
"แรงเสียดทานของเสาเข็ม(f_s)"	0	"t/m^3"

;

■ "กรอกข้อมูลของหลุมขุดและจำนวน strut";

t5 =

"ระยะห่างระหว่าง strut ชั้นแรกถึงผิวดิน "	1.2	"m"
"ระยะห่างระหว่าง strut ชั้นที่2ถึงชั้นแรก"	2.7	"m"
"ระยะห่างระหว่าง strut ชั้นที่3ถึงชั้นที่2"	2.55	"m"
"ระยะห่างระหว่าง strut ชั้นที่4ถึงชั้นที่3"	0	"m"
"ระยะห่างระหว่างกันหลุมขุดถึง strut ชั้นที่4"	0	"m"
"ความลึกทั้งหมดของหลุมขุด"	8.7	"m"
"ระยะห่าง strut ในแนวราบ"	6	"m"
"Surcharge Load"	1	"t/m^2"

;

Calculation

■ Input Parameter

```
hsoil1      =    t1[[1, 2]];
γ1          =    t1[[2, 2]];
c1          =    t1[[3, 2]];
ϕ1          =    t1[[4, 2]];
type1       =    t1[[5, 2]];
fs1         =    t1[[6, 2]];

hsoil2      =    t2[[1, 2]];
γ2          =    t2[[2, 2]];
c2          =    t2[[3, 2]];
ϕ2          =    t2[[4, 2]];
type2       =    t2[[5, 2]];
fs2         =    t2[[6, 2]];

hsoil3      =    t3[[1, 2]];
γ3          =    t3[[2, 2]];
c3          =    t3[[3, 2]];
ϕ3          =    t3[[4, 2]];
type3       =    t3[[5, 2]];
fs3         =    t3[[6, 2]];

hsoil4      =    t4[[1, 2]];
γ4          =    t4[[2, 2]];
c4          =    t4[[3, 2]];
ϕ4          =    t4[[4, 2]];
type4       =    t4[[5, 2]];
fs4         =    t4[[6, 2]];

hstrut1     =    t5[[1, 2]];
hstrut2     =    t5[[2, 2]];
hstrut3     =    t5[[3, 2]];
hstrut4     =    t5[[4, 2]];
hstrut5     =    t5[[5, 2]];
htotalcut   =    t5[[6, 2]];
bstrut      =    t5[[7, 2]]; surcharge    =    t5[[8, 2]];
```

