```
% dlt25.m    26-oct-05
% do dlt for photo 16-3 from indot/i70/woolpert
% nominally vertical - will it work ???

%
%     L1X + L2Y + L3Z + L4
% x = --------------------
%     L9X + L10Y + L11Z + 1
%
%     L5X + L6Y + L7Z + L8
% y = --------------------
%     L9X + L10Y + L11Z + 1
%
% x=[X Y Z 1 0 0 0 0 xX xY xZ] [  L1 ]
% y=[0 0 0 0 X Y Z 1 yX yY yZ] [  L2 ]
%                              [  L3 ]
%                              [  L4 ]
%                              [  L5 ]
%                              [  L6 ]
%                              [  L7 ]
%                              [  L8 ]
%                              [  L9 ]
%                              [ L10 ]
%                              [ L11 ]
%

% load purcon20.dat
% load imea20.dat
% points 137,138,238,240,16_3_5,16_3_2,16_2_3

pname=[137;138;238;240;1635;1632;1623];
pc=       [-86.156      6.300;
           -13.861    102.064;
            16.697    -50.963;
           105.471     52.462;
           -93.973    -69.159;
            19.862    -15.243;
            85.949   -106.124];
xpho=pc(:,1);
ypho=pc(:,2);
npts=7;

purcon20=       [61243.060   504941.062      230.990;
                 61355.679   505015.172      236.569;
                 61330.543   504840.250      232.079;
                 61470.483   504918.489      233.704;
                 61207.862   504864.524      231.804;
                 61347.732   504877.702      232.694;
                 61383.121   504756.429      238.181];

Xref=purcon20(1,1);
Yref=purcon20(1,2);
```

```
Zref=purcon20(1,3);
%  princ. point
xpp=0;
ypp=0;

B=zeros(2*npts,11);
f=zeros(2*npts,1);
for i=1:npts
  X=purcon20(i,1) - Xref;
  Y=purcon20(i,2) - Yref;
  Z=purcon20(i,3) - Zref;
  x=xpho(i)-xpp;
  y=ypho(i)-ypp;

  ii=(2*i)-1;
  B(ii  ,:)=[X Y Z 1 0 0 0 0 x*X x*Y x*Z];
  B(ii+1,:)=[0 0 0 0 X Y Z 1 y*X y*Y y*Z];
  f(ii  )=x;
  f(ii+1)=y;
  end

cond(B)
N=B'*B;
cond(N)

del=inv(B'*B)*B'*f;
resid=f - B*del;

del
resid

L=del;
P= -sqrt(1/(L(9)^2 + L(10)^2 + L(11)^2));
L1p=L(1)*(-P);
L2p=L(2)*(-P);
L3p=L(3)*(-P);
cx=sqrt(L1p^2+L2p^2+L3p^2);
L5p=L(5)*(-P);
L6p=L(6)*(-P);
L7p=L(7)*(-P);
cy=sqrt(L5p^2+L6p^2+L7p^2);
m31= -L(9)*P;
m32= -L(10)*P;
m33= -L(11)*P;
m11=L1p/cx;
m12=L2p/cx;
m13=L3p/cx;
m21=L5p/cy;
m22=L6p/cy;
m23=L7p/cy;
L4p=L(4)*P/cx;
L8p=L(8)*P/cy;
```

```
mx=[-m31 -m32 -m33;
     m11  m12  m13;
     m21  m22  m23];
vc=[P;L4p;L8p];
expsta=inv(mx)*vc;
EL=expsta(1) + Xref;
NL=expsta(2) + Yref;
hL=expsta(3) + Zref;
rm=[m11 m12 m13;m21 m22 m23;m31 m32 m33];
ident=rm*rm'
cx
cy
EL
NL
hL
rm
ident
phi=asin(m31);
cp=cos(phi);
kap=atan2(-m21/cp,m11/cp);
omg=atan2(-m32/cp,m33/cp);
omg
phi
kap

% write out a resect.inp format file

scr=zeros(npts,6);
for i=1:npts
  scr(i,:)=[pname(i) xpho(i) ypho(i) purcon20(i,1:3)];
  end
scrt=scr';
fid=fopen('resect.inp','wt');
fprintf(fid,'%4.0f %6.0f %6.0f %12.1f %12.1f %8.1f\n',scrt);
fclose(fid);
```

```
dlt25

condition numbers of B, N
ans =
  4.0504e+004
ans =
  1.6406e+009

L1,L2,L3,L4,L5,L6,L7,L8,L9,L10,L11
del =
    0.8360
   -0.2979
    0.0436
  -86.1589
    0.2976
    0.8372
    0.0137
    6.2945
   -0.0003
    0.0000
    0.0057

largest residual .005 mm
resid =
    0.0029
    0.0055
   -0.0019
   -0.0004
   -0.0046
    0.0024
    0.0023
   -0.0015
    0.0006
   -0.0053
   -0.0007
   -0.0023
    0.0015
    0.0017

check M*M^T
ident =
    1.0000    0.0000    0.0004
    0.0000    1.0000    0.0024
    0.0004    0.0024    1.0000

cx =
  154.5644
cy =
  154.5812
EL =
  6.1323e+004
NL =
```

```
  5.0490e+005
hL =
  409.3385

rotation matrix
rm =
    0.9408   -0.3353    0.0491
    0.3349    0.9421    0.0154
   -0.0503    0.0041    0.9987
ident =
    1.0000    0.0000    0.0004
    0.0000    1.0000    0.0024
    0.0004    0.0024    1.0000
omg =
   -0.0041
phi =
   -0.0503
kap =
   -0.3420
diary off


comparison of DLT vs. bundle block adjustment results

cx  154.564           f  153.743
cy  154.582
XL   61322.9         XL   61323.2
YL  504902.2         YL  504902.6
ZL     409.3         ZL     408.4
w     -.004 R         w    -.004 R
p     -.050 R         p    -.050 R
k     -.342 R         k    -.342 R
```