▪ Pressure Envelop

```
"Braced Cut ใน Sand";
θ              =      ϕ1 * π / 180;
pasand         =      0.65 * γsand * htotalcut * ka;
ka             =      Tan²[(π / 4) - θ / 2];

"Braced Cut ใน Clay ";
"Braced Cut ใน Soft to Medium Clay";
"ถ้า γ*h/c > 4";
pasoftclay     =      γsoft * htotalcut - (4 * c / 2);
pamedium       =      0.3 * γsoft * htotalcut;

"Braced Cut ใน Stiff Clay";
"ถ้า γ*h/c ≤ 4";
pastiffclay    =      0.3 * γstiff * htotalcut;

If[type1 = 1, c = 0];
If[type1 = 2, c = c1];
If[type1 = 3, c = 0];

If[type1 = 1, γsand = γ1, γsand = 0];
If[type1 = 2, γsoft = γ1, γsoft = 0];
If[type1 = 3, γstiff = γ1, γstiff = 0];

If[And[type1 == 1, htotalcut < hsoil1], (pa = pasand)];
If[And[type1 == 2, htotalcut < hsoil1], (pa = paclay)];
paclay = Max[pasoftclay, pamedium];
If[And[type1 == 3, htotalcut < hsoil1], (pa = pastiffclay)];

paall          =      pa + surcharge;

If[And[type1 = 1, hstrut5 ≠ 0], f1 = paall * (hstrut1 + hstrut2 * 0.5)];
If[And[type1 = 1, hstrut5 ≠ 0], f2 = paall * (0.5 * hstrut2 + 0.5 * hstrut3)];
If[And[type1 = 1, hstrut5 ≠ 0], f3 = paall * (0.5 * hstrut3 + 0.5 * hstrut4)];
If[And[type1 = 1, hstrut5 ≠ 0], f4 = paall * (0.5 * hstrut4 + 0.5 * hstrut5)];
If[And[type1 = 1, hstrut5 ≠ 0], f5 = paall * (0.5 * hstrut5)];

If[And[type1 = 1, hstrut5 = 0], f1 = paall * (hstrut1 + hstrut2 * 0.5)];
If[And[type1 = 1, hstrut5 = 0], f2 = paall * (0.5 * hstrut2 + 0.5 * hstrut3)];
If[And[type1 = 1, hstrut5 = 0], f3 = paall * (0.5 * hstrut3 + 0.5 * hstrut4)];
If[And[type1 = 1, hstrut5 = 0],
  f4 = paall * (0.5 * (htotalcut - hstrut4 - hstrut3 - hstrut2 - hstrut1))];
If[And[type1 = 1, hstrut5 = 0],
  f5 = paall * (0.5 * (htotalcut - hstrut4 - hstrut3 - hstrut2 - hstrut1))];

If[And[type1 = 1, hstrut5 = 0, hstrut4 = 0], f1 = paall * (hstrut1 + hstrut2 * 0.5)];
If[And[type1 = 1, hstrut5 = 0, hstrut4 = 0 ], f2 = paall * (0.5 * hstrut2 + 0.5 * hstrut3)];
If[And[type1 = 1, hstrut5 = 0, hstrut4 = 0],
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    f3 = paall * (0.5 * hstrut3 + 0.5 * (htotalcut - hstrut3 - hstrut2 - hstrut1))];
  If[And[type1 = 1, hstrut5 = 0, hstrut4 = 0], f4 = 0];
  If[And[type1 = 1, hstrut5 = 0, hstrut4 = 0],
    f5 = paall * (0.5 * (htotalcut - hstrut3 - hstrut2 - hstrut1))];

  If[And[type1 = 1, hstrut5 = 0, hstrut4 = 0, hstrut3 = 0],
    f1 = paall * (hstrut1 + hstrut2 * 0.5)];
  If[And[type1 = 1, hstrut5 = 0, hstrut4 = 0, hstrut3 = 0],
    f2 = paall * (0.5 * (htotalcut - hstrut2 - hstrut1))];
  If[And[type1 = 1, hstrut5 = 0, hstrut4 = 0, hstrut3 = 0], f3 = 0];
  If[And[type1 = 1, hstrut5 = 0, hstrut4 = 0, hstrut3 = 0], f4 = 0];
  If[And[type1 = 1, hstrut5 = 0, hstrut4 = 0, hstrut3 = 0],
    f5 = paall * (0.5 * (htotalcut - hstrut2 - hstrut1))];

  If[And[type1 = 2, hstrut5 ≠ 0], f1 = (0.5 * (surcharge + paall) * htotalcut * 0.25) +
      (((0.5 * hstrut2) + hstrut1) - htotalcut * 0.25) * paall];
  If[And[type1 = 2, hstrut5 ≠ 0], f2 = paall * (0.5 * hstrut2 + 0.5 * hstrut3)];
  If[And[type1 = 2, hstrut5 ≠ 0], f3 = paall * (0.5 * hstrut3 + 0.5 * hstrut4)];
  If[And[type1 = 2, hstrut5 ≠ 0], f4 = paall * (0.5 * hstrut4 + 0.5 * hstrut5)];
  If[And[type1 = 2, hstrut5 ≠ 0], f5 = paall * (0.5 * hstrut5)];

  If[And[type1 = 2, hstrut5 = 0], f1 = (0.5 * (surcharge + paall) * htotalcut * 0.25) +
      (((0.5 * hstrut2) + hstrut1) - htotalcut * 0.25) * paall];
  If[And[type1 = 2, hstrut5 = 0], f2 = paall * (0.5 * hstrut2 + 0.5 * hstrut3)];
  If[And[type1 = 2, hstrut5 = 0], f3 = paall * (0.5 * hstrut3 + 0.5 * hstrut4)];
  If[And[type1 = 2, hstrut5 = 0],
    f4 = paall * (0.5 * (htotalcut - hstrut4 - hstrut3 - hstrut2 - hstrut1))];
  If[And[type1 = 2, hstrut5 = 0],
    f5 = paall * (0.5 * (htotalcut - hstrut4 - hstrut3 - hstrut2 - hstrut1))];

  If[And[type1 = 2, hstrut5 = 0, hstrut4 = 0],
    f1 = (0.5 * (surcharge + paall) * htotalcut * 0.25) +
      (((0.5 * hstrut2) + hstrut1) - htotalcut * 0.25) * paall];
  If[And[type1 = 2, hstrut5 = 0, hstrut4 = 0 ], f2 = paall * (0.5 * hstrut2 + 0.5 * hstrut3)];
  If[And[type1 = 2, hstrut5 = 0, hstrut4 = 0],
    f3 = paall * (0.5 * hstrut3 + 0.5 * (htotalcut - hstrut3 - hstrut2 - hstrut1))];
  If[And[type1 = 2, hstrut5 = 0, hstrut4 = 0], f4 = 0];
  If[And[type1 = 2, hstrut5 = 0, hstrut4 = 0],
    f5 = paall * (0.5 * (htotalcut - hstrut3 - hstrut2 - hstrut1))];

  If[And[type1 = 2, hstrut5 = 0, hstrut4 = 0, hstrut3 = 0],
    f1 = (0.5 * (surcharge + paall) * htotalcut * 0.25) +
      (((0.5 * hstrut2) + hstrut1) - htotalcut * 0.25) * paall];
  If[And[type1 = 2, hstrut5 = 0, hstrut4 = 0, hstrut3 = 0],
    f2 = paall * (0.5 * (htotalcut - hstrut2 - hstrut1))];
  If[And[type1 = 2, hstrut5 = 0, hstrut4 = 0, hstrut3 = 0], f3 = 0];
  If[And[type1 = 2, hstrut5 = 0, hstrut4 = 0, hstrut3 = 0], f4 = 0];
  If[And[type1 = 2, hstrut5 = 0, hstrut4 = 0, hstrut3 = 0],
    f5 = paall * (0.5 * (htotalcut - hstrut2 - hstrut1))];

  If[And[type1 = 3, hstrut5 ≠ 0], f1 = (0.5 * (surcharge + paall) * htotalcut * 0.25) +
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    (((0.5 * hstrut2) + hstrut1) - htotalcut * 0.25) * paall];
If[And[type1 == 3, hstrut5 ≠ 0], f2 = paall * (0.5 * hstrut2 + 0.5 * hstrut3)];
If[And[type1 == 3, hstrut5 ≠ 0], f3 = paall * (0.5 * hstrut3 + 0.5 * hstrut4)];
If[And[type1 == 3, hstrut5 ≠ 0], f4 = paall * (0.5 * hstrut4 + 0.5 * hstrut5)];
If[And[type1 == 3, hstrut5 ≠ 0], f5 = (paall * (0.5 * hstrut5) - (0.5 * htotalcut * 0.25 * pa))];

If[And[type1 == 3, hstrut5 == 0], f1 = (0.5 * (surcharge + paall) * htotalcut * 0.25) +
    (((0.5 * hstrut2) + hstrut1) - htotalcut * 0.25) * paall];
If[And[type1 == 3, hstrut5 == 0], f2 = paall * (0.5 * hstrut2 + 0.5 * hstrut3)];
If[And[type1 == 3, hstrut5 == 0], f3 = paall * (0.5 * hstrut3 + 0.5 * hstrut4)];
If[And[type1 == 3, hstrut5 == 0],
  f4 = paall * (0.5 * (htotalcut - hstrut4 - hstrut3 - hstrut2 - hstrut1))];
If[And[type1 == 3, hstrut5 == 0],
  f5 = (paall * (0.5 * (htotalcut - hstrut4 - hstrut3 - hstrut2 - hstrut1)) -
     (0.5 * htotalcut * 0.25 * pa))];

If[And[type1 == 3, hstrut5 == 0, hstrut4 == 0],
  f1 = (0.5 * (surcharge + paall) * htotalcut * 0.25) +
    (((0.5 * hstrut2) + hstrut1) - htotalcut * 0.25) * paall];
If[And[type1 == 3, hstrut5 == 0, hstrut4 == 0], f2 = paall * (0.5 * hstrut2 + 0.5 * hstrut3)];
If[And[type1 == 3, hstrut5 == 0, hstrut4 == 0],
  f3 = paall * (0.5 * hstrut3 + 0.5 * (htotalcut - hstrut3 - hstrut2 - hstrut1))];
If[And[type1 == 3, hstrut5 == 0, hstrut4 == 0], f4 = 0];
If[And[type1 == 3, hstrut5 == 0, hstrut4 == 0], f5 =
   (paall * (0.5 * (htotalcut - hstrut3 - hstrut2 - hstrut1)) - (0.5 * htotalcut * 0.25 * pa))];

If[And[type1 == 3, hstrut5 == 0, hstrut4 == 0, hstrut3 == 0],
  f1 = (0.5 * (surcharge + paall) * htotalcut * 0.25) +
    (((0.5 * hstrut2) + hstrut1) - htotalcut * 0.25) * paall];
If[And[type1 == 3, hstrut5 == 0, hstrut4 == 0, hstrut3 == 0],
  f2 = paall * (0.5 * (htotalcut - hstrut2 - hstrut1))];
If[And[type1 == 3, hstrut5 == 0, hstrut4 == 0, hstrut3 == 0], f3 = 0];
If[And[type1 == 3, hstrut5 == 0, hstrut4 == 0, hstrut3 == 0], f4 = 0];
If[And[type1 == 3, hstrut5 == 0, hstrut4 == 0, hstrut3 == 0],
  f5 = (paall * (0.5 * (htotalcut - hstrut2 - hstrut1)) - (0.5 * htotalcut * 0.25 * pa))];
```

■ Sheet Pile

```
"ออกแบบความยาวเข็มพืดเหล็ก";
s                =        sul * (htotalcut - 2 * sul / γ1);
sf               =        (2 * s + su2 * π * b1 + 2 * su2 * b1) / (b1 * (γ * htotalcut + surcharge));
IF[htotalcut < hsoil1, (sul = c1)];
If[(hsoil2 + hsoil1) > htotalcut > hsoil1,
  (sul = (c1 * hsoil1 + c2 * (htotalcut - hsoil1)) / (hsoil1 + (htotalcut - hsoil1)))];

maxhstrut        =        Max[hstrut1, hstrut2, hstrut3, hstrut4, hstrut5];

m0 := (paal1 * maxhstrut^2 / 8);
sx := (m0 * 100000) / 1250;

If[0 < sx < 1340,    sheetpile = " Sheet Pile Type FSP III"];
If[1341 < sx < 1520, sheetpile = " Sheet Pile Type FSP IIIA"];
If[1521 < sx < 2270, sheetpile = " Sheet Pile Type FSP IV"];
If[2271 < sx < 3150, sheetpile = " Sheet Pile Type FSP V L"];
If[3151 < sx < 3820, sheetpile = " Sheet Pile Type FSP VI L"];
```

■ Table for SF

```
TableSF[{q_, H_}, {γ1_, Su1_, B1_}] :=
 Module[{S, Su2x, Bx, SF},
  S = Su1 (H - 2 Su1/γ1);
  Su2x = Su1;
  Bx = B1;
  SF = (2 S + Su2x π Bx + 2 Su2x Bx) / (Bx (γ1 H + q));
  {H + B1, SF}]

TableSF[{q_, H_}, {γ1_, Su1_, B1_}, {Su2_, B2_}] :=
 Module[{S, Su2x, Bx, SF},
  S = Su1 (H - 2 Su1/γ1);
  Su2x = ((Su1 B1 + Su2 B2) / (B1 + B2));
  Bx = B1 + B2;
  SF = (2 S + Su2x π Bx + 2 Su2x Bx) / (Bx (γ1 H + q));
  {H + B1 + B2, SF}]
```

```
TableSF[{q_, H_}, {γ1_, Su1_, B1_}, {Su2_, B2_}, {Su3_, B3_}] :=
 Module[{S, Su2x, Bx, SF},
  S = Su1 (H - 2 Su1/γ1);
  Su2x = ((Su1 B1 + Su2 B2 + Su3 B3)/(B1 + B2 + B3));
  Bx = B1 + B2 + B3;
  SF = (2 S + Su2x π Bx + 2 Su2x Bx)/(Bx (γ1 H + q));
  {H + B1 + B2 + B3, SF}]

TableSF[{q_, H_}, {γ1_, Su1_, B1_}, {Su2_, B2_}, {Su3_, B3_}, {Su4_, B4_}] :=
 Module[{S, Su2x, Bx, SF},
  S = Su1 (H - 2 Su1/γ1);
  Su2x = ((Su1 B1 + Su2 B2 + Su3 B3 + Su4 B4)/(B1 + B2 + B3 + B4));
  Bx = B1 + B2 + B3 + B4;
  SF = (2 S + Su2x π Bx + 2 Su2x Bx)/(Bx (γ1 H + q));
  {H + B1 + B2 + B3 + B4, SF}]

TableSFL[{q_, L_}, {H_, γAv_, SuAv_}, {{Su1_, D1_}, {Su2_, D2_}, {Su3_, D3_}}] :=
 Module[{},
  If[D1 + D2 < L - H <= D1 + D2 + D3,
   TableSF[{q, H}, {γ1, Su1, D1}, {Su2, D2}, {Su3, L - (H + D1 + D2)}],
   If[D1 < L - H <= D1 + D2,
    TableSF[{q, H}, {γ1, Su1, D1}, {Su2, L - (H + D1)}],
    If[0 < L - H <= D1,
     TableSF[{q, H}, {γ1, Su1, L - H}]]]]]

tSFL = Table[TableSFL[{surcharge, iLi}, {htotalcut , γ1 , c1 }, {{c1 , hsoil1 - htotalcut},
    {c2, hsoil2}, {c3, hsoil3}}], {iLi, Ceiling[htotalcut], 50}];
Do[
 If[And[tSFL[[i, 2]] ≥ 1.50, tSFL[[i, 2]] - tSFL[[i - 1, 2]]] > 0,
  xtx = tSFL[[i - 1, 1]] + (tSFL[[i, 1]] - tSFL[[i - 1, 1]]) ((1.50 - tSFL[[i - 1, 2]])/(tSFL[[i, 2]] - tSFL[[i - 1, 2]]));
  Break[]], {i, 2, Length[tSFL]}];
L =
 Ceiling[
  xtx]
```

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■ Wale

```
"ออกแบบ Waler ชั้นแรก";
moment1          =     f1 * (bstrut / 3)^2 / 10;  "t-m/m";
axialfw1         =     (bstrut / 3) * f1;         "tons";
"stress due to Temperature Change = 0.000011*Es*ΔT = 116 ksc";

"fa=P/A";   "ksc";
"fb=M0/Sx"; "ksc";
fa1 = axialfw1 * 1000 / 119.8;
fb1 = moment1 * 100000 / 1360;
fa2 = axialfw1 * 1000 / 173.9;
fb2 = moment1 * 100000 / 2300;
fa3 = axialfw1 * 1000 / 238.70;
fb3 = moment1 * 100000 / 3330;

  "W 300*300*94 Kg/m"  "Kl/rx=200/13.1"  "Fa = 1460 ksc"
""W 350*350*137 Kg/m"  "Kl/rx=200/15.2"  "Fa = 1470 ksc"";
 "W 400*400*172 Kg/m"  "Kl/rx=200/17.5"  "Fa = 1475 ksc"

"fa/Fa+fb/Fb < 1 ใช้ได้ ";
"fa/Fa+fb/Fb = fafbi";
fafb1 = (fa1 + 116) / 1460 + fb1 / 1250;
fafb2 = (fa2 + 116) / 1470 + fb2 / 1250;
fafb3 = (fa3 + 116) / 1475 + fb3 / 1250;

w300 = "Wide Flange 300*300*94  Kg/m";
w350 = "Wide Flange 350*350*137 Kg/m";
w400 = "Wide Flange 400*400*172 Kg/m";

If[fafb3 < fafb2 < fafb1 ≤ 1, (firstW = w300)];
If[fafb3 < fafb2 ≤ 1 < fafb1, (firstW = w350)];
If[fafb3 ≤ 1 < fafb2 < fafb1, (firstW = w400)];

"ออกแบบ Waler ชั้นอื่นๆ";
fwmax            =     Max[f2, f3, f4] ;
moment2          =     fwmax * (bstrut / 3)^2 / 10;  "t-m/m";
axialfw2         =     (bstrut / 3) * fwmax;         "tons";
"stress due to Temperature Change = 0.000011*Es*ΔT = 116 ksc";

"fa=P/A";   "ksc";
"fb=M0/Sx"; "ksc";
"fa=fai";
"fb=fbi";

fa1 = axialfw2   * 1000 / 119.8;
fb1 = moment2  * 100000 / 1360;
fa2 = axialfw2   * 1000 / 173.9;
fb2 = moment2  * 100000 / 2300;
```

```
fa3 = axialfw2   * 1000 / 238.7;
fb3 = moment2  * 100000 / 3330;

"fa/Fa+fb/Fb  < 1 ใช้ได้ ";
"fa/Fa+fb/Fb  = aaa,bbb,ccc";

aaa = (fa1 + 116) / 1460 + fb1 / 1250;
bbb = (fa2 + 116) / 1470 + fb2 / 1250;
ccc = (fa3 + 116) / 1475 + fb3 / 1250;

If[ccc < bbb < aaa ≤ 1, (otherW = w300)];
If[ccc < bbb ≤ 1 < aaa, (otherW = w350)];
If[ccc ≤ 1 < bbb < aaa, (otherW = w400)];
```

■ Strut

```
"ออกแบบ strut ชิ้นแรก";
"แรงตามแนวแกนของ strut(fsp)";
fsp = f1 * bstrut; "tons";

"หน้าตัด Wide Flange 300*300*94 Kg/m";
"แรงในแนวแกน x(fpx)";
"แรงในแนวแกน y(fpy)";
"หน้าตัด Wide Flange 350*350*137 Kg/m";
"แรงในแนวแกน x(spx)";
"แรงในแนวแกน y(spy)";
"หน้าตัด Wide Flange 400*400*172 Kg/m";
"แรงในแนวแกน x(tpx)";
"แรงในแนวแกน y(tpy)";

fpx = fsp * 1000 / 119.8 + 116;
fpy = fsp * 1000 / (1.3 * 119.8) + 116;
spx = fsp * 1000 / 173.9 + 116;
spy = fsp * 1000 / (1.3 * 173.9) + 116;
tpx = fsp * 1000 / 238.7 + 116;
tpy = fsp * 1000 / (1.3 * 238.7) + 116;
```

"W 300*300*94 Kg/m"	"Kl/r_x=600/13.1"	"F_a = 1312 ksc"	
	"Kl/r_y=600/7.51"	"F_a = 1077 ksc"	
"W 350*350*137 Kg/m"	"Kl/r_x=600/15.2"	"F_a = 1347 ksc"	;
	"Kl/r_y=600/8.84"	"F_a = 1169 ksc"	
"W 400*400*172 Kg/m"	"Kl/r_x=600/17.5"	"F_a = 1372 ksc"	
	"Kl/r_y=600/10.1"	"F_a = 1225 ksc"	

```
If[And[fpx > spx > tpx, fpx ≤ 1312], ddd = fpx];
If[And[spx > tpx, fpx > 1313], fff = spx];
If[And[spx > 1347, tpx ≤ 1372], hhh = tpx];
If[And[fpy > spy > tpy, fpy ≤ 1077], eee = fpy];
```

```
If[And[spy > tpy, fpy > 1078], ggg = spy];
If[And[spx > 1169, tpy ≤ 1225], iii = tpy];

"แรงในแกน x (ddd,fff,hhh)< Fa ใช้ได้ ";
"แรงในแกน y (eee,ggg,iii)< Fa ใช้ได้ ";

w300 = "Wide Flange 300*300*94  Kg/m";
w350 = "Wide Flange 350*350*137 Kg/m";
w400 = "Wide Flange 400*400*172 Kg/m";

If[And[ddd < 1312, eee < 1077], {firstS = w300}];
If[And[fff < 1347, ggg < 1169], {firstS = w350}];
If[And[hhh < 1372, iii < 1225], {firstS = w400}];

"ออกแบบ strut ชิ้นอื่นๆ";
"แรงตามแนวแกนของ strut(osp)";
fsmax           =    Max[f2, f3, f4] ;
osp             =    fsmax   *bstrut;

"หน้าตัด Wide Flange 300*300*94 Kg/m";
"แรงในแนวแกน x(ofx)";
"แรงในแนวแกน y(ofy)";
"หน้าตัด Wide Flange 350*350*137 Kg/m";
"แรงในแนวแกน x(osx)";
"แรงในแนวแกน y(osy)";
"หน้าตัด Wide Flange 400*400*172 Kg/m";
"แรงในแนวแกน x(otx)";
"แรงในแนวแกน y(oty)";

ofx = osp*1000/119.8+116;
ofy = osp*1000/(1.3*119.8)+116;
osx = osp*1000/173.9+116;
osy = osp*1000/(1.3*173.9)+116;
otx = osp*1000/238.7+116;
oty = osp*1000/(1.3*238.7)+116;

"แรงในแกน x (ggg,kkk,lll)< Fa ใช้ได้ ";
"แรงในแกน y (mmm,nnn,ooo)< Fa ใช้ได้ ";

If[And[ofx > osx > otx, ofx ≤ 1312], jjj = ofx];
If[And[osx > otx, ofx > 1313], kkk = osx];
If[And[osx > 1347, otx ≤ 1372], lll = otx];
If[And[ofy > osy > oty, ofy ≤ 1077], mmm = ofy];
If[And[osy > oty, ofy > 1078], nnn = osy];
If[And[osy > 1169, oty ≤ 1225], ooo = oty];

If[And[jjj < 1312, mmm < 1077], {otherS = w300}];
If[And[kkk < 1347, nnn < 1169], {otherS = w350}];
If[And[lll < 1372, ooo < 1225], {otherS = w400}];

If[hstrut5 == 0, at = 4];
```

```
If[hstrut4 == 0, at = 3];
If[hstrut3 == 0, at = 2];
If[hstrut2 == 0, at = 1];
```

■ King Post

```
"กำหนดให้แรงกระจายเนื่องจากน้ำหนักของ Platform = 2 t/m²";
"แรงที่กำลงบน King Post 1 ต้น(fkp)";
fkp  = 2*bstrut*bstrut/2; "tons";
"ความยาวของ King Post(lkp)"; "m";
If[type2 = 3, lkp = (hsoil1 + 3)];
If[type2 = 1, lkp = (hsoil1 + 3)];
If[type3 = 3, lkp = (hsoil1 + hsoil2 + 3)];
If[type3 = 1, lkp = (hsoil1 + hsoil2 + 3)];
If[type4 = 3, lkp = (hsoil1 + hsoil2 + hsoil3 + 3)];
If[type4 = 1, lkp = (hsoil1 + hsoil2 + hsoil3 + 3)];

If[type2 = 3, fl = ((hsoil1 - htotalcut) * fs1 + 3 * fs2)];
If[type3 = 3, fl = ((hsoil1 - htotalcut) * fs1 + hsoil2 * fs2 + 3 * fs3)];
If[type4 = 3, fl = ((hsoil1 - htotalcut) * fs1 + hsoil2 * fs2 + hsoil3 * fs3 + 3 * fs4)];

If[type2 = 1, fl = ((hsoil1 - htotalcut) * fs1 + 3 * fs2)];
If[type3 = 1, fl = ((hsoil1 - htotalcut) * fs1 + hsoil2 * fs2 + 3 * fs3)];
If[type4 = 1, fl = ((hsoil1 - htotalcut) * fs1 + hsoil2 * fs2 + hsoil3 * fs3 + 3 * fs4)];

qf1 = fl * 4 * 0.3;
qf2 = fl * 4 * 0.35;
qf3 = fl * 4 * 0.4;

If[type2 = 3, (qb1 = 9 * c2 * 0.3 * 0.3)];
If[type3 = 3, (qb1 = 9 * c3 * 0.3 * 0.3)];
If[type4 = 3, (qb1 = 9 * c4 * 0.3 * 0.3)];
If[type2 = 3, (qb2 = 9 * c2 * 0.35 * 0.35)];
If[type3 = 3, (qb2 = 9 * c3 * 0.35 * 0.35)];
If[type4 = 3, (qb2 = 9 * c4 * 0.35 * 0.35)];
If[type2 = 3, (qb3 = 9 * c2 * 0.4 * 0.4)];
If[type3 = 3, (qb3 = 9 * c3 * 0.4 * 0.4)];
If[type4 = 3, (qb3 = 9 * c4 * 0.4 * 0.4)];

If[type2 = 1, (qb1 = 0.7 * σv * Tan[δ5])];
If[type3 = 1, (qb2 = 0.7 * σv * Tan[δ5])];
If[type4 = 1, (qb3 = 0.7 * σv * Tan[δ5])];

θ5          =      ϕ5 * π / 180;
δ5          =      3 * θ5 / 4;

If[type2 = 1, (σv = hsoil1 * γ1 + 3 * γ2)];
If[type3 = 1, (σv = hsoil1 * γ1 + hsoil2 * γ2 + 3 * γ3)];
If[type4 = 1, (σv = hsoil1 * γ1 + hsoil2 * γ2 + hsoil3 * γ3 + 3 * γ4)];
```

```
If[type2 == 1, ϕ5 = ϕ2, ϕ5 = 0];
If[type3 == 1, ϕ5 = ϕ3, ϕ5 = 0];
If[type4 == 1, ϕ5 = ϕ4, ϕ5 = 0];

qu1 = qb1 + qf1;
qa1 = qu1 / 1.25;
qu2 = qb2 + qf2;
qa2 = qu2 / 1.25;
qu3 = qb3 + qf3;
qa3 = qu3 / 1.25;

w300 = "Wide Flange 300*300*94  Kg/m";
w350 = "Wide Flange 350*350*137 Kg/m";
w400 = "Wide Flange 400*400*172 Kg/m";

If[fkp < qa1 < qa2 < qa3, (kingpost = w300)];

If[qa1 < fkp < qa2 < qa3, (kingpost = w350)];

If[qa1 < qa2 < fkp < qa3, (kingpost = w400)];
```

■ Graphics

```
<< Graphics`Arrow`
Fig1[surcharge_, pa_, htotalcut_, bracings_, soiltype_] :=
  Module[{},
   ArrowT = Table[
     Arrow[{1.5, -bracings[[i, 1]]}, {0, -bracings[[i, 1]]}], {i, Length[bracings]}];
   TArrow = Table[Text[ToString[bracings[[i, 2]]] <> " t/m",
      {1.6, -bracings[[i, 1]]}, {-1, 0}], {i, Length[bracings]}];
   TPressure = {
     Text["surcharge = " <> ToString[surcharge] <> "t/m²", {-0.8 surcharge, 0}, {-1, -1}],
     Text["pa= " <> ToString[pa] <> " t/m²", {-0.8 surcharge, -htotalcut - 0.5}]};
   If[soiltype == 1, "sand";
    PressureG = {Line[{{0, 0},
        {-surcharge - pa, 0}, {-surcharge - pa, -htotalcut},
        {0, -htotalcut}, {0, 0}}]},
    If[soiltype == 2, "soft clay";
     PressureG = {Line[{{0, 0},
         {-surcharge, 0},
         {-surcharge - pa, -0.25 htotalcut}, {-surcharge - pa, -htotalcut},
         {0, -htotalcut}, {0, 0}}]},
     If[soiltype == 3, "stiff clay";
      PressureG = {Line[{{0, 0},
          {-surcharge, 0},
          {-surcharge - pa, -0.25 htotalcut},
          {-surcharge - pa, -0.75 htotalcut},
          {-surcharge, -htotalcut},
          {0, -htotalcut}, {0, 0}}]}]], pressureG = .];
   Show[Graphics[Flatten[{ArrowT, TArrow, PressureG, TPressure}]],
    AspectRatio → 1.5, PlotRange → {{-surcharge - pa - 2, 15}, {1, -htotalcut - 1.5}}]];
```

Output

```
Print["-" sheetpile, "    ,Length =", L, " m"];
Print["- Bracing System"];
If[And[hstrut5 == 0, hstrut4 > 0], Print["  ", at, " Layers at", " -", (hstrut1),
   " m, -", (hstrut1 + hstrut2), " m, -", (hstrut1 + hstrut2 + hstrut3), " m and -",
   (hstrut1 + hstrut2 + hstrut3 + hstrut4), " m", " from ground Surface"]];
If[And[hstrut4 == 0, hstrut3 > 0], Print["  ", at, " Layers at",
   " -", (hstrut1), " m, -", (hstrut1 + hstrut2), " m and -",
   (hstrut1 + hstrut2 + hstrut3), " m", " from ground Surface"]];
If[And[hstrut3 == 0, hstrut2 > 0], Print["  ", at, " Layers at", " -", (hstrut1),
   " m and -", (hstrut1 + hstrut2), " m", " from ground Surface"]];
If[And[hstrut2 == 0, hstrut1 > 0], Print["  ", at, " Layers at",
   " -", (hstrut1), " m", " from ground Surface"]];
Print["- Strut Spacing = ", bstrut, " m"];
Print["- Wale "];
Print["  1st Layer Use Section ", firstW];
If[And[hstrut5 == 0, hstrut4 > 0],
  Print["  2rd , 3nd and 4th Layer Use Section ", otherW]];
If[And[hstrut4 == 0, hstrut3 > 0], Print["  2rd and 3nd  Layer Use Section ", otherW]];
If[And[hstrut3 == 0, hstrut2 > 0], Print["  2rd   Layer Use Section ", otherW]];
Print["- Strut "];
Print["  1st Layer Use Section ", firstS];
If[And[hstrut5 == 0, hstrut4 > 0],
  Print["  2rd , 3nd and 4th Layer Use Section ", otherS]];
If[And[hstrut4 == 0, hstrut3 > 0], Print["  2rd and 3nd  Layer Use Section ", otherS]];
If[And[hstrut3 == 0, hstrut2 > 0], Print["  2rd   Layer Use Section ", otherS]];
Print["- King Post "];
Print["  Use Section ", kingpost, " , Tip at - ", lkp, " m from ground Surface"];
Fig1[surcharge, paall, htotalcut,
  {{hstrut1, f1}, {hstrut1 + hstrut2, f2}, {hstrut1 + hstrut2 + hstrut3, f3}}, 2];
```

```
- Sheet Pile Type FSP III    ,Length =16 m

- Bracing System

  3 Layers at -1.2 m, -3.9 m and -6.45 m from ground Surface

- Strut Spacing = 6 m

- Wale

  1st Layer Use Section Wide Flange 300*300*94  Kg/m

  2rd and 3nd  Layer Use Section Wide Flange 350*350*137 Kg/m

- Strut

  1st Layer Use Section Wide Flange 300*300*94  Kg/m

  2rd and 3nd  Layer Use Section Wide Flange 350*350*137 Kg/m

- King Post
```

Use Section Wide Flange 300*300*94 Kg/m , Tip at - 18. m from ground Surface